Draft Final
Work Plan for MEC Clearance at Open Detonation (OD) Grounds
Seneca Army Depot Activity, New York

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Acronyms and Abbreviations

2D	two-dimensional
AOC	area of concern
AOI	area of interest
APP	Accident Prevention Plan
AR	Army Regulation
ASCII	American Standard Code for Information Interchange
ASR	Archives Search Report
ATF	Bureau of Alcohol, Tobacco, Firearms, and Explosives
bgs	below ground surface
BIP	blown-in-place
BRAC	Base Realignment and Closure
CAMP	Community Air Monitoring Plan
CD-ROM	compact disc-read only memory
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CHSM	Corporate Health and Safety Manager
cm	centimeters
COR	contracting officer's representative
CP	Command Post
CY	cubic yards
DDESB	DoD Explosives Safety Board
DERP	Defense Environmental Response Program
DFW	definable feature of work
DGM	digital geophysical mapping
DID	Data Item Description
DMM	discarded military munitions
DoD	Department of Defense
DOT	Department of Transportation
DQCR	Daily Quality Control Report
DQO	data quality objective
DVD	digital versatile disc
EBS	Environmental Baseline Survey
EE/CA	Engineering Evaluation/Cost Analysis
ELAP	Environmental Laboratory Accreditation Program
EM	Engineer Manual
EOD	explosive ordnance disposal
EP	Engineer Pamphlet
EPP	Environmental Protection Plan
ER	Engineer Regulation
ES	Engineering Science, Inc.
ESI	Expanded Site Investigation
ESS	Explosives Safety Submission

Acronyms and Abbreviations *(continued)*

EZ	exclusion zone
FADL	Field Activity Daily Log
ft	feet or foot
GDB	geodatabase
GIS	geographic information system
GPR	ground penetrating radar
GPS	global positioning system
HE	high explosive
HEPA	High Efficiency Particulate Air
HFD	hazard fragmentation distance
HTRW	Hazardous, Toxic, and Radiological Waste
Hz	Hertz
IAW	in accordance with
ID	identification
IDW	investigative-derived waste
ISO	industry standard object
IVS	instrument verification strip
lb	pound
LRA	Local Redevelopment Authority
MC	munitions constituents
MD	munitions debris
MDAS	Material Documented As Safe
MEC	munitions and explosives of concern
mg/m^3	milligram per cubic meter
MGFD	munition with the greatest fragmentation distance
MMRP	Military Munitions Response Program
mph	miles per hour
MPPEH	material potentially presenting an explosive hazard
MRS	Munitions Response Site
MSD	Minimum Separation Distance
mV	millivolts
NAD 83	North American Datum of 1983
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NCR	Nonconformance Report
NEW	Net Explosive Weight
NPL	National Priorities List
NRL	Naval Research Laboratory
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OB	open burning
OD	open detonation
OE	ordnance and explosives
OSHA	Occupational Safety and Health Administration

Acronyms and Abbreviations *(continued)*

PCB	polychlorinated biphenyl
PDA	personal digital assistant
PM	Project Manager
PPE	personal protective equipment
PSR	Periodic Status Report
PWS	Performance Work Statement
QA	quality assurance
QAPP	Quality Assurance Project Plan
QASP	Quality Assurance Surveillance Plan
QC	quality control
QCP	Quality Control Plan
QCR	Quality Control Report
RAR	Remedial Action Report
RCRA	Resource Conservation and Recovery Act
RTK	real-time kinematic
RTS	robotic total station
SAP	Sampling and Analysis Plan
SCIDA	Seneca County Industrial Development Agency
SEDA	Seneca Army Depot
Shaw	Shaw Environmental & Infrastructure, Inc.
ShawEIMS	Shaw Environmental Information Management System
ShawMIMS	Shaw Munitions Information Management System
SOP	standard operating procedure
SPLP	Synthetic Leaching Precipitation Procedure
SSHP	Site Safety and Health Plan
SUXOS	Senior Unexploded Ordnance Supervisor
SVOC	semi-volatile organic compound
SWMU	solid waste management unit
TCLP	Toxicity Characteristic Leaching Procedure
TDEM	time domain electromagnetics
TM	Technical Manual
TP	Technical Paper
TPP	Technical Project Planning
UFP	Uniform Federal Policy
USACE	U.S. Army Corps of Engineers
USAESCH	U.S. Army Engineering Support Center, Huntsville
USC	United States Code
USEPA	U.S. Environmental Protection Agency
UXO	unexploded ordnance
UXOQCS	Unexploded Ordnance Quality Control Specialist
UXOSO	Unexploded Ordnance Safety Officer
VOC	volatile organic compound
WERS	Worldwide Environmental Remediation Services
WP	white phosphorus

Draft Final
WORK PLAN
Approval Signature Sheet

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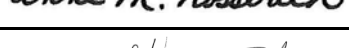
EDITORIAL OK: 		
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1.0 INTRODUCTION

1.0.0.0. Shaw Environmental & Infrastructure, Inc. (Shaw) is submitting this *Work Plan for Munitions and Explosives of Concern (MEC) Clearance at Open Detonation (OD) Grounds at Seneca Army Depot (SEDA), Romulus, New York*, hereafter referred to as the "work plan," to the U.S. Army in accordance with (IAW) the Performance Work Statement (PWS) included in the Huntsville Worldwide Environmental Remediation Services (WERS) Contract No. W912DY-10-D-0014, Task Order 0005. This Task Order was established to conduct a remedial action within the 0- to 1,000-foot (ft) radius area surrounding the former OD Area to remove material potentially presenting an explosive hazard (MPPEH) as well as closing the Open Burning Tray. A landfill cap will also be placed at the site following the MEC remedial activities. Because the landfill cap design will depend upon the results of the MEC removal and subsequent munitions constituents (MC) sampling, the landfill design document is not included as part of this work plan. The landfill cap will be addressed in a separate Landfill Cap Design Work Plan, so is not addressed further in this work plan. The Task Order was issued by the U.S. Army Engineering Support Center, Huntsville (USAESCH) on November 23, 2011. A copy of the PWS is included as **Appendix A**.

1.0.0.1. This work plan describes the activities planned to perform the MPPEH and Open Burning Tray removal portion of the remediation activities at the OD Grounds. The location of SEDA and the OD Grounds, including the Open Burning Tray, is shown on **Figure 1-1** and **Figure 1-2**, respectively.

1.1 Project Authorization

1.1.0.0. The Department of Defense (DoD) has established the Military Munitions Response Program (MMRP) to address DoD sites suspected of containing MEC or MC. This project is being conducted under Contract No. W912DY-10-D-0014 on behalf of the U.S. Army, SEDA for USAESCH as Delivery Order 5. Shaw will coordinate this effort with USAESCH, SEDA, and U.S. Army Corps of Engineers (USACE) – New York District. Management of waste materials produced from historical operations at SEDA has been IAW the requirements of the Resource Conservation and Recovery Act (RCRA). In 1990, SEDA was included in the federal section of the National Priorities List (NPL). As a federal facility listed on the NPL, provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA - 42 United States Code [USC] § 9620e) required that the U.S. Army investigate the sites known to exist at SEDA and complete all necessary remedial investigations and actions at the facility. In accordance with this stipulation, the U.S. Army, the U.S. Environmental Protection Agency (USEPA), and the New York State Department of Environmental Conservation (NYSDEC) negotiated and

finalized a Federal Facility Agreement that outlines the administrative process and the procedures that will be followed to comply with the CERCLA.

1.1.0.1. Pursuant to USACE Engineer Regulation (ER) 200-3-1 and the Management Guidance for the Defense Environmental Response Program (DERP) (Office of the Deputy Under Secretary of Defense [Installations and Environment], September 2001), USAESCH is conducting MMRP response activities IAW the DERP statute (10 USC 2701 et seq.), the CERCLA (42 USC §9620), Executive Orders 12580 and 13016, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 Code of Federal Regulations [CFR] Part 300). While not all MEC or MC constitutes CERCLA hazardous substances, pollutants, or contaminants, the DERP statute provides the DoD with the authority to respond to releases of MEC and MC. DoD policy states that such responses shall be conducted IAW CERCLA and the NCP.

1.2 Purpose and Scope

1.2.0.0. The purpose and scope of this Task Order is to design and complete the installation of an NYS Part 360 landfill cap to inter contaminated soils at the SEDA in Romulus, New York. Additionally, other activities will be performed in support of the landfill construction to include additional MEC remedial actions and long-term monitoring at the site. Only those activities associated with the MEC clearance and closure of the Open Burning Tray are discussed in this work plan. Because the planning of these activities are dependent upon the results of the MEC clearance, activities related to the landfill cap design and installation and long-term monitoring will be discussed in separate work planning documents.

1.2.0.1. The MEC clearance activities include the following:

a. Geophysically map the 0- to 1,000-ft radius area with the exception of those areas that are wooded or severely overgrown or have sloped terrain. Delineate all areas which exhibit metallic saturation, whereby individual targets exhibiting a signal >50 millivolts (mV) are not distinguishable. A surface sweep will be performed prior to conducting the geophysical survey to remove MPPEH and other metal that may impede the geophysical survey. The surface sweep will focus on clearing MPPEH and metal of a sufficient size to interfere with the geophysical survey (i.e. items larger than a 20 mm projectile).

b. Excavate those areas exhibiting metallic saturation to a depth of 6 inches, sifting the soils to remove any MPPEH that might be present, ultimately transporting the excavated soils to within the anticipated cap footprint and regrading the excavated soils with the existing OD hill material. Areas exhibiting metallic saturation are

defined as areas within which individual targets with signals over 50 mV cannot be discriminated. The excavated material will be maintained within the anticipated capping footprint area until it can be interred beneath the cap. Construction support will be performed while earth work is ongoing.

c. Geophysically remap the portions of the 0- to 1,000-ft radius area which were considered saturated and which were excavated to a depth of 6 inches. Repeat steps a and b until targets in all portions of the 0- to 1,000-ft radius can be mapped.

d. Reacquire and prosecute all identified, mapped targets in the area of the 0- to 1,000-ft radius which exceed the 50 mV threshold.

e. Re-contour the OD Hill removing all MEC on the surface. Cover the OD Hill with one foot of soil in preparation for CERCLA remedy.

f. In the area of 0- to 1,000-ft radius for the existing OD Hill, identified targets in wooded or severely overgrown or sloped terrain will be located using magnetometers or other agreed on instruments and prosecuted (i.e., mag and dig).

g. Close the Open Burning Tray IAW the approved *Closure Plan for the Open Burning Tray in Solid Waste Management Unit (SWMU) – SEAD-23* (Parsons, 2005).

1.3 Work Plan Organization

1.3.0.0. This work plan covers all activities necessary to complete the MEC clearance activities for the remedial activities at the OD Grounds. The work plan is organized to address each of the components of the PWS IAW Data Item Description (DID) WERS-001.01, Engineer Manual (EM) 1110-1-4009, Engineer Pamphlet (EP) 75-1-3, and other guidance. The work plan is comprised of several sub-plans, each discussing a different aspect of the MEC clearance activities. The chapters and subchapters are summarized below.

a. **Section 1, Introduction.** Details the overall authorization, scope, and objective of the project, presents the organization of the work plan, presents an overview of the site and its history, summarizes the MEC risk, and describes the potential for presence or absence of MC.

b. **Section 2, Technical Management Plan.** Documents the technical approach and procedures to be used to manage project tasks, and details the organizational structure, lines of authority, and communication of the project team.

c. **Section 3, Field Investigation Plan.** Describes the procedures that will be implemented to complete the required field work. Portions of the Field Investigation

Plan detailing the geophysical investigation were prepared IAW DID WERS-0004.01.

d. **Section 4, Quality Control Plan (QCP).** Describes Shaw's procedures for controlling and measuring the quality of work performed, including training requirements, audit procedures, and corrective/preventive action procedures.

e. **Section 5, Explosives Management Plan.** Describes the details for the management of explosives used to destroy unexploded ordnance (UXO) recovered during the project, including acquisition, receipt, storage, transportation, and inventory. The Explosives Management Plan was written IAW DID WERS-002.01.

f. **Section 6, Environmental Protection Plan (EPP).** The EPP provides general information and lists applicable requirements for avoiding, minimizing, and mitigating potential impacts to environmental and cultural resources during field activities.

g. **Section 7, Property Management Plan.** Describes how property management will be performed. The Property Management Plan has been written IAW DID WERS-008.01.

h. **Section 8, Interim Holding Facility Siting Plan.** Not applicable to the SEDA Project.

i. **Section 9, Physical Security Plan.** Not applicable to the SEDA Project.

j. **Section 10, References.**

1.3.0.1. Additional information and plans are attached to this work plan as appendices:

a. **Appendix A, Performance Work Statement.** The most recent PWS, dated 23 November 2011, is included.

b. **Appendix B, Site Maps.** Appendix B will be used as a placeholder; all maps will be contained in the body of the work plan for ease of referencing.

c. **Appendix C, Points of Contact.** Various points of contact are listed.

d. **Appendix D, Accident Prevention Plan (APP).** The APP describes the health and safety procedures, personal protection standards, and environmental health hazards applicable to this project. The Site Safety and Health Plan (SSHP) is included as Attachment 1 to the APP. The APP and SSHP were written IAW DID WERS-005.01, APP.

e. **Appendix E, MC Sampling and Analysis Plan (SAP).** The project will utilize all applicable portions of the Generic Site-Wide SAP, Revised Final, July 2006 (Parsons,

2006) for all environmental sampling to take place under this task order. **Appendix E** contains the Uniform Federal Policy-Quality Assurance Project Plan (UFP-QAPP) which presents a comprehensive plan to ensure quality for all environmental sampling to take place under the task order. The UFP-QAPP has been developed IAW the requirements of the Uniform Federal Policy for Quality Assurance Project Plans and per the PWS in accordance with WERS-009.01 Munitions Constituents Chemical Data Quality Deliverables.

f. **Appendix F, Forms.** Relevant forms and templates are provided.

g. **Appendix G, Explosives Safety Submission (ESS).** The ESS, prepared IAW the requirements of EM 385-1-97, Errata Sheet#3, and DoD 6055.09-M, where applicable, provide a scope of effort intended to support all aspects of explosives remedial activities at the OD Grounds.

h. **Appendix H, Contractor Personnel Qualifications Certification Letter.** Resumes for key project personnel are included in this appendix.

i. **Appendix I, Technical Project Planning (TPP) Worksheets.** This appendix will be used as a placeholder, TPP worksheets are not applicable to this task order.

1.4 Project Location

1.4.0.0. The SEDA facility is located in Seneca County, Romulus, New York. It is a former U.S. Army site that at one time occupied approximately 10,587 acres. SEDA was owned by the U.S. Government and Operated by the Department of the Army from 1941 until 2000. In 2000, the Army assumed a caretaker role at the SEDA, and since this time more than 8,500 acres have been transferred to other parties. It is bounded to the west by State Route 96A and to the east by State Route 96. Geneva and Rochester are located to the northwest (14 and 50 miles, respectively), Syracuse is 50 miles to the northeast, and Ithaca is 31 miles to the south. The surrounding area outside the SEDA property is used mainly for agriculture. A site vicinity map is provided on **Figure 1-1**.

1.4.0.1. The OD Grounds is located in the northwestern corner of SEDA and is designated SEAD-006-R-01 (formally identified as SEAD-45 and SEAD-115) (See **Figure 1-2**). The OD Grounds, together with the Open Burning (OB) Grounds, comprise the 365-acre demolition area at SEDA. The OB Grounds were previously remediated with the exception of the burn tray. The burn tray remained operational so it could continue to be used for munitions destruction, and if needed as part of the remediation process of the OD Grounds. The remainder of the OB Grounds has been remediated and is therefore not part of this scope of work. This scope of work includes a circular area formed by a 1,000-ft radius (approximately 72 acres) from the center of the OD Hill and closure of the Open Burning Tray.

1.5 Site Description

1.5.1 Topography

1.5.1.0.0. SEDA is located on an uplands area, at an elevation of approximately 600 ft above mean sea level. The OD Grounds sits on gently sloping terrain as shown on **Figure 1-3**. A majority of the former OD Grounds slopes downwards away from a local topographic high that is located near the western edge of the site towards the east, where the land is bounded by Reeder Creek, which is a perennial stream. In the center of the OD Grounds is the OD Hill, which is approximately 675 ft by 225 ft, running north-south, and the top of the hill is approximately 15 ft above the surrounding grade. The western-most portion of the site slopes gently towards the west, away from the top of the local topographic high.

1.5.1.0.1. The center of the site is characterized by a manmade earthen mound referred to as OD Hill. OD Hill was historically used to buffer the intensity of planned detonations carried out to destroy munitions. The shape of the OD hill was routinely modified in order to carry out planned detonations. In March of 2010, a topographic survey of the OD Hill was conducted using a global positioning system (GPS) (Parsons, 2011). This survey was conducted to determine the current location and shape of the OD Hill and to develop an estimate of the soil volume contained in the hill.

1.5.2 Climate

SEDA is located near Romulus, New York, in the Finger Lakes region of New York. This area has four distinct seasons. Warm summers averaging between 75 and 85 degrees Fahrenheit make way for crisp, cool fall air and breathtaking foliage. Winter snowfall typically begins in November and varies greatly throughout the region. Lake effect snow is moderate in the Ithaca region, averaging 67.3 inches per year, and heavier in the Rochester, and Syracuse areas, which average between 92.3 inches and 115.6 inches.

1.5.3 Vegetation

1.5.3.0.0. SEDA consists mostly of former farmland that has been overgrown by dense underbrush between buildings and within the igloo area. Woodlands predominate in most of the areas that are not immediately associated with a former facility or building complex, there is slight change in topographic relief trending towards Seneca Lake to the west.

1.5.3.0.1. The former OD Grounds was located in an area that is currently characterized as gently sloping terrain that is mostly vegetated with grasses and scrub brush. The grass and scrub brush vegetation is interrupted by the continuing evidence of the former earthen roadway system that was used to access the 11 former burn pads. In addition, there are several areas (approximately 14 acres) of dense tree stands in the OD Grounds.

1.5.4 Site Geology

1.5.4.0.0. The Finger Lakes uplands area is underlain by a broad north-to-south trending series of rock terraces mantled by glacial till. As part of the Appalachian Plateau, the region is underlain by a tectonically undisturbed sequence of Paleozoic rocks consisting of shales, sandstones, conglomerates, limestones, and dolostones. In the vicinity of SEDA, Devonian age (385 million years ago) rocks of the Hamilton Group are monoclinally folded and dip gently to the south. No evidence of faulting or folding is present. The Hamilton Group is a sequence of limestones, calcareous shales, siltstones, and sandstones.

1.5.4.0.1. SEDA geology is characterized by gray Devonian shale with a thin weathered zone where it contacts the overlying mantle of Pleistocene glacial till. This stratigraphy is consistent over the entire SEDA facility. The predominant surficial geologic unit present at the site is dense glacial till. The till is distributed across the entire facility and ranges in thickness from less than 2 ft to as much as 15 ft, although it is generally only a few feet thick. The till is generally characterized by brown to gray-brown silt, clay and fine sand with few fine to coarse gravel-sized inclusions of weathered shale. Larger diameter weathered shale clasts (as large as 6 inches in diameter) are more prevalent in basal portions of the till and are probably ripped-up clasts removed by the active glacier.

1.5.4.0.2. The bedrock underlying the site is composed of the Ludlowville Formation of the Devonian age, Hamilton Group. Merin (1992) also cites three prominent vertical joint directions of northeast, north-northwest, and east-northeast in outcrops of the Genesee Formation 30 miles southeast of SEDA near Ithaca, New York. Three predominant joint directions, N60^{o}E, N30^{o}W, and N20^{o}E are present within this unit (Mozola, 1951). These joints are primarily vertical. The Hamilton Group is a gray-black, calcareous shale that is fissile and exhibits parting (or separation) along bedding planes.

1.5.5 Soils

1.5.5.0.0. Pleistocene age (Wisconsin event, 20,000 years ago) glacial till deposits overlies the shales. SEDA lies on the western edge of a large glacial till plain between Seneca Lake and Cayuga Lake. The till matrix, the result of glaciations, varies locally but generally consists of horizons of unsorted silt, clay, sand, and gravel. The soils at SEDA contain varying amounts of inorganic clays, inorganic silts, and silty sands. In the central and eastern portions of SEDA, the till is thin and bedrock is exposed or within 3 ft of the surface. The thickness of the glacial till deposits at SEDA generally ranges from 1 to 15 ft.

1.5.5.0.1. Darien silt-loam soils, 0 to 18 inches thick, have developed over Wisconsin age glacial tills. These soils are developed on glacial till where they overlie the shale. In general, the topographic relief associated with these soils is from 3 to 8 percent.

1.5.6 Groundwater Hydrology

1.5.6.0.0. Regionally, four distinct hydrologic units have been identified within Seneca County (Mozola, 1951). These include two distinct shale formations, a series of limestone units, and unconsolidated beds of Pleistocene glacial drift. Overall, the groundwater in the county is very hard, and therefore, the quality is minimally acceptable for use as potable water.

1.5.6.0.1. Regionally, the water table aquifer of the unconsolidated surficial glacial deposits of the region would be expected to flow in a direction consistent with the ground surface elevations. Geologic cross-sections from Seneca Lake and Cayuga Lake have been constructed by the State of New York (Mozola, 1951 and Crain, 1974). The geologic cross-sections suggest that a groundwater divide exists approximately half way between the two Finger Lakes. SEDA is located on the western slope of this divide and therefore regional groundwater flow is expected to be primarily westward towards Seneca Lake. Local hydrogeology is overall consistent with the regional hydrogeology.

1.5.6.0.2. The groundwater flow direction in the till/weathered shale aquifer on the site is to the east based on the groundwater elevations measured in nine monitoring wells on April 4, 1994. The distribution of groundwater in the till aquifer is characterized by moist soil with coarse-grained lenses of water-saturated soil and in most instances the deeper weathered shale horizons were saturated. The recharge of water to the wells during sampling in 1994 was generally poor.

1.5.6.0.3. All groundwater in the State of New York, including that underlying the former OD Grounds, is classified as Class GA, which designates its best use as a suitable source for drinking water.

1.5.7 Surface Water

1.5.7.0.0. Surface drainage from SEDA flows to five primary creeks. In the southern portion of the Depot, the surface drainage flows through manmade drainage ditches and streams into Indian and Silver Creeks. These creeks then merge and flow into Seneca Lake just south of the SEDA airfield. The central part and administration area of the SEDA drain into Kendaia Creek. Kendaia Creek flows in a predominant westerly direction, and discharges into Seneca Lake at a location north of Pontius Point and the SEDA's former Lake Shore Housing Area. The majority of the northwestern and north-central portion of the SEDA drains into Reeder Creek. Reeder Creek flows predominantly northwesterly and leaves the Depot at a point that is north of the OD Area (i.e., SEAD-45) before it turns to the west and flows into Seneca Lake. The northeastern portion of the Depot, which includes a marshy area called the Duck Pond, drains into Kendig Creek and then flows north into the

Cayuga-Seneca Canal and to Cayuga Lake. Other minor creeks are also present and drain portions of the Depot.

1.5.7.0.1. Surface water flow from precipitation events at OD Grounds is controlled by local topography which slopes gently to the east-northeast, as there is little relief on site other than the demolition mound. In general, surface water flows east making its way into a network of drainage swales throughout the site that eventually lead into Reeder Creek, a sustained surface water body. Reeder Creek flows to the north-northwest along the eastern border of the OD grounds and is a perennial creek that is generally less than 1 ft deep and eventually flows into Seneca Lake. The quality of surface water in Reeder Creek has been designated by the State of New York as a Class C water body (best usage of fresh water is fishing; the waters shall be suitable for fish propagation and survival). Seneca Lake is located approximately 10,000 ft west of the OD Grounds and is used as a source of drinking water for numerous surrounding communities and SEDA. Surface drainage is generally to the east towards Reeder Creek.

1.6 Site History

1.6.0.0. The SEDA facility was constructed in 1941, and was operated by the U.S. Army until its closure in July 2000. From 1941 to 1995, the site was used for receipt, storage, maintenance, and supply of military items including munitions and equipment. In 1989, SEDA was included on the Federal Facilities NPL, which mandated that necessary remedial investigations and actions be completed for the site. The USEPA, NYSDEC, and the Army entered into a Federal Facility Agreement. The agreement states that future investigations would be based on CERCLA guidelines, and that the RCRA was considered an applicable or relevant and appropriate requirement pursuant to Section 121 of CERCLA.

1.6.0.1. Following recommendation by DoD, approval by the Base Closure Commission, the President and Congress, SEDA was approved for the 1995 Base Realignment and Closure (BRAC) list in October 1995. The mission closure date was scheduled for September 30, 1999. Installation closure date was September 30, 2000, with 22 employees after that date. Current reuse plans project that most of the property will be transferred to the local redevelopment authority with some parts of the base transferred to New York State Department of Corrections or other Federal Agencies.

1.6.0.2. The OD Grounds was formerly used for the treatment and disposal of military munitions, and consequently MPPEH and munitions debris (MD) are anticipated throughout this area. During the operational period, munitions were placed on the ground surface after excavating the side of the hill and then covered with a minimum of 8 ft of soil and detonated remotely (Parsons, 2011). Based on the findings from an Engineering Evaluation/Cost Analysis (EE/CA) performed by Parson (Parsons, 2004), the inner 1,000-ft radius is

considered saturated with potential MPPEH and MD. The area outside of the 1,000-ft radius are also considered to be contaminated with MPPEH and MD as a result of kick-out from the demolition operation. The area outside of the 1,000-ft radius are being addressed under a separate action.

1.6.0.3. The Open Burning Tray is located within the OB Grounds. The area was used for treatment and demilitarization of munitions for approximately 50 years.

1.6.0.4. Designated munitions were open-burned on the nine separate burning pads comprising the OB Grounds until 1987. After 1987, munitions were destroyed by burning them within the aboveground steel tray mounted atop a concrete pad to minimize the impact of the burning on the environment. The Open Burning Tray measures 8 ft in width, 40 ft in length, and 2 ft in depth. The tray sat atop concrete foundation on top of a concrete pad which measures approximately 40 ft by 65 ft by approximately 1 ft thick. The maximum OB treatment capacity, proposed in SEDA's 1987 application for a RCRA Part A and Part B permit, was 5,000 pounds (lbs) per day with a maximum of 80 burn days/year. The tray has not been used on a consistent basis since the closure of SEDA in 1995; however, it is still used to thermally verify burnable items recovered during UXO clearance work performed at sites around SEDA do not pose an explosive hazard.

1.6.0.5. The Army intends to close the Open Burning Tray and dispose of its underlying concrete pad upon completion of ongoing Munitions Response work at SEDA. Until that time, the tray will be maintained in its current state for use thermally certified material generated during CERCLA cleanup actions. The 30-acre OB Grounds facility surrounding the tray has been remediated IAW a Record of Decision under CERCLA.

1.7 Current and Projected Land Use

In accordance with the requirements of the BRAC process, the Seneca County Board of Supervisors established the SEDA Local Redevelopment Authority (LRA) in October 1995. The primary responsibility assigned to the LRA was to plan and oversee the redevelopment of SEDA. The Reuse Plan and Implementation Strategy for SEDA was adopted by the LRA and approved by the Seneca County Board of Supervisors on October 22, 1996. Under this plan and subsequent amendment, areas within SEDA were classified as to their most likely future use. In 2005, after it has acquired land at the former Depot from the Army, the Seneca County Industrial Development Agency (SCIDA/LRA) changed the planned use designations of land in many portion of the former Depot. As indicated on **Figure 1-4**, the future use of this Area of Concern (AOC) is for "Conservation/Recreation." The intended use is for public access for surface activities such as hiking and wildlife viewing. Since 1995, approximately 9,800 acres of the former Depot has been released to the SCIDA and other parties.

1.8 Previous Site Investigations

This section briefly summarizes the results from previous investigations at the OD Grounds, based on historical and recent information contained in the following documents below:

a. Solid Waste Classification Report, Seneca Army Depot (Engineering Science, Inc. [ES], September 1994)

b. Expanded Site Investigation (ESI) for Seven High Priority SWMUs SEAD 1, 16, 17, 24, 25, 26, 45, Seneca Army Depot (Engineering Science, Inc. [ES], December 1995)

c. Archives Search Report, Seneca Army Depot USACE St. Louis District, 1998

d. Environmental Baseline Survey (EBS) Report, Seneca Army Depot Activity, New York (Woodward-Clyde, October 1996)

e. Ordnance and Explosives (OE) EE/CA Report, Seneca Army Depot Activity (Parsons, 2004)

f. Seneca Army Depot Activity Time Sensitive Geophysical Investigation Site-Specific Project Report SEAD-45/115 Open Detonation Grounds, OE Removal Phase I Geophysical Survey and Cost Estimate (Weston, 2005b)

g. Draft Completion Report for Additional Munitions Response Site (MRS) Investigations, Seneca Army Depot Activity (Parsons, 2010)

1.8.1 SWMU Classification Report - 1994

ES classified each of the previously identified SWMUs at SEDA (ES, September 1994). ES used existing records and a limited sampling program to classify each SWMU as No Action, a High Priority Area of Concern (AOC), a Moderate Priority AOC, a Moderately Low Priority AOC, or a Low Priority AOC. In this report, OD Grounds was classified as a High Priority AOC. These classifications were used to group sites for ESIs. The ESI conducted for the OD Grounds is discussed below.

1.8.2 Expanded Site Inspection, Seven High Priority SWMUs - 1995

1.8.2.0.0. ESIs were performed at seven SWMUs, including the OD Grounds (Parsons, 1995). These ESIs were undertaken to determine the nature and extent of possible contamination at each of the AOCs investigated. Fieldwork for the ESIs was begun in November of 1993, and the report detailing the results of the High Priority AOCs was issued in 1994.

1.8.2.0.1. The investigation included geophysical surveys conducted with EM-31 in the areas surrounding OD Hill to determine the potential for subsurface MPPEH. Subsequent ground penetrating radar (GPR) surveys were conducted to characterize the anomaly source.

The GPR surveys were unsuccessful in identifying the anomaly source. Additionally, 10 test pits were excavated in order to determine the types of subsurface material responsible for the EM-31 anomalies and determine if subsurface MPPEH was present at the site. The test pits identified several pipes placed as electrical conduit to carry wiring to the OD Hill. The investigation identified a 1-inch galvanized pipe containing electrical wires. This pipe was excavated at a depth of 1.5 to 2.5 ft in test pits TP45-3, TP45-4, and TP45-6. The excavation of TP45-5 revealed another 1-inch galvanized pipe running from east to west. Test pit TP45-10 encountered an east- to west-trending pipe 3 inches in diameter directly north of the berm that houses the existing conduit and blasting cables. This section of pipe probably carried the blasting wires to the former detonation pits interpreted west of the existing detonation mound. The other test pits excavated based on the EM-31 survey encountered a variety of material, including munitions fragments, wood, ash, wire, nails, etc., all of which may have contributed to the observed EM-31 anomalies. In addition to the anomalies targeted for investigation, the EM-31 survey showed a large number of small isolated anomalies scattered throughout the site.

1.8.2.0.2. The ESI also included collection of surface soil samples, subsurface soil samples from test pits, installation and sampling of groundwater monitoring wells, and the collection of surface water/sediment samples from drainage swales and low-lying areas of the site. In addition to the 10 test pits excavated based on the EM-31 survey, an additional five test pits were excavated from the OD Hill material. One soil sample was collected from a 3-ft depth from each of these test pits. Nine surface soil samples, four surface water/sediment samples, and eight groundwater samples were collected from the site. All samples were analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), Pesticide/polychlorinated biphenyls (PCBs), herbicides, metals, and nitro aromatics. The ESI report concluded that with the exception of metals, low levels of contaminants were identified at the site. The ESI recommended a remedial investigation/feasibility study be performed to full define the potential impacts to soil, sediment, and groundwater at the site. Additional information is available in the *Expanded Site Investigation Report for Seven Areas of Concern SEAD 1,16,17,24, 25,26,45, Seneca Army Depot* (Engineering Science, 1995).

1.8.3 Environmental Baseline Survey - 1996

Woodward-Clyde Federal Services was retained to prepare an EBS for SEDA. Under this process, Woodward-Clyde was charged with the initial classification of discrete areas of the depot into one of seven standard environmental conditions of property area types consistent with the Community Environmental Response Facilitation Act (Public Law 102-426), which amends Section 120 of CERCLA. The results of Woodward-Clyde's effort were documented in the U.S. Army BRAC 95 Program Report (Woodward-Clyde, 1996). This

report served as part of the basis for subsequent decisions made regarding land use. The EBS included the OD Grounds (SEAD-45) as part of a larger parcel, which also included the OB Ground (SEAD-23), the Explosive Ordnance Disposal Area (SEAD-57), and a filled area at Building T-2110 (SEAD-70). The overall categorization of the parcel was Category 6, which is defined as Areas where storage, release, disposal or migration of hazardous substance or petroleum products has occurred, but required removal or remedial actions have not been initiated.

1.8.4 OE Archives Search Report - 1998

The USACE St. Louis District conducted a site inspection and archives search of the SEDA (USACE, 1998). The Archives Search Report (ASR) listed a number of sites (Areas of Interest [AOIs]) at SEDA that may have contained OE/UXO. The ASR concluded that the potential for ordnance contamination was highest at nine sites, which included the OD Grounds.

1.8.5 OE Removal Report UXO and Soil Remediation Open Burning Grounds - 2003

Weston Solutions conducted an OE removal at the OB Grounds between September 2001 and December 2002 (Weston, 2003). The stated objective of the project was to continue OE removal efforts and to the maximum extent possible, removal all OE from the OB Grounds. The remedial action included the completion of the original ESS requirements including:

a. Phase III requirements – Excavation and sifting of pad, berm, and low-lying hills soil;

b. Phase IV requirements – Excavation an sifting of the 1-ft cut material;

c. Phase I requirements – Geophysical mapping and clearing of the site;

d. Phase VI requirements – Geophysical mapping and clearing of the former pad areas; and,

e. Phase VII requirements – Completion of excavation and sifting of soils between pad areas.

1.8.6 Completion Report Soil and Sediment Remediation Open Burning Grounds - 2005

1.8.6.0.0. Weston Solutions conducted remedial actions at the OB Grounds site at various times between June 1999 and May 2004 (Weston, 2005a). The remedial action included:

a. Excavation of approximately 88,000 cubic yards (CY) of lead contaminated soil;

b. Diversion of Reeder Creek and excavation of 2,300 CY of sediment;

c. Post excavation confirmation and characterization sampling;

d. Stabilization of soils and sediments to meet Toxicity Characteristic Leaching Procedure (TCLP) hazardous waste disposal criteria;

e. Off-site disposal of approximately 7,000 tons of untreated soil and 50,400 tons of treated soil and sediment as non-hazardous waste at a licensed disposal facility;

f. Off-Site disposal of approximately 283,300 gallons of wastewater generated from site activities; and,

g. Site restoration including backfilling, grading, and seeding the site.

1.8.6.0.1. The report concluded that all pad and perimeter locations had been sufficiently remediated and delineated and all elevated levels of lead and copper in Reeder Creek sediments had been delineated and remediated. At the conclusion of the action the report recommended that the site be evaluated for transfer.

1.8.7 Seneca OE EE/CA - 2004

1.8.7.0.0. An EE/CA was performed in order to determine the nature and extent of possible MEC contamination at AOIs identified as potential MEC sites in the ASR. The EE/CA fieldwork used geophysical survey techniques and intrusive investigations to estimate the density of the ordnance in different areas, which was then compared with the current and future activities and anticipated users. Data collected from the characterization project were also used to develop alternatives designed to reduce the risk of possible exposure to MEC within AOIs. These alternatives were then evaluated to determine their effectiveness, implementability, and cost.

1.8.7.0.1. Results of this comparison indicate that there are portions of SEDA where alternatives requiring removal of UXO will be necessary to ensure public safety. The results also indicate that implementation of site-wide institutional controls will be necessary to manage residual risk.

1.8.7.0.2. The remedial alternatives evaluated for SEAD-45 were no further action, institutional controls, removal of OE items to a depth of 6 inches, removal of OE items to depth using a geophysical instrument selected in a prove-out, excavation of soil to a specified depth followed by mechanical sifting to remove OE. The response action identified for SEAD-45 in the EE/CA was clearance to depth by means of excavation and mechanical sorting. The report concluded that the OD Grounds contained very high concentrations of subsurface metal. The geophysical survey was not able to identify individual anomalies. Therefore, the recommendation of the EE/CA was for the area to be completely excavated and the soil sifted in order to remove MEC. After the excavations were completed, the areas

were to be resurveyed in order to remove remaining MEC. Areas outside of the excavation areas were to be cleared to depth of detection or 6 inches.

1.8.8 Time-Sensitive Geophysical Investigation - 2005

1.8.8.0.0. An EM-61 MK2 towed-array system was used to collect digital geophysical mapping (DGM) data for locating subsurface anomalies in all accessible areas (213 acres) between the 1,000-ft and 2,500-ft radial limits of the OD Grounds. A manual "mag & flag" approach using hand-held magnetometers was used to locate subsurface anomalies in wooded/transect areas (9.65 acres).

1.8.8.0.1. Results of the digital and manual geophysical surveys indicate that approximately 599 targets per acre exist between 1,000 ft and 1,500 ft of the OD Grounds Center, and approximately 139 targets per acre exist between 1,500 ft and 2,500 ft of the OD Grounds Center. These results confirm that the density of MEC and MD within the OD Grounds decreases further away from the OD Grounds Center, as previously suggested in the *EE/CA* (Parsons, 2004).

1.8.8.0.2. To verify the accuracy of results obtained both digitally and manually, WESTON investigated and removed a total of 512 items from anomaly target locations within non-wooded/open areas and a total of 736 items from anomaly target locations within transects. Dig results within the open areas of the OD Grounds revealed that approximately 97 percent of the excavated items were found at a maximum depth of 12 inches below ground surface (bgs). No items were excavated from a depth exceeding 20 inches bgs.

1.8.9 Phase II Ordnance and Explosives Removal Activities - 2006

1.8.9.0.0. The primary objective of Phase II removal activities was to reacquire, remove, and dispose of approximately 8,500 items located in non-wooded areas, between the 1,500-ft and 2,500-ft radius to a depth of 4 ft. In addition, potential items located within 220 transects through wooded areas of the OD Grounds also required reacquisition, removal, and disposal.

1.8.9.0.1. Between September 2003 and March 2005, Weston removed 7,940 out of the 8,500 identified anomalies within the open area of the OD Grounds. In the wooded area, Weston investigated and removed and cleared 169 of the 220 transects. The area containing these identified anomalies and transects is within the boundaries of the remedial action currently being performed by Parsons. Additional information regarding these areas can be found in the Parsons After Action Report when published.

1.8.9.0.2. In the open area, a total of 9,497 individual items were removed between the 1,500-ft and 2,500-ft radius representing targets with responses between 9.5 mV and 2,861

mV. The frequency of MPPEH increased towards the OD Hill. From the wooded areas, Weston removed 6,663 individual items.

1.8.9.0.3. As a result of the anomaly reacquisition and removal, the following data was produced: items were located at depths ranging from the surface to 36 inches bgs. A total of five MPPEH items considered hazardous and unsafe to move were located at depths ranging from 3 to 8 inches bgs. All five of these MPPEH items were fuzed 37mm, High Explosive (HE) Projectiles. MPPEH that were found that were considered acceptable to move included a 1.1-inch Anti-Aircraft Projectile, Smoke Pots, 2.36-inch white phosphorus (WP) Warheads and Rocket Motors, 20mm Projectiles, 25mm Projectiles, 30mm Projectiles, 37mm Projectiles (unfuzed), 4.2-inch Mortar Fuzes, 40mm Projectiles (unfuzed), 57mm Projectiles (unfuzed), 76mm APHE Projectile with a base fuze, 75mm projectiles (unfuzed), and assorted Fuzes.

1.8.10 Completion Report for Additional Munitions Response Site Investigations - 2010

1.8.10.0.0. Focused investigations were performed at the OD Grounds that included topographic and geophysical surveys of specific areas within the OD Grounds and the collection and analysis of soil samples from test pit and surface soil locations (Parsons, 2010). There were a total of 92 (including QC) soil samples analyzed during the investigation. Samples were either analyzed for a full suite of parameters (26 samples), explosives and metals (12 samples), metals (66 samples) or metals and SPLP (8 samples). A full suite of parameters included TAL metals, explosives, TCL semivolatile organic compounds, pesticides/PCBs, and organochlorine herbicides. The objectives of these site investigations included the following:

a. Determine the volume of soil in the OD Grounds Hill;

b. Estimate the bedrock surface at the OD Grounds;

c. Determine and document the density of geophysical anomalies from the ground surface to lower elevations at selected areas to assess potential depth of penetration profiles at 1-ft elevations;

d. Determine the nature of MPPEH items that are present at the OD Grounds;

e. Determine the vertical and horizontal extent of metals, explosives, semivolatile organics, pesticides and herbicides, and PCBs in the OD Grounds Hill and surrounding area; and,

f. Assess the potential leachability of certain compounds identified at the site.

1.8.10.0.1. Based on the results of this investigation, the following conclusions were offered:

a. The quantity of soil contained in the OD Hill above surrounding grade level is estimated to be 38,000 CY.

b. Bedrock underlying the area of the OD Hill mound is estimated to vary from 10 to 20 ft bgs.

c. Geophysical anomaly densities generally decrease from saturated levels at surface elevations to lower densities at depth at each test plot; this is especially true for the test plots that are further from the initial point of detonation.

d. Test plot areas were selected within locations shown to have saturated levels. The test plots were then excavated to a depth of 12 inches and resurveyed using EM-61. The survey results were plotted and anomalies with a response greater than 50 mV were designated as targets. If the initial resurvey of a test plot continued to show high levels of geophysical anomalies, additional 1-ft excavations were performed. Of the six test plots, five of them were excavated to 1 ft and one was excavated to 2 ft. After all excavations were completed, the estimated number of targets per acre ranged from 0 to 282. After excavations were completed and all areas re-surveyed, all targets were excavated. Generally, after excavation and inspection all targets were classified as MD.

e. Review of the anomaly density depth information obtained during this investigation indicates that anomaly densities generally decrease with depth of excavation especially at distances greater than 100 to 200 ft from the OD Hill.

f. The report also concluded that the vertical distribution of anomalies may have a directional component as more anomalies to the northeast and northwest of OD Hill and fewer to the southeast.

g. The closest test plot contained similar numbers of targets at the 1 ft and 2 ft profiles, indicating that the soils in close proximity to the OD Hill may have been heavily reworked.

h. Metals are the predominant contaminants that were identified at the OD Grounds, both in terms of the frequency of detection and with respect to the number of samples with concentrations that exceed applicable guidance values. In addition, 95^{th} upper confidence limit values calculated from the four assessed datasets (i.e., overall data, OD Hill only, test pit only, and radius samples only) indicate that metal contamination at levels above comparator values is distributed throughout surface and subsurface and soils at and beyond the OD Hill. The comparator values in the 2010 Draft Completion Report included the New York State unrestricted use soil clean

objective (SCO) levels, an adjusted version of the U.S. Environmental Protection Agency Regional Screening Levels (RSLs) for residential soils and the 95th UCL of regional background concentrations. The metals with the largest number of exceedances were cadmium, copper, mercury, nickel and zinc. The metals with the greatest ratio of exceedance were cadmium, chromium, copper and zinc.

i. Metal concentrations are generally highest in samples collected in close proximity to the OD Hill, and generally decrease as distance from the hill increases. However, some of the elevated concentrations were found in subsurface soil off of the OD Hill but within the 500 foot radius. For instance, concentrations of copper are highest in soil near OD Hill; with increasing distance from OD Hill, the concentration of copper decreases until reaching acceptable concentrations somewhere between 500 and 1000 feet away from OD Hill. There is evidence that several of the highest concentrations of copper, including the overall highest (i.e., 7,310 mg/kg at S45-TP1-02 at 2.5 ft bgs), are found in underground test pit samples. Many of the highest metal concentrations were found in the surface soils collected from the OD Hill, but as is indicated by the discussion regarding copper, other elevated concentrations may be present at depth in, and around, the OD Hill Area (namely copper). However, at distances of greater than 500 feet from the OD Hill only sporadic exceedances of metals were noted. The following exceedances of NYS unrestricted SCO were noted for the 14 samples collected outside of the 500 foot radius. Chromium in 2 samples, copper in 4 samples, lead in 1 sample, mercury in 8 samples, nickel in 6 samples and zinc in 8 samples.

j. Four metals, mercury, lead, cadmium, and copper, exhibit potential to leach from soils at levels that exceed State of New York GA Groundwater Effluent Limitation levels when exposed to synthetic precipitation solutions. Other metals also are observed to leach from soils found at the OD Grounds, but not to levels that currently indicate potential problems. The following metals leached at detectable levels below the NYSDEC GA GW Effluent criteria: arsenic, barium, chromium, cobalt, silver vanadium and zinc.

1.9 Initial Summary of Risk from MEC and MC

1.9.0.0. MEC, where present, is a safety hazard and constitutes an imminent and substantial danger to the general public, site personnel, and the environment. MEC and MD were previously recovered from the OD Grounds between the 0- to 1,000-ft radius that is the subject of this work plan. Based on results of investigations and previous removals, the density of MEC/MD is greater in the areas closer to the OD Hill.

1.9.0.1. A variety of ordnance was destroyed by detonation at this area, including explosives, mortars, and artillery rounds. The blast radius shown on old drawings included in the ASR is 1,800 ft from the center of the demolition berm.

1.9.0.2. The types of MEC/MD identified at the OD Grounds are identified in Section 1.8.9.0.3. **Table 1-1** presents the types of MEC/MD identified during the investigation of the test plots in the 2010 Additional Munitions Response Investigation. These test plots determined that in all cases the number of anomalies was much greater in the 0- to 1-ft interval than beneath 1 ft. However, in the one test plot closest to OD Hill, the number of anomalies was similar after removing the top 1 ft of soil and the top 2 ft of soil. This potentially indicates the anomaly density in the OD Hill and the area adjacent to the OD Hill is homogeneous as a result of soil mixing during years of operation at the facility.

1.9.0.3. Access into the OD Grounds is possible via a paved road that enters the area from the southeast and roughly parallels the path of Reeder Creek along its western bank. The unnamed access road branches off North-South Baseline Road near Building 2104, which is located in the southeastern corner of the OD Grounds.

1.9.0.4. Hazards to human health and the environment as a result of an explosion are the primary risk factor involved with potential MEC at the OD Grounds. No installation workers are currently located at the OD Grounds and the area is enclosed with a perimeter fence. There is a potentially complete pathway for human exposure (authorized personnel, authorized visitors, and trespassers) to MPPEH.

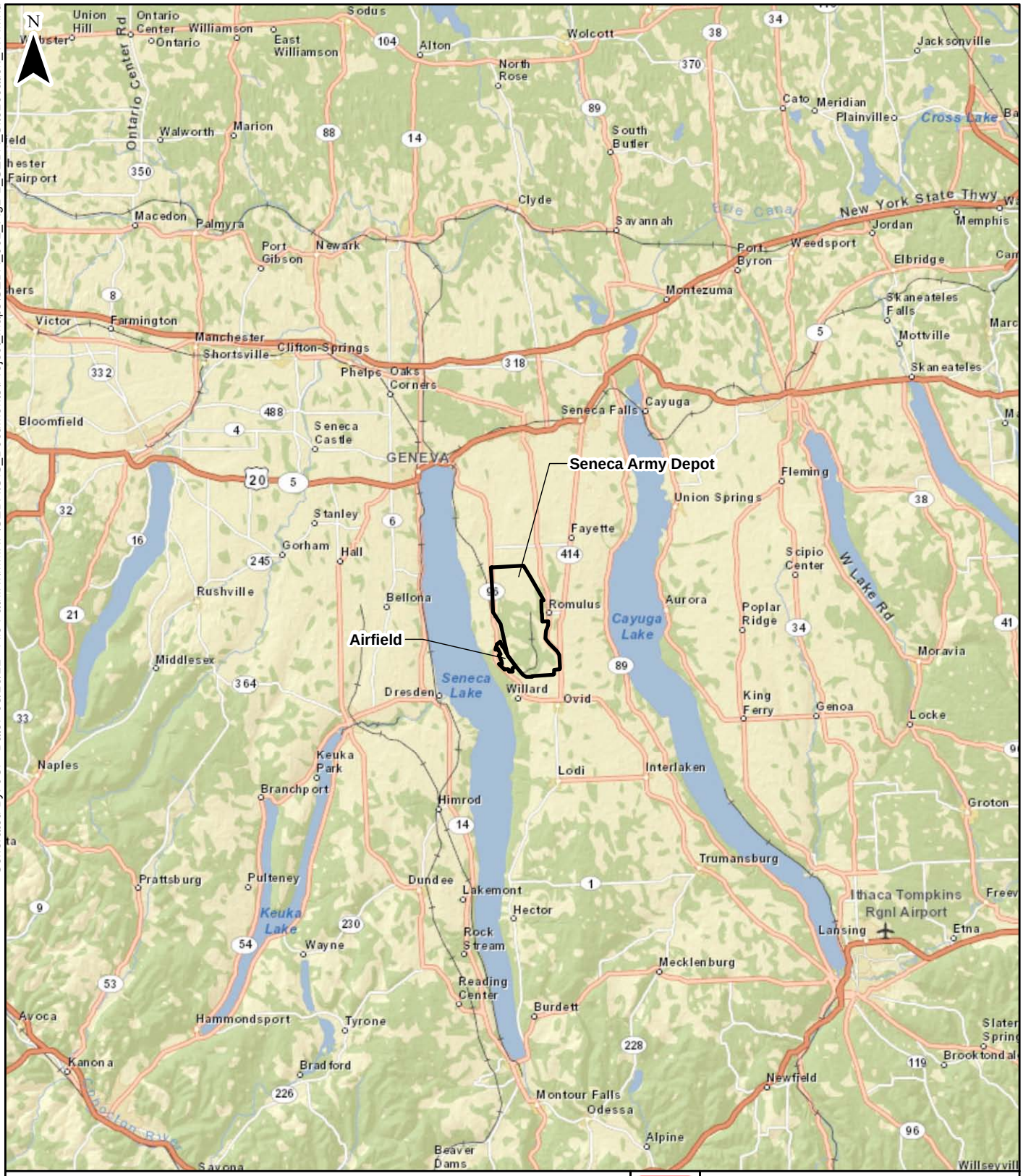
1.9.0.5. Elevated heavy metals were identified, primarily surrounding OD Hill, which is located at the center of the OD Grounds. These elevated metals are present within the 0- to 500-ft radius; the number and magnitude of the exceedances are reduced with distance from the OD Hill. With the exception of isolated instances, at distances greater than 500 ft, metal concentrations detected at concentrations above levels of comparison were in OD Hill surface soil samples only. Risks to human health and the environment will be addressed with the capping activities that are being discussed in separate documents.

1.9.0.6. The Open Burning Tray is empty of munitions so explosive hazards do not remain, but the tray may be used for thermal verification during the OD Grounds MEC clearance activities. However, following completion of the clearance activities, it is expected that all leftover materials will be removed from the tray and disposed of properly. Please refer to Section 2 for a discussion of the technical approach for closure of the burning tray. Residual wastes (i.e., MC) present in the Open Burning Tray could present an unacceptable risk to human health or the environment and will be addressed in the closure of the tray.

Table 1-1
Munitions and Munitions Related Findings During the OD Grounds Additional Munitions Response Investigations, 2010

Munition Type (0-1,000 ft Radius)	Quantity/Number of Locations
Rocket Assisted Projectile (RAP) Round Base	2
Projectile Base	1
Approximately 25 steel Fragments between 1" and 3" long and ¼" and 1" thick	2
Fuze Components	2
Pile of Bullets	1
Large Fragment	1
20mm Fragment Round	3
57mm Fragment Round	1
Fragment Pieces	1

(Parsons, 2010)



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Project Number: 144717

U.S. ARMY
ENGINEERING SUPPORT CENTER
HUNTSVILLE

MILITARY MUNITIONS RESPONSE PROGRAM

FIGURE NUMBER
1-1

SITE LOCATION MAP
SENECA ARMY DEPOT ACTIVITY
NEW YORK

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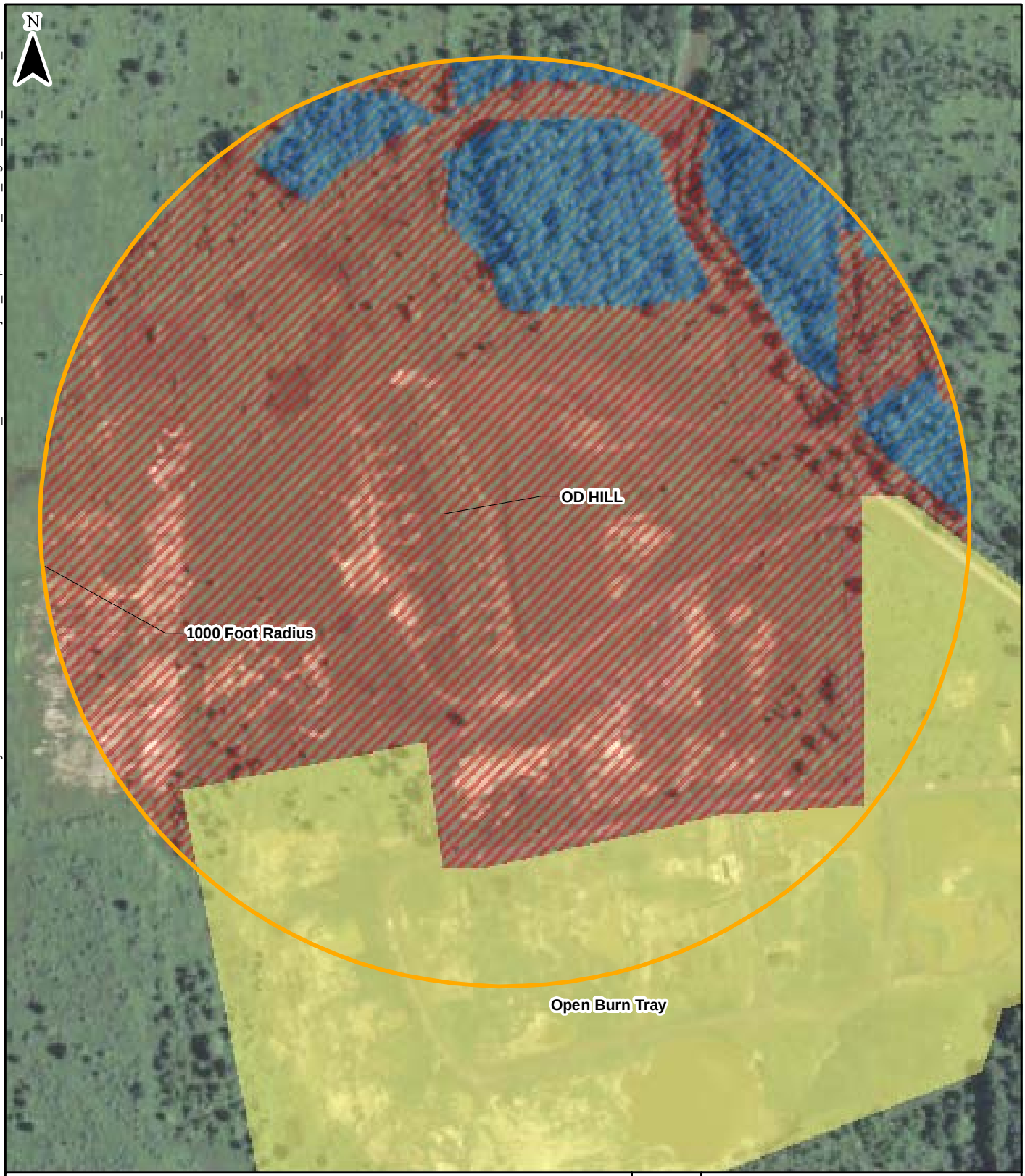

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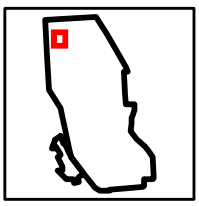
Project Number: 144717

OB Grounds (Already Cleared)

MRS 1,000-Foot Buffer

Mag and Dig Area

DGM Area



0 300 600 Feet

Projection : NAD_1983_StatePlane_New_York_Central_FIPS_3102_Feet

U.S. ARMY
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MILITARY MUNITIONS RESPONSE PROGRAM

FIGURE NUMBER 1-2

OD GROUNDS SITE PLAN
SENECA army DEPOT ACTIVITY
NEW YORK

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Project Number: 144717

Ground Surface Contour (1 ft Interval)

MRS 1,000-Foot Buffer To Be Cleared

0 300 600 Feet

Projection : NAD_1983_StatePlane_New_York_Central_FIPS_3102_Feet

U.S. ARMY ENGINEERING SUPPORT CENTER
HUNTSVILLE

MILITARY MUNITIONS RESPONSE PROGRAM

FIGURE NUMBER	
1-3	TOPOGRAPHY MAP SENECA ARMY DEPOT ACTIVITY NEW YORK

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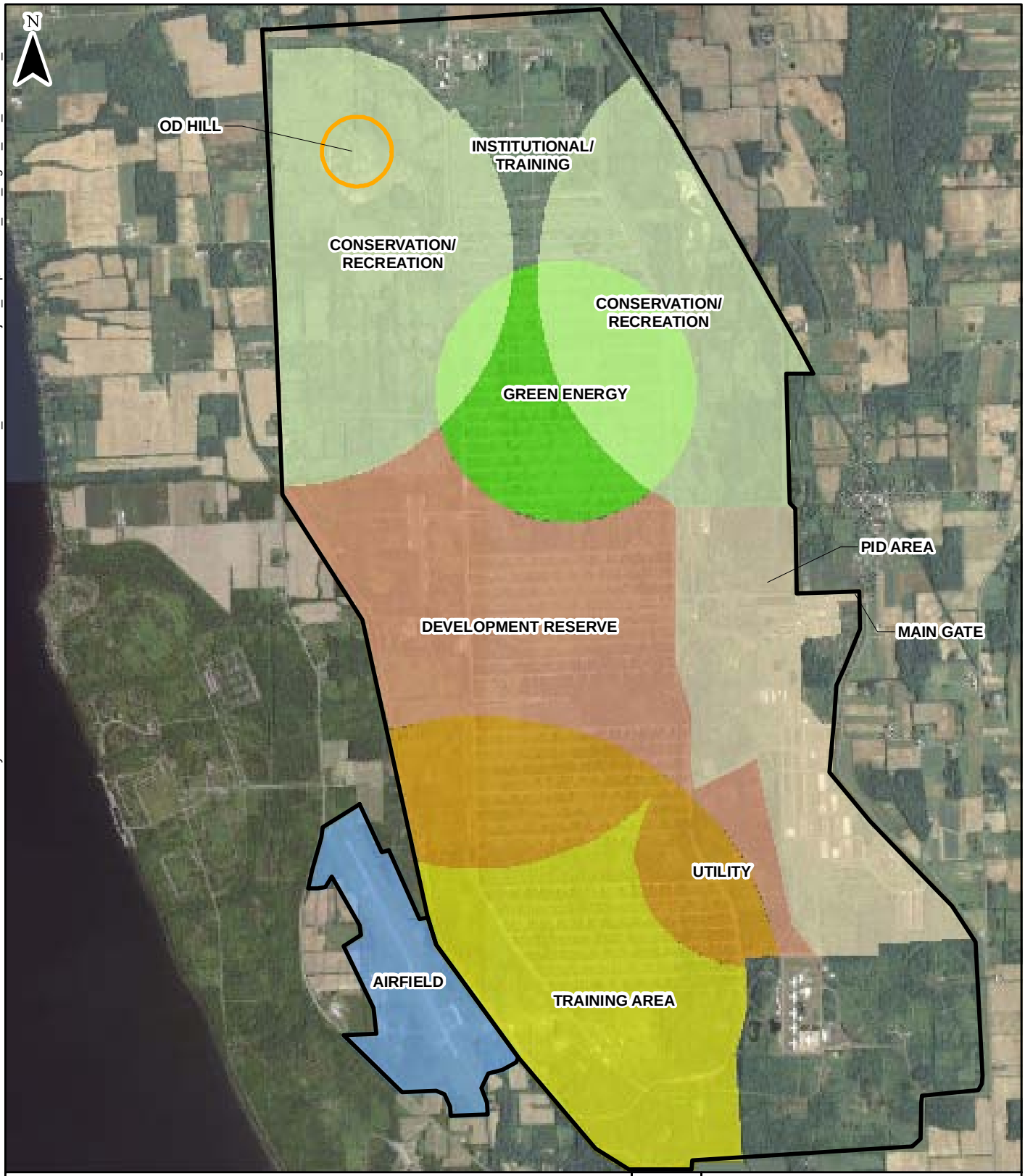

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Project Number: 144717

MRS 1,000-Foot Buffer To Be Cleared

Seneca Army Depot Activity Boundary

0 4,000 8,000
Feet

Projection : NAD_1983_StatePlane_New_York_Central_FIPS_3102_Feet

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MILITARY MUNITIONS RESPONSE PROGRAM

FIGURE NUMBER	
1-4	OD GROUNDS LAND USE SENECA ARMY DEPOT ACTIVITY NEW YORK

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2.0 TECHNICAL MANAGEMENT PLAN

2.1 Project Objectives

The overall objective of the work described in this work plan is to remove MPPEH from within the 0- to 1,000-ft radius for the OD Grounds and to close the Open Burning Tray. The objectives for this task order will be met when the following are accomplished:

a. Work plans are prepared IAW the PWS and referenced governing regulations and requirements. These work plans identify appropriate field work elements and define and present a cost-effective approach to the planning and implementation of field work.

b. All MEC has been removed from the surface within the 0- to 1,000-ft radius.

c. All targets exhibiting a geophysical response greater than 50 mV have been investigated and removed from the 0- to 1,000-ft radius.

d. The Open Burning Tray has been closed IAW the approved work plan (Parsons, 2005).

e. A Remedial Action Report (RAR) is completed that summarizes the results from the remedial action at the OD Grounds.

f. The Government accepts the RAR, meeting the requirements of DID WERS-013.01.

2.2 Project Organization

This subchapter describes the organizations involved, along with their project roles. **Table 2-1** lists the key project organizations and their responsibilities. In addition to the key organizations listed in **Table 2-1**, support organizations, local governments, local emergency management agencies, and other stakeholders may also have roles in the project.

2.2.1 Responsibility Matrix

2.2.1.0.0. **Figure 2-1** presents the project organizational chart for the SEDA remedial activities at OD Grounds. The responsibilities of the key personnel are presented in **Table 2-2**. The Shaw Project Manager (PM), Site Manager, Senior Unexploded Ordnance Supervisor (SUXOS), Unexploded Ordnance Quality Control Supervisor (UXOQCS), Unexploded Ordnance Safety Officer (UXOSO), and the Corporate Health and Safety Manager (CHSM) are responsible for formulating and enforcing environmental, health and safety and quality requirements for implementing the approved work plan.

2.2.1.0.1. Services that may be subcontracted for the MEC clearance activities may include waste transportation and disposal, survey work, drilling, munitions demolition

operations, demolition explosives, and chemical analytical services. Shaw will solicit bids from small business and small disadvantaged business firms to maximize small business content and meet contract goals. Shaw will research local subcontractors and providers and solicit proposals from qualified local vendors. Selection of subcontractors will be based on most qualified for the task required as determined by Shaw.

2.3 Project Communications and Reporting

All communication to stakeholders, regulators and local authorities will be coordinated with SEDA. Shaw will not contact any stakeholders other than Army stakeholders without receiving approval from the Army. All aspects of administering the project must be substantiated by permanent records, such as written correspondence, notes, and photographs. It is essential to summarize important non-written communications with notes covering conferences, telephone calls, and discussions, giving the date, location, parties involved, and important issues/topics discussed. Written correspondence is the most deliberate, as well as the most important, of the three general types of contractual communication (i.e., person to person, telephone calls, and written correspondence). All incoming correspondence from a USAESCH representative that requires a reply must be responded to within five working days in one of the following manners:

a. Reply in full;

b. Interim reply (stating the date by which a full answer can be expected); or,

c. Acknowledgment of receipt.

2.3.1 Office Communications and Reporting

2.3.1.0.0. The Shaw PM is responsible for issuing the following documents throughout the project:

a. Meeting minutes (due 7 days after a meeting);

b. Record of telephone conversations (due with the Periodic Status Report [PSR]); and,

c. PSRs (IAW DID WERS-016.02).

2.3.1.0.1. A PSR will be issued pursuant to the terms of the contract. The PSR will include a progress report regarding project tasks, scheduling, work progress, budget completion, pertinent correspondence, deliverable status, potential barriers to project completion, exposure data, and quality control (QC) documentation.

2.3.2 Field Communications and Reporting

2.3.2.0.0. The following communications will be documented in a chronological communications log maintained by the Shaw SUXOS and the UXOSO:

a. Each occasion that MPPEH is encountered;

b. When and why work is stopped for safety reasons;

c. Health and Safety violations/plan deviations; and,

d. Personnel changes and reason for changes.

2.3.2.0.1. When field operations are being conducted, a daily progress report will be completed by the SUXOS. The report will include the following:

a. Discussion of work progress;

b. Individuals contacted;

c. Equipment on site;

d. Personnel on site;

e. Problems encountered;

f. MPPEH found; and,

g. Discussion of work completed versus project schedule.

2.3.2.0.2. Additionally, during the MC sampling activities, a Daily Quality Control Report (DQCR) will be prepared and submitted by the UXOQCS. The DQCR will include, at a minimum, weather information at the time of sampling, field instrument measurements, calibrations, identification of all field and control samples collected, departures from the Parsons, 2005 work plan for closure of the Open Burning Tray, UFP-QAPP in **Appendix E**, or SEDA Generic Site-Wide SAP (Parsons, 2006), any problems encountered, and any government personnel directives.

2.4 Project Deliverables

2.4.0.0. At a minimum, each report shall be issued in pre-draft, draft, draft final, and final versions. The pre-draft is typically for Army review and comment only. Following Army approval of the pre-draft version, the draft version will then be submitted for regulatory (USEPA and NYSDEC) review and comment. The draft final version will be prepared as needed in order to facilitate agency back check of responses to comments. Finally, the final version will be submitted to all the stakeholders and is accessible for public viewing following approval by the regulators. All final major submittals will be submitted in

both hard copy and electronic (compact disc-read only memory [CD-ROM]) format. A CD-ROM that includes the report, all data, and maps produced will be delivered with each copy of the report.

2.4.0.1. Project deliverables will consist of the following documents:

a. Meeting Minutes;

b. Public Meeting Materials;

c. Work Plan;

d. Geophysical Data;

e. QC Documents;

f. RAR;

g. Final geographic information system (GIS) data package; and,

h. Administrative Record Updates.

2.5 Project Schedule

An overall project schedule is provided as **Figure 2-2**. This schedule will be updated, when necessary, and submitted to USAESCH with the associated progress report. The included schedule is based on the PWS and the anticipated time needed for document review and planning for field mobilization.

2.6 Periodic Reporting

2.6.1 Monthly Progress Reports

Project status reports will be provided monthly when field activities are not ongoing IAW DID WERS-016.02. The Monthly Status Report will be submitted no later than 10 calendar days following the reporting cut-off date. Weekly status reports will report project status from beginning through completion of field work. In addition, IAW WERS-016.02, a Munitions Response Monthly Progress Summary Report (as indicated in WERS-016.02, Table 1) and an Exposure Data Report will be provided. Our reporting systems are routinely customized to meet customer needs. Various productivity comparison reports can be generated by Task Order or other selected elements. Safety/QC documentation will be provided on the required forms IAW the WERS DIDs.

2.6.2 Web-Based Information Portal

2.6.2.0.0. Shaw will establish and maintain a web-based portal to facilitate the management of work under this contract to disseminate project-related information to project delivery team and the interested public for the contract duration.

2.6.2.0.1. The portal will be established so that Shaw, USAESCH, and SEDA will have access to a common website (SharePoint portal) that houses relevant historical project information. The portal (located at https://shawxnet.shawgrp.com/sites/SEDAODA/default.aspx) will provide access to items including schedules, submittals, meeting minutes, site data and plans, regulatory documents, reference documents, and project management information. The portal can also be made available to the USEPA and NYSDEC at the direction of the Army.

2.6.3 Field Status Reports

Shaw will prepare and submit weekly status reports during field activities to document field activities completed and planned. The report will be delivered electronically via e-mail and posted to a project website.

2.7 Costing and Billing

This project delivery order was awarded as a combination of Firm Fixed Price and Fixed Unit Pricing tasks. The Firm Fixed Price tasks will be billed based on physical work completed derived from negotiated milestones or unit rates. Shaw will invoice the Fixed Unit Pricing tasks monthly and submit the PSR and the back-up information required by the contract.

2.8 Project Public Relations Support

2.8.0.0. Shaw will not make available or publicly disclose any project data or reports generated or reviewed under this contract unless specifically authorized by USAESCH and SEDA. Shaw will support USAESCH, SEDA, USEPA, and NYSDEC with managing public affairs related to all remedial activities. The support will include providing information for items such as public meetings and fact sheets on an as-needed basis.

2.8.0.1. If required, Shaw will also assist in the coordination of community relations with the local community. The primary objectives are building and maintaining a positive relationship with the community, establishing communications as quickly as possible, and continuing to provide public information regarding ongoing activities and MEC safety.

2.9 Subcontractor Management

Each subcontractor working on the Installation will be required to adhere to the APP/SSHP and will be subject to the same training and medical surveillance requirements as Shaw personnel depending on job activity. All activities involving the potential for exposure to hazardous waste materials will require medical and training certification as mandated by Title 29 CFR Sections 1910.120 and 1926.65.

2.10 Management of Field Operations

Fieldwork will be coordinated within the Shaw Mt. Arlington, New Jersey, office. Field teams may be composed of Shaw staff from throughout the United States (e.g., UXO Technicians, geophysicists). Such resources, as well as any necessary subcontractor support, will be managed by the PM and/or Site Manager. The Site Manager will be responsible for identifying appropriate field staff through local office managers and will confirm that proposed project personnel have the necessary experience and required training for the project.

Table 2-1
Roles and Responsibilities of Project Organizations

Participant Organizations	Responsibilities
SEDA	Ultimate team leader for project decisions and actions; approves and directs the project, including changes in the objectives, budget, and scope; programs and obtains funding to accomplish tasks as appropriate; review and comment on project related documents including work plans, designs, status reports, and final report (document specific, from draft forward); attend all project related meetings/calls; coordinate operations on facility side as it relates to Shaw's work under the WERS contract at SEDA. Exchange/transfer technical data and information with Integrated Team throughout the project.
USACE – NY District	Provides life cycle project management of all aspects of the project; serves as the Project Delivery Team leader for all COE support; overall responsibility for project definition, scope, budget, schedule, quality and change; manages all funding for the project; oversight of Shaw activities including review and conditional approval of Shaw deliverables; attend all project planning meetings and other meetings/ calls as it deems necessary; support SEDA in discussions with regulators related to approaches to meet performance objectives at OD Grounds; oversee the safety and quality of field work efforts, oversee the day to day activities of the projects construction phase; coordinating technical activities and elements required to meet the established schedules and complete work within established budgets and performing quality assurance (QA) review of the contractors field practices during the work efforts as required and identifying and recording deficiencies in field practices. Exchange/transfer technical data and information with Integrated Team throughout the project.
USAESCH	Provides life cycle project management of all aspects of the project; ensuring a quality product; serves as the design team lead; ensures all project objectives are met; oversight of Shaw activities including review and conditional approval of Shaw deliverables; attend all project planning meetings and other meetings/ calls as it deems necessary; support SEDA in discussions with regulators related to approaches to meet performance objectives at OD Grounds; coordinating technical activities and elements required to meet the established schedules and complete work within established budgets and performing QA review of the contractors field practices during the work efforts as required and identifying and recording deficiencies in field practices; and approval of payment milestones and Shaw invoices. Exchange/transfer technical data and information with Integrated Team throughout the project.
Shaw	Overall management and execution of all services related to the WERS project for implementation of a remedial actions required to meet performance objectives for OD Grounds at SEDA; support SEDA as lead interface with the USEPA and NYSDEC as it relates to the OD Ground remedy; obtain approval of documents submitted to the regulators and the U.S. Department of the Army (U.S. Army); prepare contract required submittals; coordinate and attend all project related meetings/calls; and coordinate Shaw's site activities with SEDA, USAESCH, NYSDEC, and USEPA personnel. Exchange/transfer technical data and information with Integrated Team throughout the project.
NYSDEC and USEPA Region 2	Provide regulatory oversight for project activities. Review, comment on, and approve work plans, designs, and reports and attend planning meetings.

Table 2-2
Responsibilities of Team Members – SEDA OD Grounds MEC Clearance Activities

Title	General Description	Responsibilities
PM	Reports to upper-level management. Has authority to direct response operations and implement the PWS for USAESCH.	Coordinates and reviews the project records, the Work Plan, the ESS, the APP/SSHP, and the reports. Organizes the field team. Obtains approval to start field work and coordinates activities with appropriate officials. Employs the Project Safety and Health Officer to ensure that safety and health requirements are met. Oversees the performance of all project team members. Coordinates subcontracted activities. Assures that technical and contractual issues are resolved. Controls cost and schedule targets.
Site Manager	Primary point of contact for Shaw for all field activities. Responsible for logistics and coordination of all field teams and subcontractors.	Manages overall field operations and determines the sequence of field team activities in consultation with the SUXOS. Oversees subcontractors' field operations and reviews subcontractors' weekly status reports. Coordinates with the PM to take corrective actions to assure budgets and schedules are enforced during the field work. Reports all QC failures and corrective actions to the PM and QA Manager. Enforces site control. Documents field activities and reports to the PM. Responsible for understanding field procedures and ensuring that the procedures are followed IAW the work plan. Certifies that all site personnel are properly trained in their respective positions (Sect. 3.9.3 of the Work Plan and Chapter 5 of the APP).
Senior UXO Supervisor (SUXOS)	Responsible for field team operations and safety.	Manages field operations related to MEC and determines the sequence and locations of surface, intrusive, disposal and field team activities. Coordinates with the site manager to take corrective actions to assure QC procedures, budgets and schedules related to MEC operations are enforced during the field work. Conducts certifications related to material documented as safe (MDAS) and documents all MDAS prior to releasing the materials for disposal. Reports all QC failures and corrective actions to the Site Manager. Enforces site control. Documents field activities and reports to the Site Manager. Responsible for understanding field procedures and ensuring that the procedures are followed IAW the work plan. Certifies that all site personnel are properly trained in their respective positions (Sect. 3.9.3 of the Work Plan and Chapter 5 of the APP).

Table 2-2 *(continued)*
Responsibilities of Team Members – SEDA OD Grounds MEC Clearance Activities

Title	General Description	Responsibilities
CHSM	Advises PM on all aspects of health and safety and supervises the SSHO/UXOSO.	Provides technical support concerning health and safety issues. Manages/Oversees the preparation of the APP/SSHP. Ensures that the health and safety protocols being followed conform to established industry protocols and standards. Confirms each team member's suitability for work based on a physician's recommendation. Conducts field health and safety audits to ensure APP/SSHP conformance and Shaw's policy compliance. Certifies that all workers have proper training. Investigates each accident or reportable incident.
UXOSO	Reports to the CHSM on all aspects of health and safety on site. Performs day-to-day health and safety tasks. Stops work if any operation threatens work or public health or safety.	Knows emergency procedures, evacuation routes, and telephone numbers of the ambulance, local hospital, poison control center, fire department, and police department. Notifies USAESCH of emergency conditions. Conducts hazard communications training. Notifies emergency response personnel by telephone or radio in the event of an emergency. Acts as spokesperson if an Occupational Safety and Health Administration (OSHA) inspector visits the site. Conducts on-site training concerning pertinent health and safety issues and new concerns. Reports all accidents or health and safety incidents to the CHSM USACE NY District and USAESCH. Provides MEC safety oversight during clearance activities conducted. Conducts MEC safety briefings/training. Conducts safety oversight during identification, excavation, movement and disposal of all MEC to ensure only the safest possible procedures are used. Reports/investigates MEC accidents and incidents
UXOQCS	Coordinates with SUXOS and QC Manager	Conduct and document QC inspections of all UXO and explosives operations for compliance with established procedures. Prepares and submits DQCR. Implement QC procedures Performs QC oversight for MEC disposal operations. QCs the completion of surface and subsurface removal operations using visual means and magnetometers. Implement the UXO specific sections of the QC Program for all MEC related evolutions. Approves all corrective actions to ensure all MEC related work complies with contractual requirements.

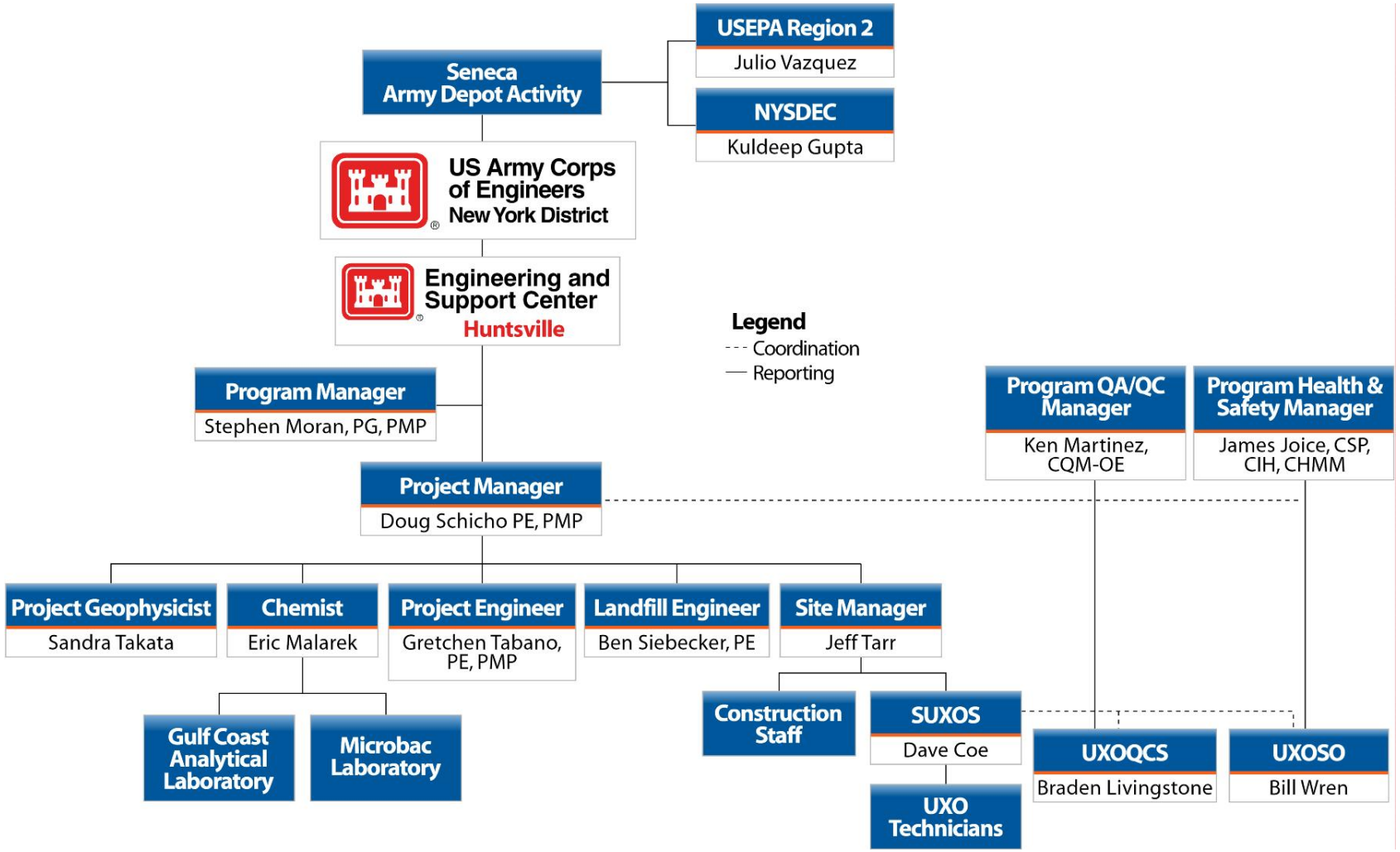
Table 2-2 *(continued)*
Responsibilities of Team Members – SEDA OD Grounds MEC Clearance Activities

Title	General Description	Responsibilities
QC Manager	Independent of the project team and interacts and communicates with subcontractor and USAESCH QA personnel.	Reviews all QA/QC procedures to be used in the project. Reviews subcontractor system audits and QC procedures to ensure compliance with the project QC guidelines. Performs a quality review to ensure the quality of deliverables from the project team.
Senior Geophysicist	Coordinates with the PM and USAESCH Geophysicist.	The Project Geophysicist will assist with the preparation and review of work plans. Provide day-to-day technical support and oversight to field geophysical survey personnel. Reviews geophysical data and prepares packages for USAESCH.
Senior Engineer	Coordinates with the PM and other Shaw disciplines	Responsible for the management of the technical quality of the contract, including the QC/QA Program. The Senior Environmental Engineer will direct the development and implementation of the QC/QA Program and ensure the Health and Safety Program is adequately implemented. Experienced and knowledgeable in the field of environmental remediation and shall be the primary point of contact for technical coordination of project requirements.
Geophysics or Sampling Field Teams	Takes daily instruction from and reports directly to the PM.	Safely completes the on-site tasks. Complies with Work Plan, Field Sampling Plan, ESS, APP/SSHP. Notifies UXOSO, or SUXOS of suspected unsafe conditions. Inspects personal protective equipment (PPE) prior to, during, and after each use.
UXO Team Leader (UXO Technician III)	Takes daily instruction from and reports directly to the SUXOS. Directs the action of a downrange team IAW the approved plans and the daily verbal directions of the SUXOS.	Supervises the direct MEC field operations for assigned tasks. Complies with all safety and work related standard operating procedures (SOPs), including ESS, APP/SSHP. Meets schedules on task/team time lines and budgetary control amounts. Coordinates with the UXOSO to ensure all site safety considerations are enforced. Supervises assigned personnel. Responsible for task/team assigned equipment and vehicles.
Demolition Team Leader (UXO Technician III)	Takes daily instruction from and reports directly to the SUXOS. Lead during demolitions.	Supervises all tasks associated with demolition of MEC. Complies with all safety and work related SOPs, including ESS, APP/SSHP. Coordinates with the UXOSO to ensure all site safety considerations are enforced. Supervises assigned personnel.

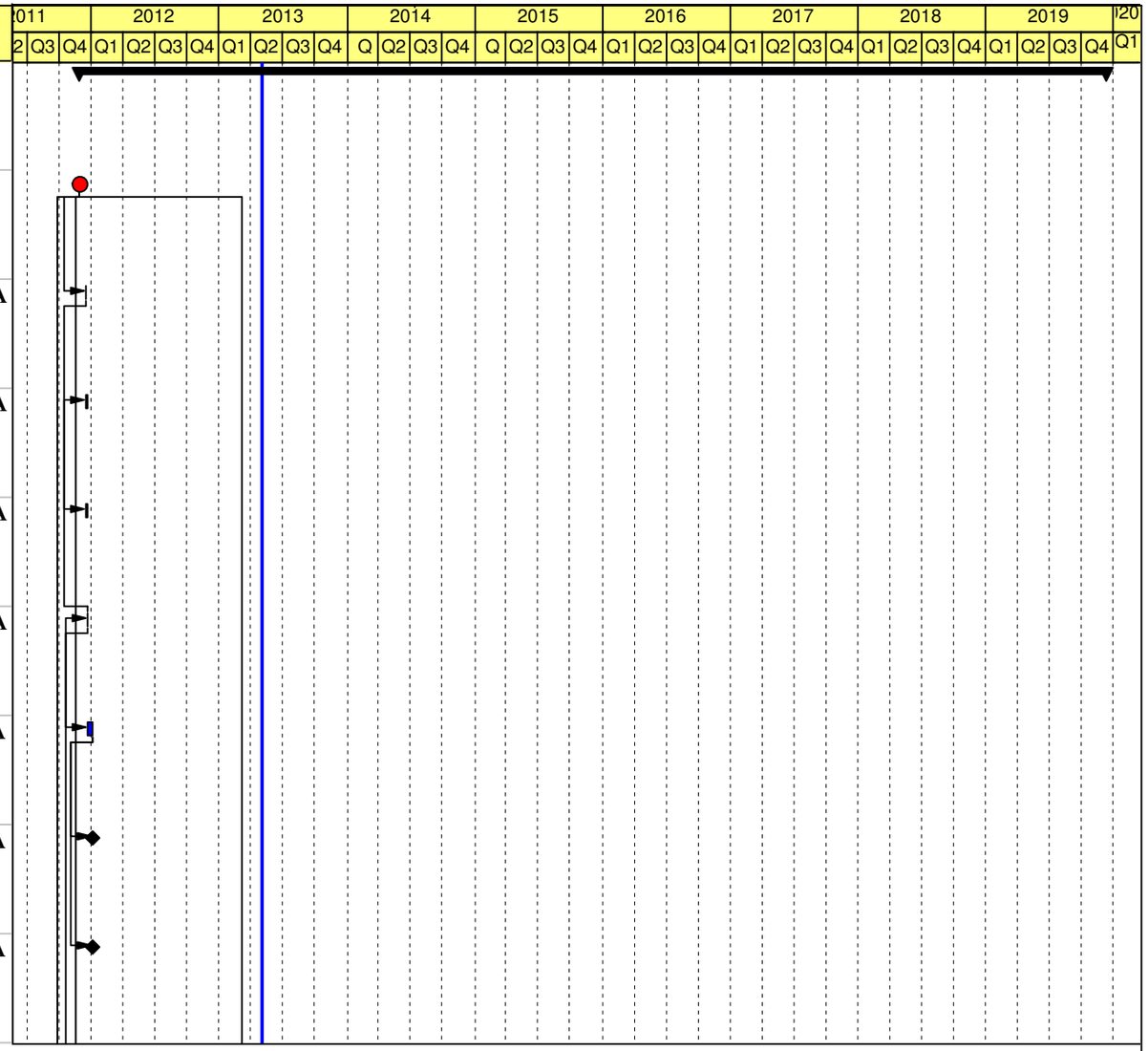
Table 2-2 *(continued)*
Responsibilities of Team Members – SEDA OD Grounds MEC Clearance Activities

Title	General Description	Responsibilities
UXO Field Teams	Under direct supervision of the UXO Team Leaders. Authorized to temporarily stop performance of work to immediately alert UXO Supervisor of unsafe conditions.	Safe and efficient performance of MEC field operations, including location, identification, removal and disposal of MEC IAW the approved Work Plan, ESS, and APP/SSHP.
USACE Ordnance and Explosive Safety Specialist	Reports to home USACE District	Provides safety oversight and QA of project related activities. Monitors operations within the exclusion zone (EZ). Verifies proper certification of MEC-related debris. Stops work in the event of unsafe conditions or if approved health and safety procedures are not being followed.

Figure 2-1
Project Organization Chart



Activity ID	Activity Name	Original Durati...	Start	Finish
Seneca Army Depot Open Detonation Ground		**2937**	**28-Nov-11 A**	**12-Dec-19**
0301	**Award / Notice To Proceed**	**0**	**28-Nov-11 A**	
030101	**Kickoff Conference Call**	**1**	**15-Dec-11 A**	**15-Dec-11 A**
030121	**Abbreviated Accident Prevention Plan**	**2**	**16-Dec-11 A**	**20-Dec-11 A**
030111	**Meeting Minutes / Kickoff Conference Call**	**7**	**16-Dec-11 A**	**22-Dec-11 A**
030131	**Site Visit / Stakeholder Kick Off Meeting**	**2**	**22-Dec-11 A**	**22-Dec-11 A**
030141	**Stakeholder Kick Off Meeting Minutes**	**7**	**22-Dec-11 A**	**05-Jan-12 A**
030141PM	**Payment Milestone: Approval / Acceptance of Meeting Minutes & Abbreviated Accident Prevention Plan**	**0**		**05-Jan-12 A**
030141M-MM	**Completion of Kick Off Meetings, Minutes and Abbreviated Accident Prevention Plan**	**0**		**05-Jan-12 A**



Remaining Level of Effort
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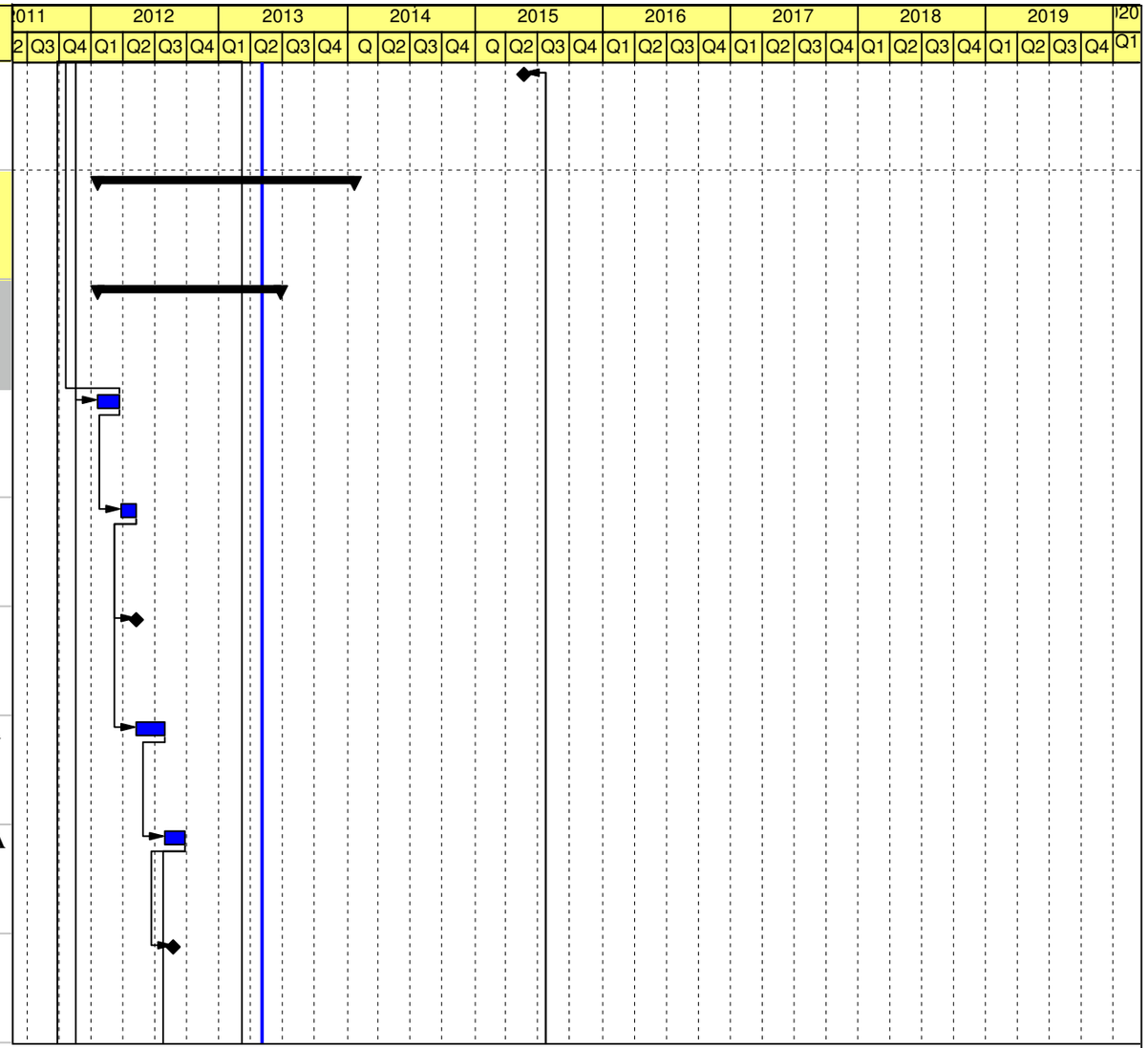
Critical Remaining Work
Milestone
Start Milestone
Summary

Huntsville WERS Contract #W912DY-10-D-0014

Remedial Action, Seneca Army Depot Activity, Open Detonation Ground

Romulus, New York

Activity ID	Activity Name	Original Durati...	Start	Finish
030199	Project Completion (Not Including Optional Tasks)	0		21-May-15
Task 1. Preparation of Work Plans & Designs		736	20-Jan-12 A	24-Jan-14
Work Plan		521	20-Jan-12 A	23-Jun-13
03100100	Draft Work Plan	30	20-Jan-12 A	23-Mar-12 A
03100105	Huntsville, NY District Corp, Seneca Army Depot & US Army Public Health Command Review Draft Work Plan	45	25-Mar-12 A	08-May-12 A
03100105PM	Payment Milestone: Approval / Acceptance of Draft Work Plan	0		08-May-12 A
03100110	Incorporate Comments / Submit Regulatory Draft Work Plan	10	09-May-12 A	30-Jul-12 A
03100115	USEPA, NYDEC and Bureau of Environmental Exposure Investigation Review Draft-Final Work Plan	30	31-Jul-12 A	24-Sep-12 A
03100115PM	Payment Milestone: Approval / Acceptance of Draft-Final Work Plan	0		23-Aug-12 A



Remaining Level of Effort
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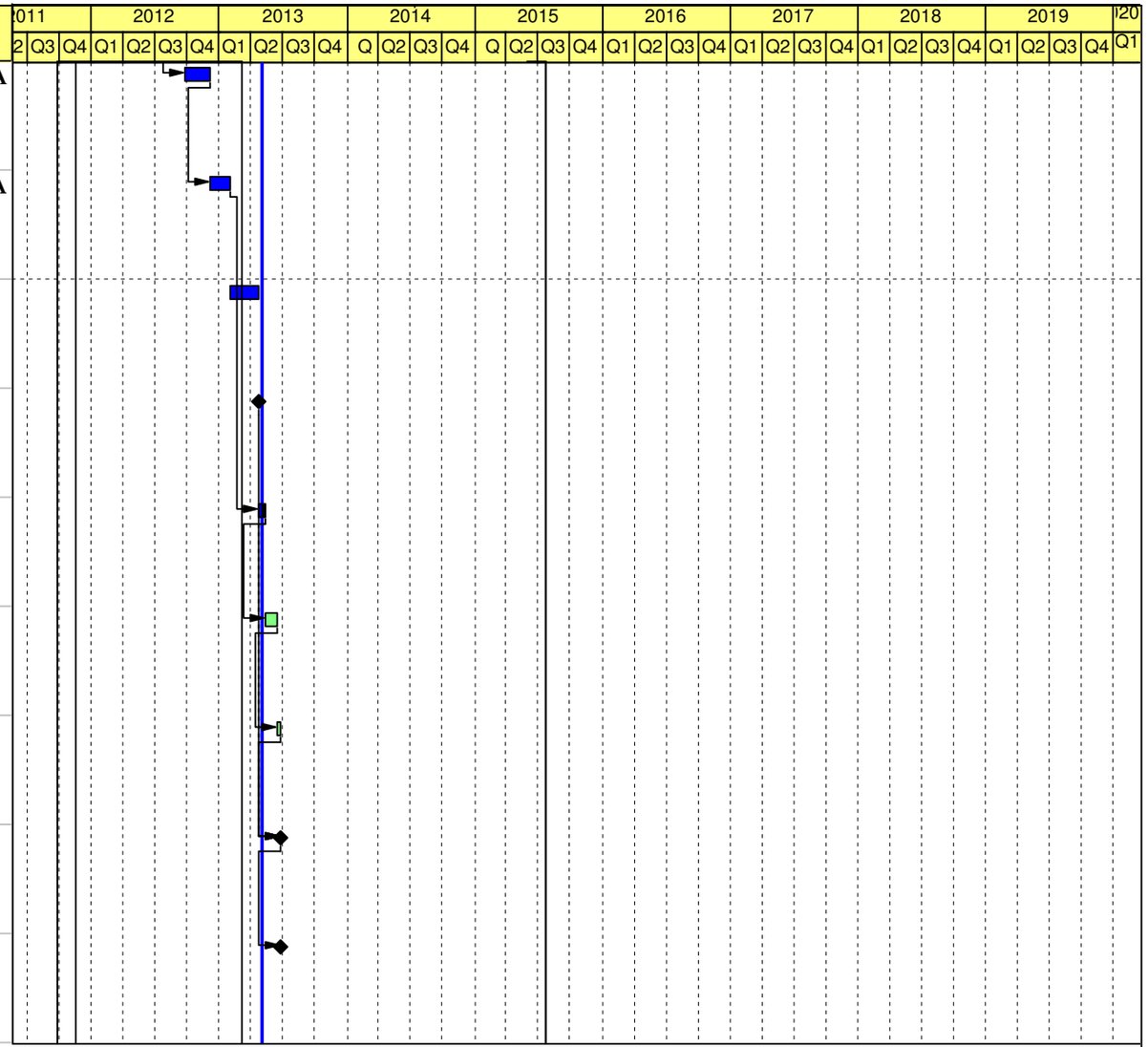
Summary

Activity ID	Activity Name	Original Durati...	Start	Finish
03100117	Response To Comments	5	24-Sep-12 A	04-Dec-12 A
03100119	Army Review / Approval of Response To Comments	5	04-Dec-12 A	01-Feb-13 A
03100119A	Discussion of Technical Approach	45	01-Feb-13 A	23-Apr-13 A
03100119A10	Army Approval to Finalize Work Plan	0		23-Apr-13 A
03100120	Incorporate Comments / Submit Draft Final Work Plan	10	24-Apr-13 A	14-May-13
03100120A	Regulatory Backcheck of Draft Final Work Plan	30	15-May-13	13-Jun-13
03100120A10	Submit Final Work Plan	10	14-Jun-13	23-Jun-13
03100125M-WP	Approval / Acceptance Final Work Plan	0		23-Jun-13
03100125PM	Payment Milestone: Approval / Acceptance of Final Work Plan	0		23-Jun-13



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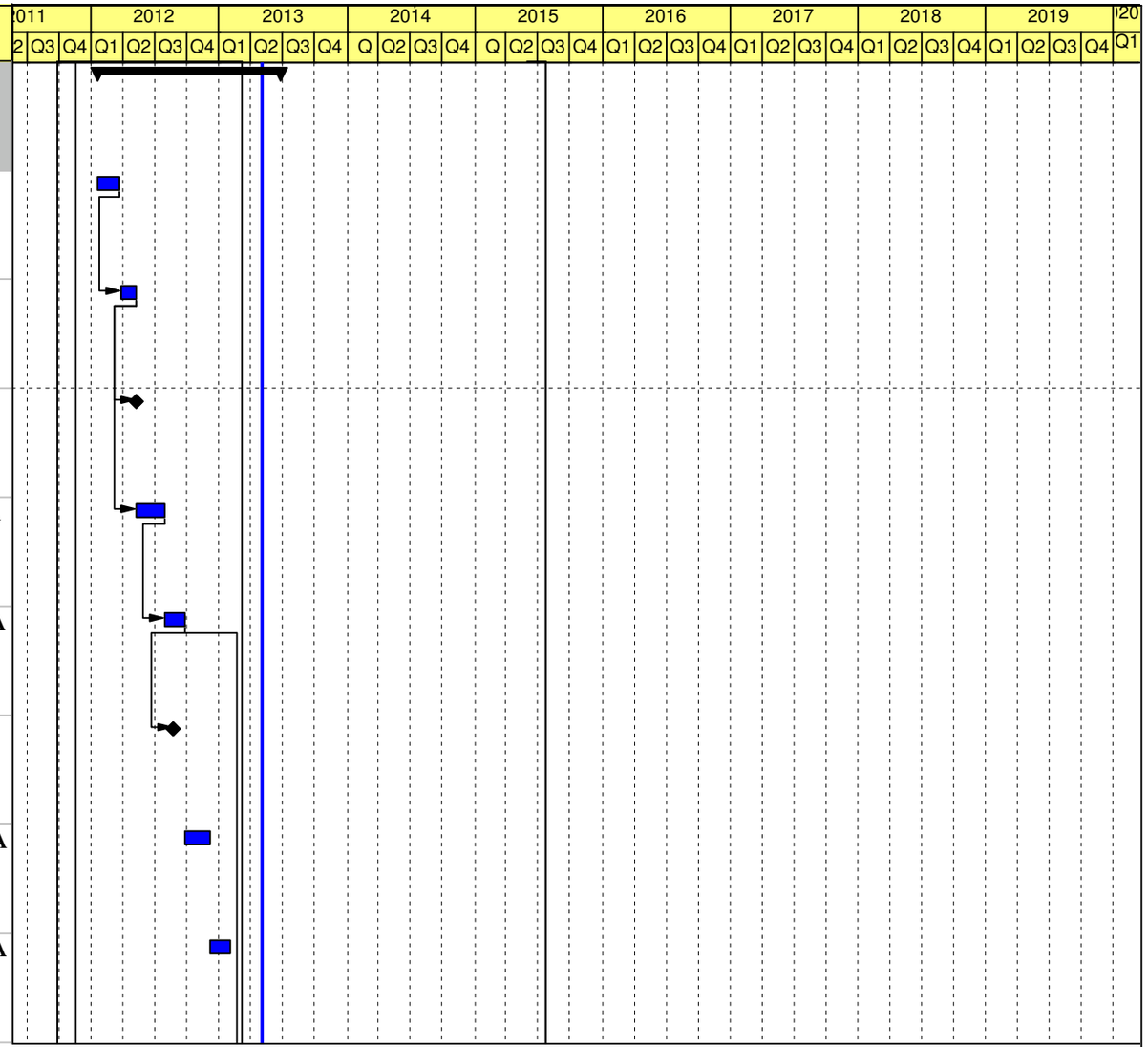
Start Milestone
Summary

Huntsville WERS Contract #W912DY-10-D-0014

Remedial Action, Seneca Army Depot Activity, Open Detonation Ground

Romulus, New York

Activity ID	Activity Name	Original Durati...	Start	Finish
Quality Assurance Project Plan (QAPP)		**521**	**20-Jan-12 A**	**23-Jun-13**
03100200	**Draft QAPP**	**30**	**20-Jan-12 A**	**23-Mar-12 A**
03100205	**Huntsville, NY District Corp, Seneca Army Depot & US Army Public Health Command Review Draft QAPP**	**45**	**25-Mar-12 A**	**08-May-12 A**
03100205PM	**Payment Milestone: Approval / Acceptance of Draft QAPP**	**0**		**08-May-12 A**
03100210	**Incorporate Comments / Submit Regulatory Draft QAPP**	**10**	**09-May-12 A**	**30-Jul-12 A**
03100215	**USEPA, NYDEC and Bureau of Environmental Exposure Investigation Review Draft-Final QAPP**	**30**	**31-Jul-12 A**	**24-Sep-12 A**
03100215PM	**Payment Milestone: Approval / Acceptance of Draft-Final QAPP**	**0**		**23-Aug-12 A**
03100217	**Response To Comments**	**5**	**25-Sep-12 A**	**04-Dec-12 A**
03100219	**Army Review / Approval of Response To Comments**	**5**	**05-Dec-12 A**	**01-Feb-13 A**



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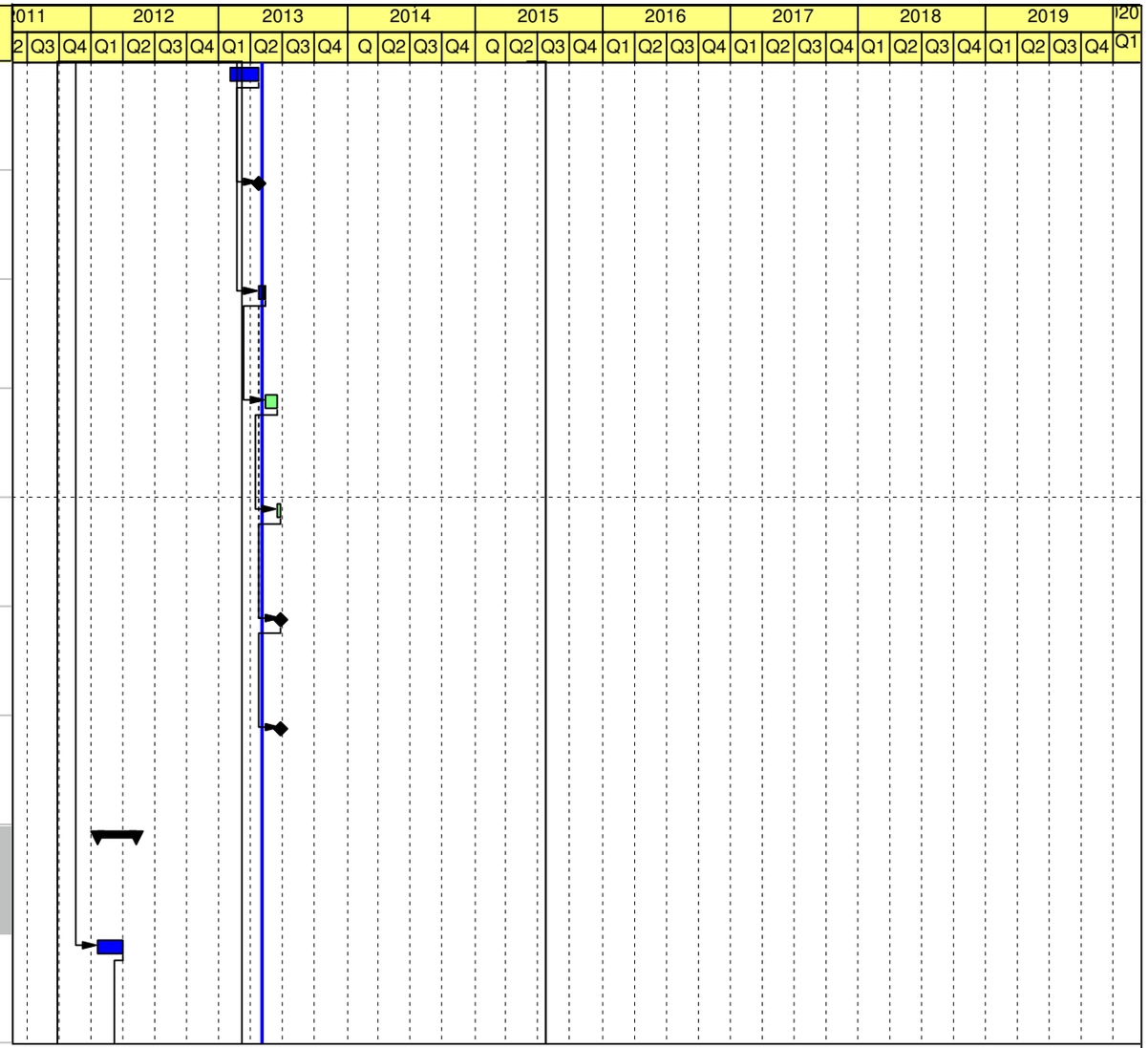
Huntsville WERS Contract #W912DY-10-D-0014

Remedial Action, Seneca Army Depot Activity, Open Detonation Ground

Romulus, New York

Activity ID	Activity Name	Original Durati...	Start	Finish
03100219A	Discussion of Technical Approach	5	01-Feb-13 A	23-Apr-13 A
03100219A10	Army Approval to Finalize QAPP	0		23-Apr-13 A
03100220	Incorporate Comments / Submit Draft Final QAPP	10	24-Apr-13 A	14-May-13
03100220A	Requlatory Backcheck of Draft Final QAPP	30	15-May-13	13-Jun-13
03100220A10	Submit Final QAPP	10	14-Jun-13	23-Jun-13
03100225M-QAPP	Approval / Acceptance Final QAPP	0		23-Jun-13
03100225PM	Payment Milestone: Approval / Acceptance of Final QAPP	0		23-Jun-13
Quality Assurance Surveillance Plan (QASP)		318	20-Jan-12 A	08-May-12 A
03100300	Draft QASP	30	20-Jan-12 A	30-Mar-12 A



Remaining Level of Effort
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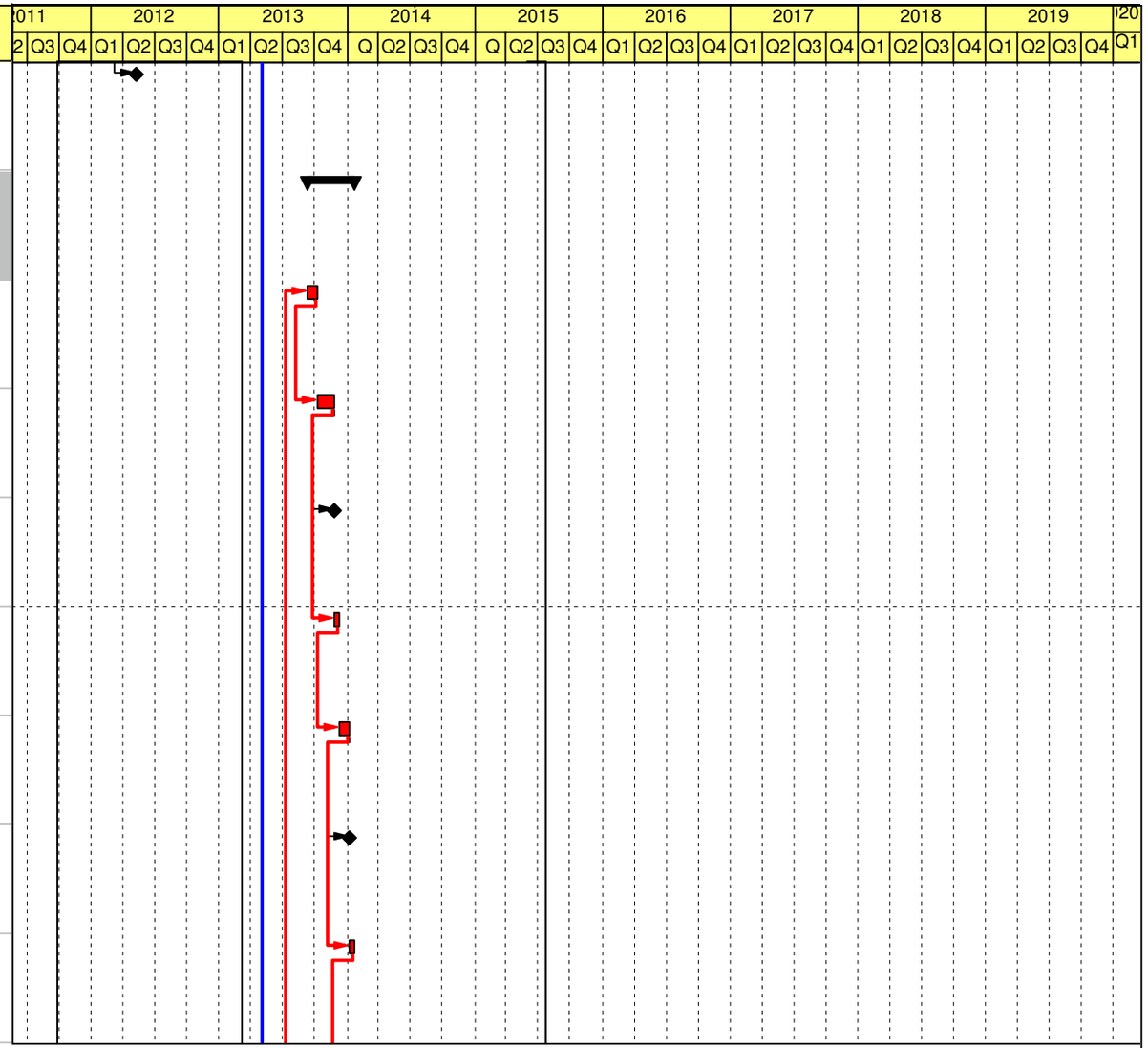
Summary

Activity ID	Activity Name	Original Durati...	Start	Finish
03100305PM	Payment Milestone: Approval / Acceptance of Draft QASP	0		08-May-12 A
Landfill Cap Design		133	08-Sep-13	24-Jan-14
03100400	Draft Landfill Cap Design	30	08-Sep-13	07-Oct-13
03100405	Huntsville, NY District Corp, Seneca Army Depot & US Army Public Health Command Review Draft Landfill CAP Design	45	08-Oct-13	23-Nov-13
03100405PM	Payment Milestone: Approval / Acceptance of Draft Landfill CAP Design	0		23-Nov-13
03100410	Incorporate Comments / Submit Draft-Final Landfill CAP Design	14	24-Nov-13	08-Dec-13
03100415	USEPA, NYDEC and Bureau of Environmental Exposure Investigation Review Draft-Final Landfill CAP Design	30	09-Dec-13	09-Jan-14
03100415PM	Payment Milestone: Approval / Acceptance of Draft-Final Landfill CAP Design	0		09-Jan-14
03100420	Incorporate Comments / Submit Final Landfill CAP Design	14	10-Jan-14	24-Jan-14



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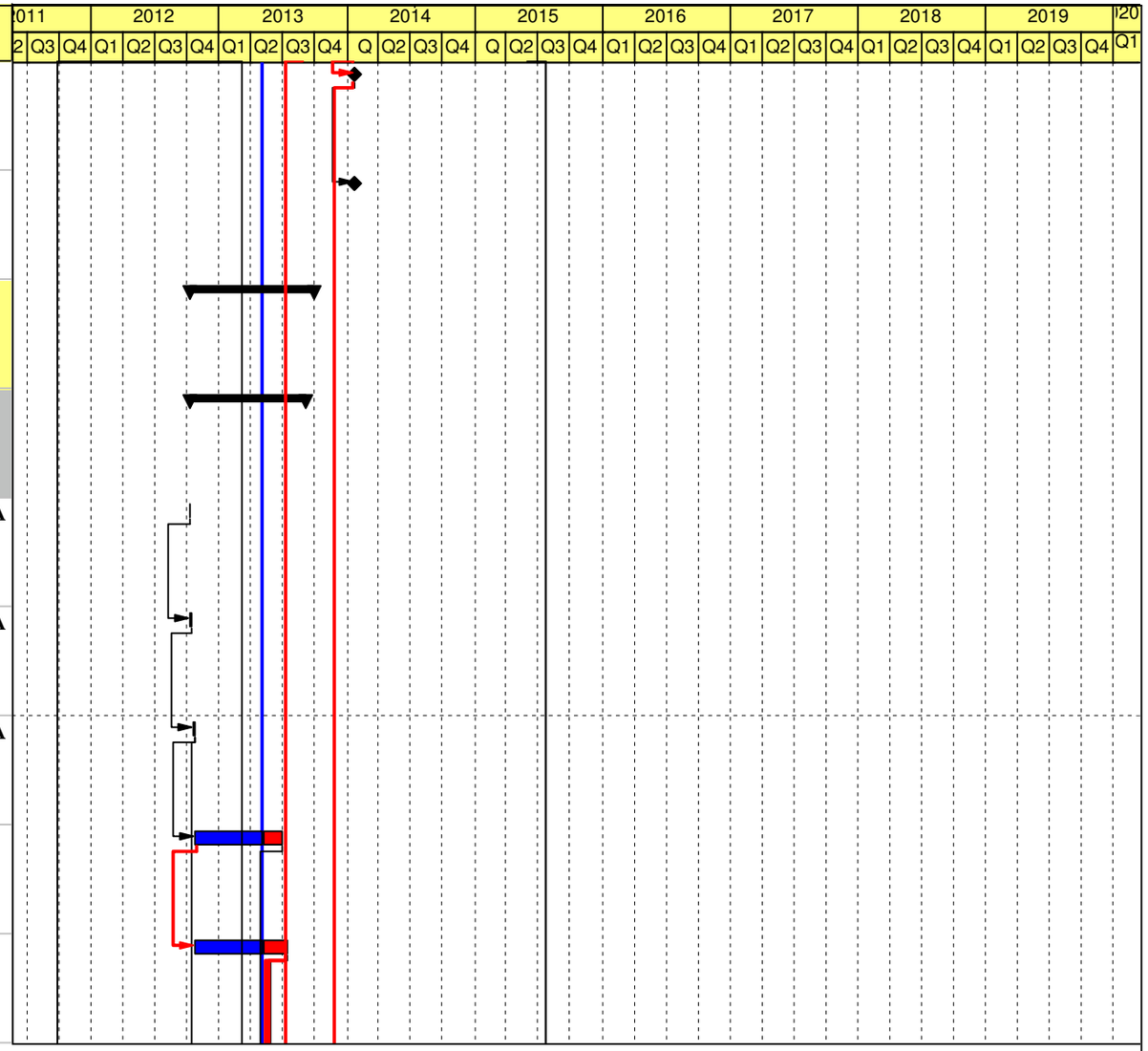
Remaining Work
Critical Remaining Work
Milestone
Start Milestone
Summary

Activity ID	Activity Name	Original Durati...	Start	Finish
03100425M-LCD	Approval / Acceptance Final Landfill CAP Design	0		24-Jan-14
03100425PM	Payment Milestone: Approval / Acceptance of Final Landfill CAP Design	0		24-Jan-14
Task 2. Field Sampling Activities		347	08-Oct-12 A	30-Sep-13
Task 2a Area of 0-1,000 Foot Radius from the Existing OD Hill		324	08-Oct-12 A	07-Sep-13
03210000	Mobilization	2	08-Oct-12 A	10-Oct-12 A
03210010	Brush Clearance	6	10-Oct-12 A	16-Oct-12 A
03210020	Surveying	6	17-Oct-12 A	22-Oct-12 A
03213100	Task 2a.3: Surface Sweep of OD Hill Material	15	22-Oct-12 A	29-Jun-13
03211100	Task 2a.1: Geophysical Mapping (Including Establish GSV)	23	24-Oct-12 A	12-Jul-13



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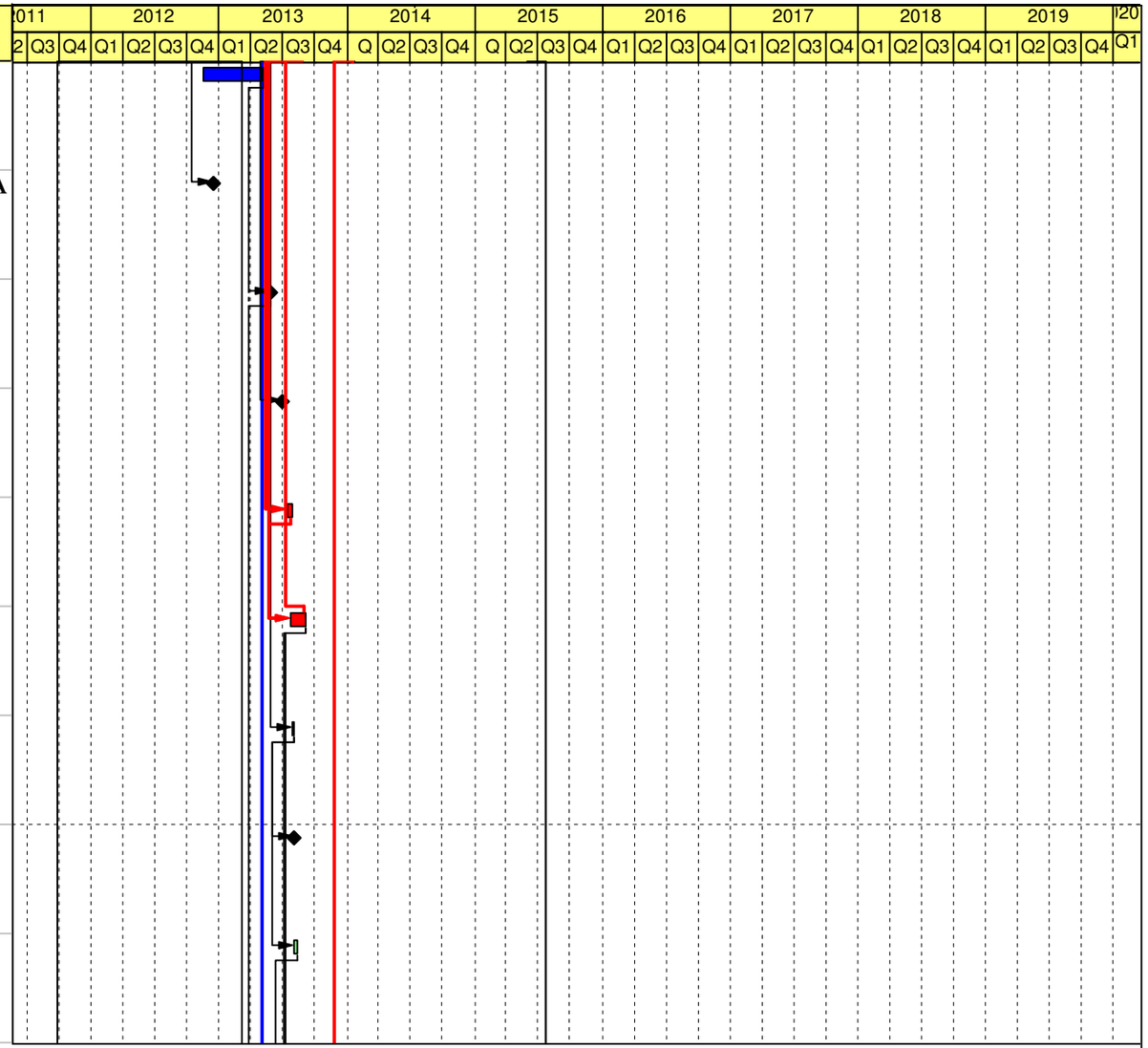
Start Milestone
Summary

Activity ID	Activity Name	Original Durati...	Start	Finish
03213110A	Demobilize (Deer Season)	49	17-Nov-12 A	06-May-13
03210020PM	Payment Milestone: Acceptance of QC Documentation for Completion of Mobilization, Brush Clearance and Surveying	0		14-Dec-12 A
03213110A10	Receipt of DGM NTP	0		25-May-13
03213100PM	Payment Milestone: Acceptance of QC Documentation for Completion of Surface Sweep of OD Hill Material	0		29-Jun-13
03211100A	Review of DGM Results	15	12-Jul-13	26-Jul-13
03215100	Task 2a.5: Reacquire & Prosecute Mapped Targets	43	26-Jul-13*	07-Sep-13
03211200	Task 2a.1: Delineation of Areas with Metallic Saturation	6	29-Jul-13	03-Aug-13
03211200PM	Payment Milestone: Acceptance of QC Documentation for Completion of Delineated Areas with Metallic Saturation	0		03-Aug-13
03212100	Task 2a.4: Excavation of Areas with Metallic Saturation to 6 inches	10	04-Aug-13	13-Aug-13



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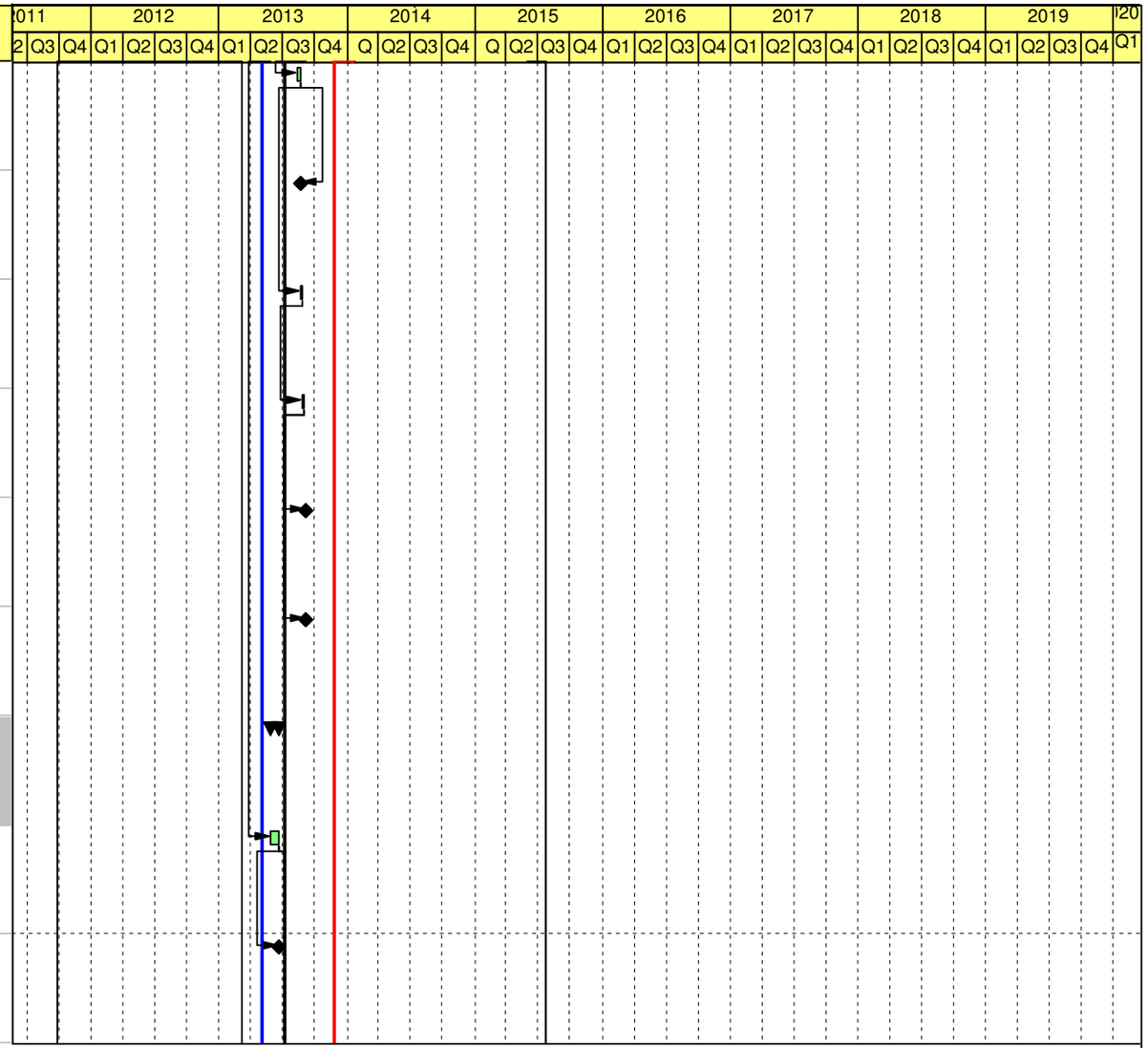
Summary

Huntsville WERS Contract #W912DY-10-D-0014

Remedial Action, Seneca Army Depot Activity, Open Detonation Ground

Romulus, New York

Activity ID	Activity Name	Original Durati...	Start	Finish
03212200	Task 2a.4: Processing & Relocation of Excavated Soils	10	14-Aug-13	23-Aug-13
03212200PM	Payment Milestone: Acceptance of QC Documentation for Completion of Relocation of Excavated Soils	0		23-Aug-13
03214100	Task 2a.4: Geophysical Re-Mapping	3	24-Aug-13	26-Aug-13
03213200	Task 2a.3: Remove MPPEH in OD Hill Material	6	27-Aug-13	01-Sep-13
03213200PM	Payment Milestone: Acceptance of QC Documentation for Completion of MPPEH Removal in OD Hill Material	0		04-Sep-13
03215100PM	Payment Milestone: Acceptance of QC Documentation for Completion of Reacquired & Prosecuted Mapped Targets	0		07-Sep-13
Task 2c. Mag, Flag & Prosecute Targets		24	26-May-13	19-Jun-13
03231000	Mag & Dig of 9,800 Anomalies	24	26-May-13	19-Jun-13
03231000PM	Payment Milestone: Acceptance of QC Documentation for Completion of Mag & Dig of 9,800 Anomalies	0		19-Jun-13



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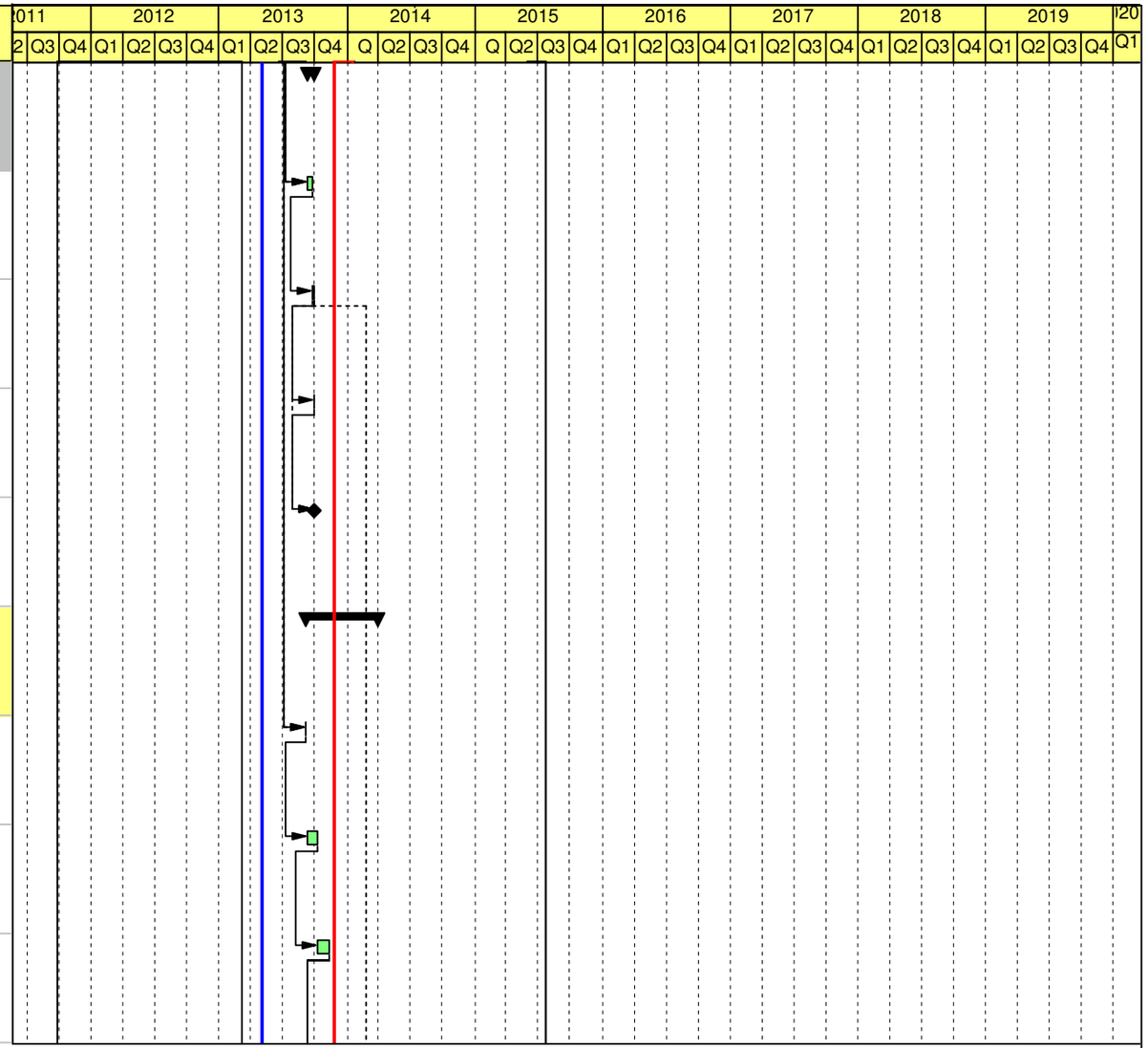
Summary

Activity ID	Activity Name	Original Durati...	Start	Finish
Task 2g. Open Burning Tray		23	08-Sep-13	30-Sep-13
03241000	Close Open Burning Tray	16	08-Sep-13	23-Sep-13
03241010	Transportation and Disposal of Waste	5	24-Sep-13	28-Sep-13
03241020	Demobilization	2	29-Sep-13	30-Sep-13
03241010PM	Payment Milestone: Acceptance of QC Documentation for Open Burning Tray Closure and Transportation and Disposal of Waste	0		30-Sep-13
Task 3. Environmental Sampling & Analysis		200	03-Sep-13	28-Mar-14
03300100	Perform MC Sampling	4	03-Sep-13	06-Sep-13
03300200	Analytical	30	10-Sep-13	09-Oct-13
03300300	Data Validation / Data Management	30	10-Oct-13	09-Nov-13



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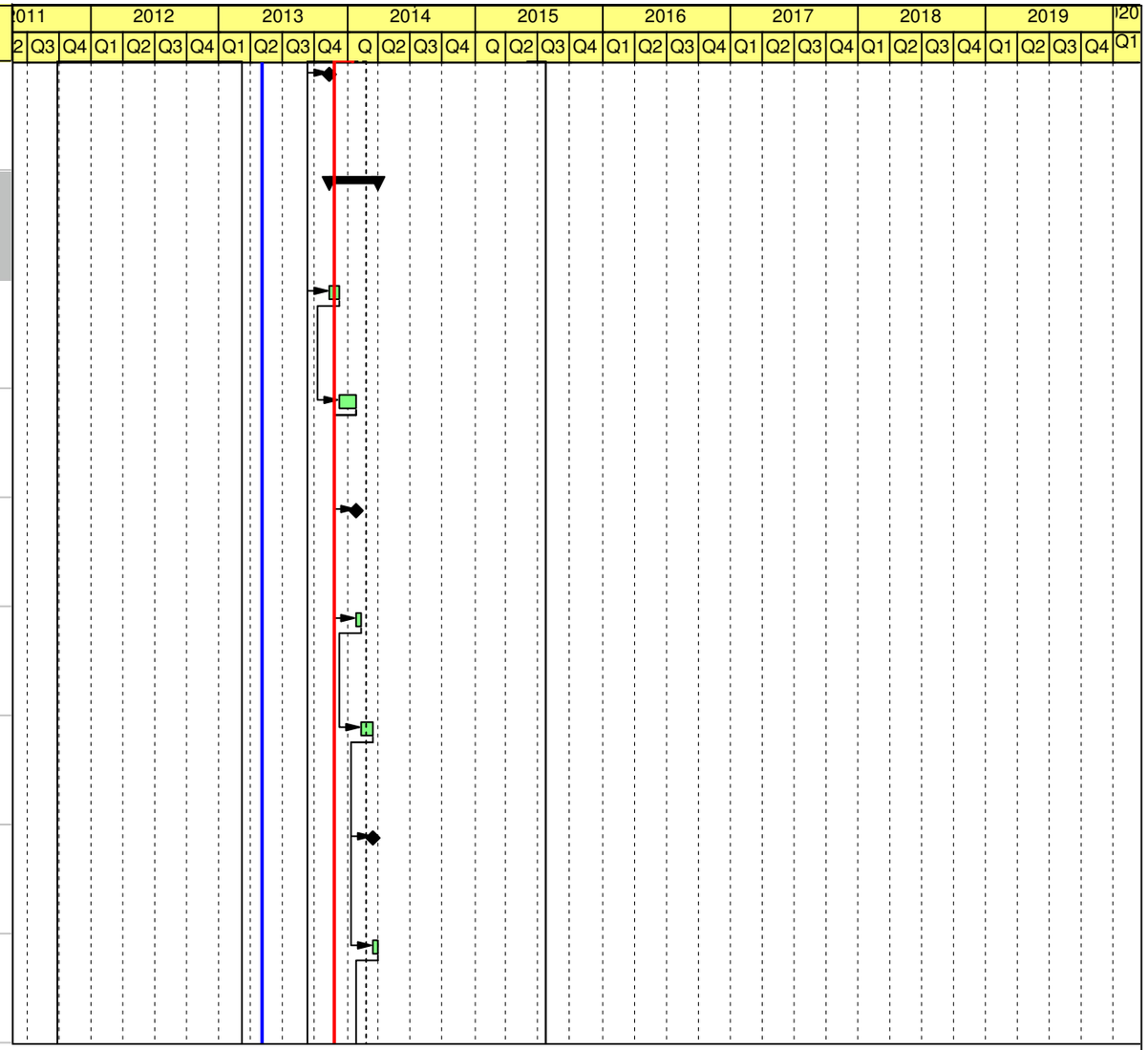
Summary

Activity ID	Activity Name	Original Durati...	Start	Finish
03300300PM	Payment Milestone: Acceptance of Analytical Data Package	0		09-Nov-13
MC Characterization Report		133	10-Nov-13	28-Mar-14
03400200	Draft MC Characterization Report	30	10-Nov-13	11-Dec-13
03400205	Huntsville, NY District Corp, Seneca Army Depot & US Army Public Health Command Review Draft MC Characterization Report	45	12-Dec-13	28-Jan-14
03400205PM	Payment Milestone: Approval / Acceptance of Draft MC Characterization Report	0		28-Jan-14
03400210	Incorporate Comments / Submit Draft-Final MC Characterization Report	14	29-Jan-14	11-Feb-14
03400215	USEPA, NYDEC and Bureau of Environmental Exposure Investigation Review Draft-Final MC Characterization Report	30	12-Feb-14	14-Mar-14
03400215PM	Payment Milestone: Approval / Acceptance of Draft-Final MC Characterization Report	0		14-Mar-14
03400220	Incorporate Comments / Submit Final MC Characterization Report	14	15-Mar-14	28-Mar-14



Remaining Level of Effort
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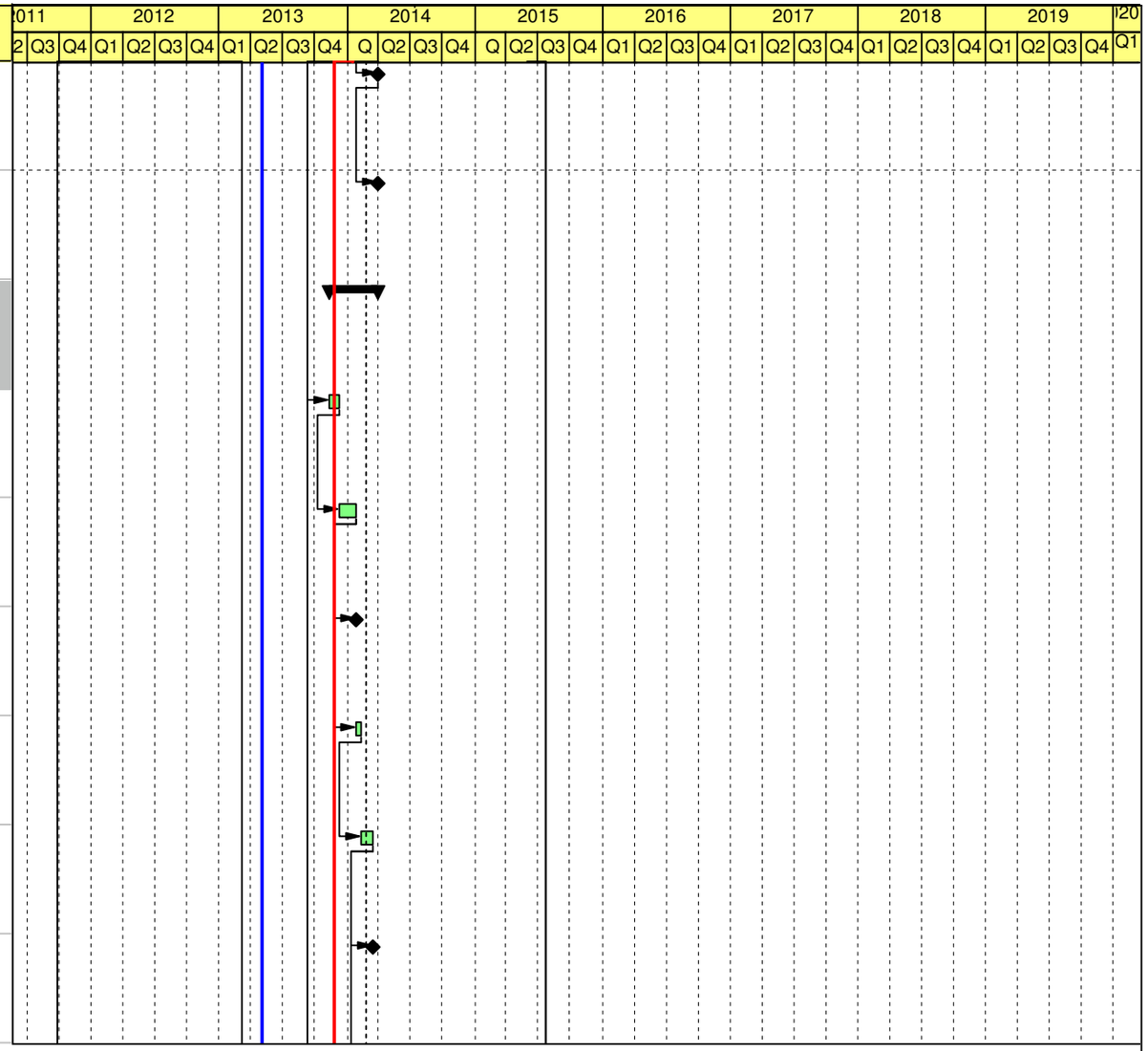
Actual Work
Remaining Work
Critical Remaining Work
Milestone
Start Milestone
Summary

Activity ID	Activity Name	Original Durati...	Start	Finish
03400220M-CR	Approval / Acceptance Final MC Characterization Report	0		28-Mar-14
03400220PM	Payment Milestone: Approval / Acceptance of Final MC Characterization Report	0		28-Mar-14
Human Health Risk Assessment		133	10-Nov-13	28-Mar-14
03400300	Draft Human Health RA	30	10-Nov-13	11-Dec-13
03400305	Huntsville, NY District Corp, Seneca Army Depot & US Army Public Health Command Review Draft Human Health RA	45	12-Dec-13	28-Jan-14
03400305PM	Payment Milestone: Approval / Acceptance of Draft Human Health RA	0		28-Jan-14
03400310	Incorporate Comments / Submit Draft-Final Human Health RA	14	29-Jan-14	11-Feb-14
03400315	USEPA, NYDEC and Bureau of Environmental Exposure Investigation Review Draft-Final Human Health RA	30	12-Feb-14	14-Mar-14
03400315PM	Payment Milestone: Approval / Acceptance of Draft-Final Human Health RA	0		14-Mar-14



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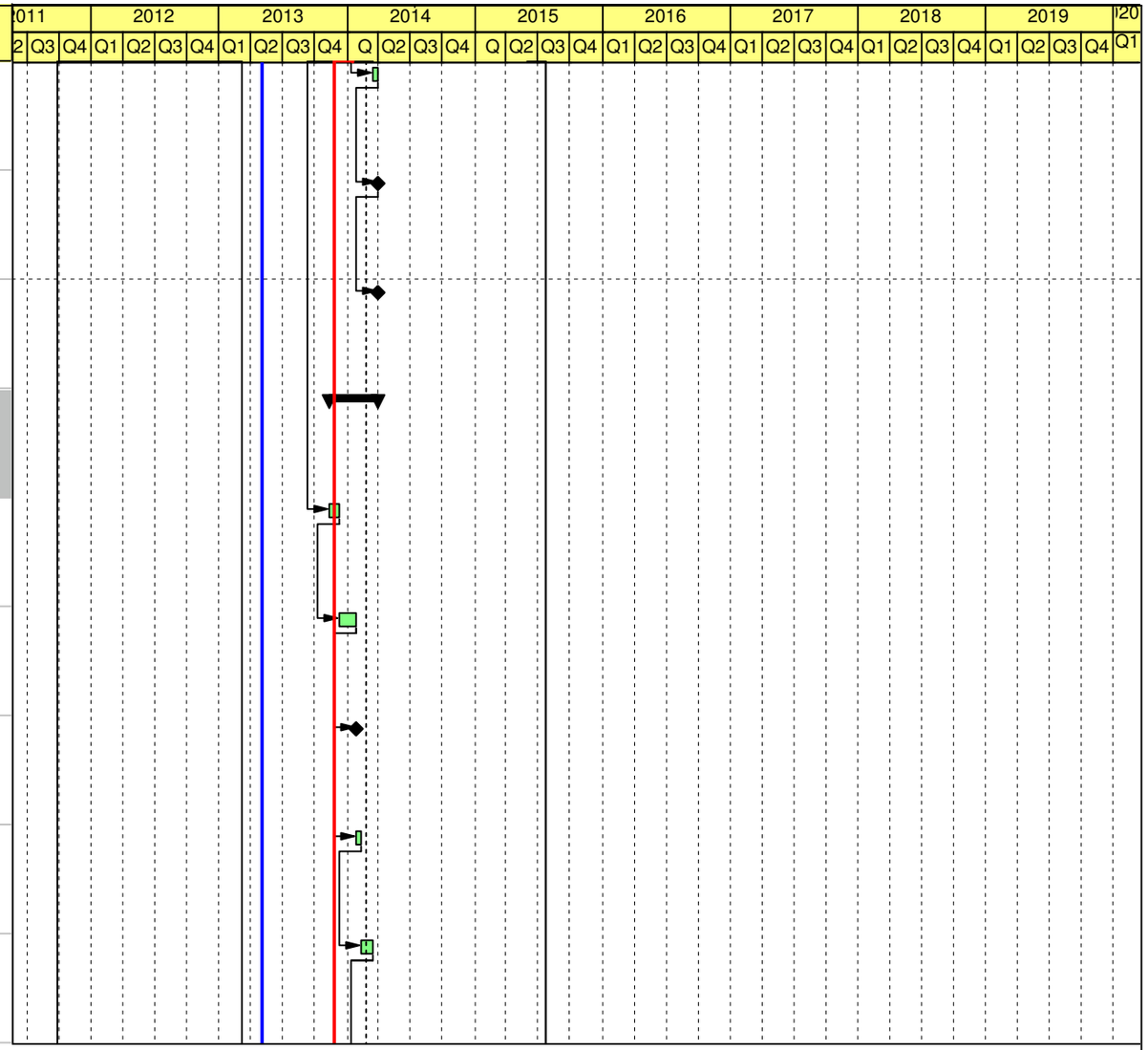
Activity ID	Activity Name	Original Durati...	Start	Finish
03400320	Incorporate Comments / Submit Final Human Health RA	14	15-Mar-14	28-Mar-14
03400320M-HHRA	Approval / Acceptance Final Human Health RA	0		28-Mar-14
03400320PM	Payment Milestone: Approval / Acceptance of Final Human Health RA	0		28-Mar-14
Ecological Risk Assessment		133	10-Nov-13	28-Mar-14
03400400	Draft Ecological RA	30	10-Nov-13	11-Dec-13
03400405	Huntsville, NY District Corp, Seneca Army Depot & US Army Public Health Command Review Draft Ecological RA	45	12-Dec-13	28-Jan-14
03400405PM	Payment Milestone: Approval / Acceptance of Draft Ecological RA	0		28-Jan-14
03400410	Incorporate Comments / Submit Draft-Final Ecological RA	14	29-Jan-14	11-Feb-14
03400415	USEPA, NYDEC and Bureau of Environmental Exposure Investigation Review Draft-Final Ecological RA	30	12-Feb-14	14-Mar-14



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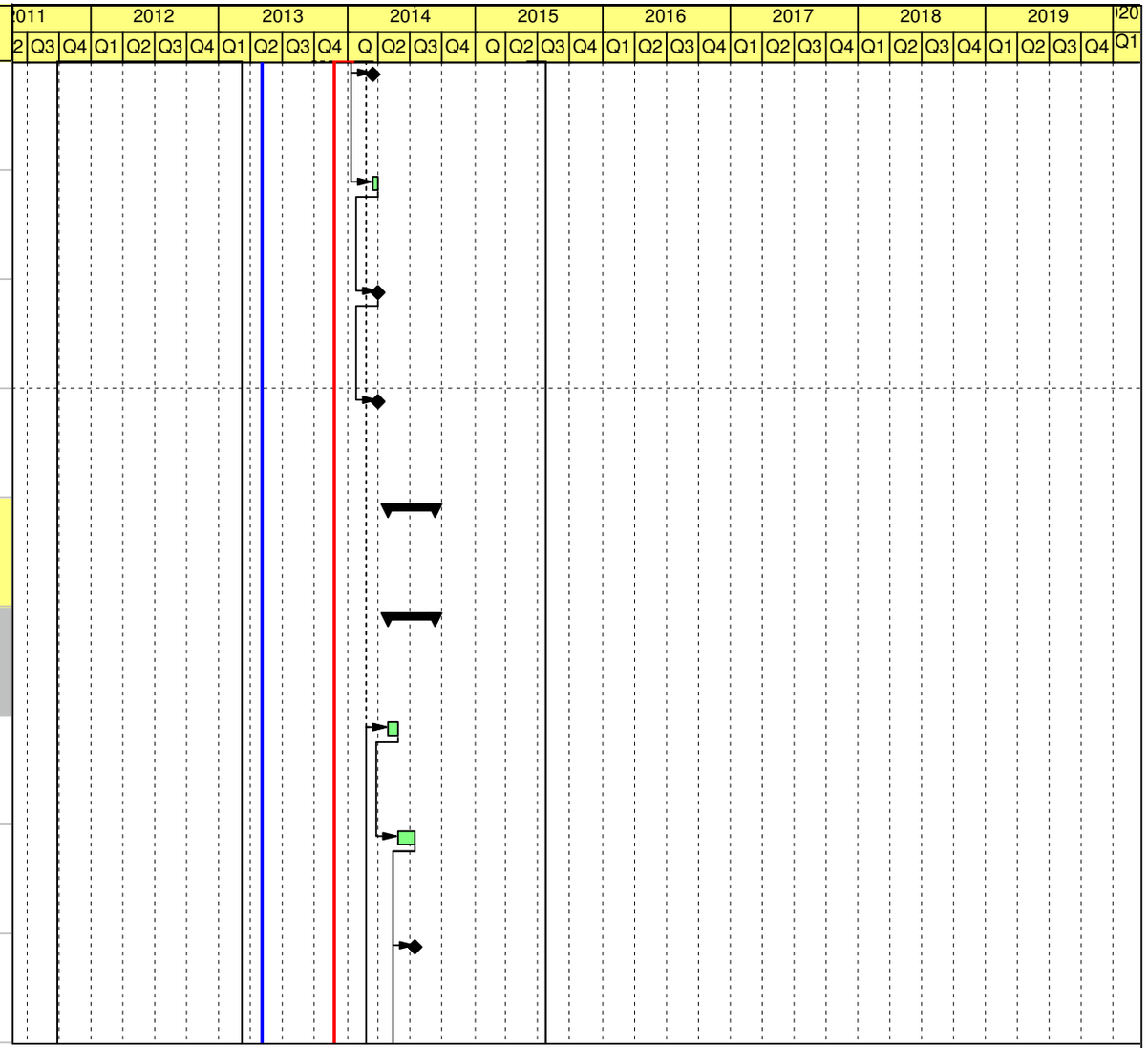
Summary

Activity ID	Activity Name	Original Durati...	Start	Finish
03400415PM	Payment Milestone: Approval / Acceptance of Draft-Final Ecological RA	0		14-Mar-14
03400420	Incorporate Comments / Submit Final Ecological RA	14	15-Mar-14	28-Mar-14
03400420M-ERA	Approval / Acceptance Final Ecological RA	0		28-Mar-14
03400420PM	Payment Milestone: Approval / Acceptance of Final Ecological RA	0		28-Mar-14
Task 4. Remedial Action Report		133	28-Apr-14	10-Sep-14
Remedial Action Report		133	28-Apr-14	10-Sep-14
03400100	Draft Remedial Action Report	30	28-Apr-14	28-May-14
03400105	Huntsville, NY District Corp, Seneca Army Depot & US Army Public Health Command Review Draft Remedial Action Report	45	29-May-14	13-Jul-14
03400105PM	Payment Milestone: Approval / Acceptance of Draft Remedial Action Report	0		13-Jul-14



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Actual Work
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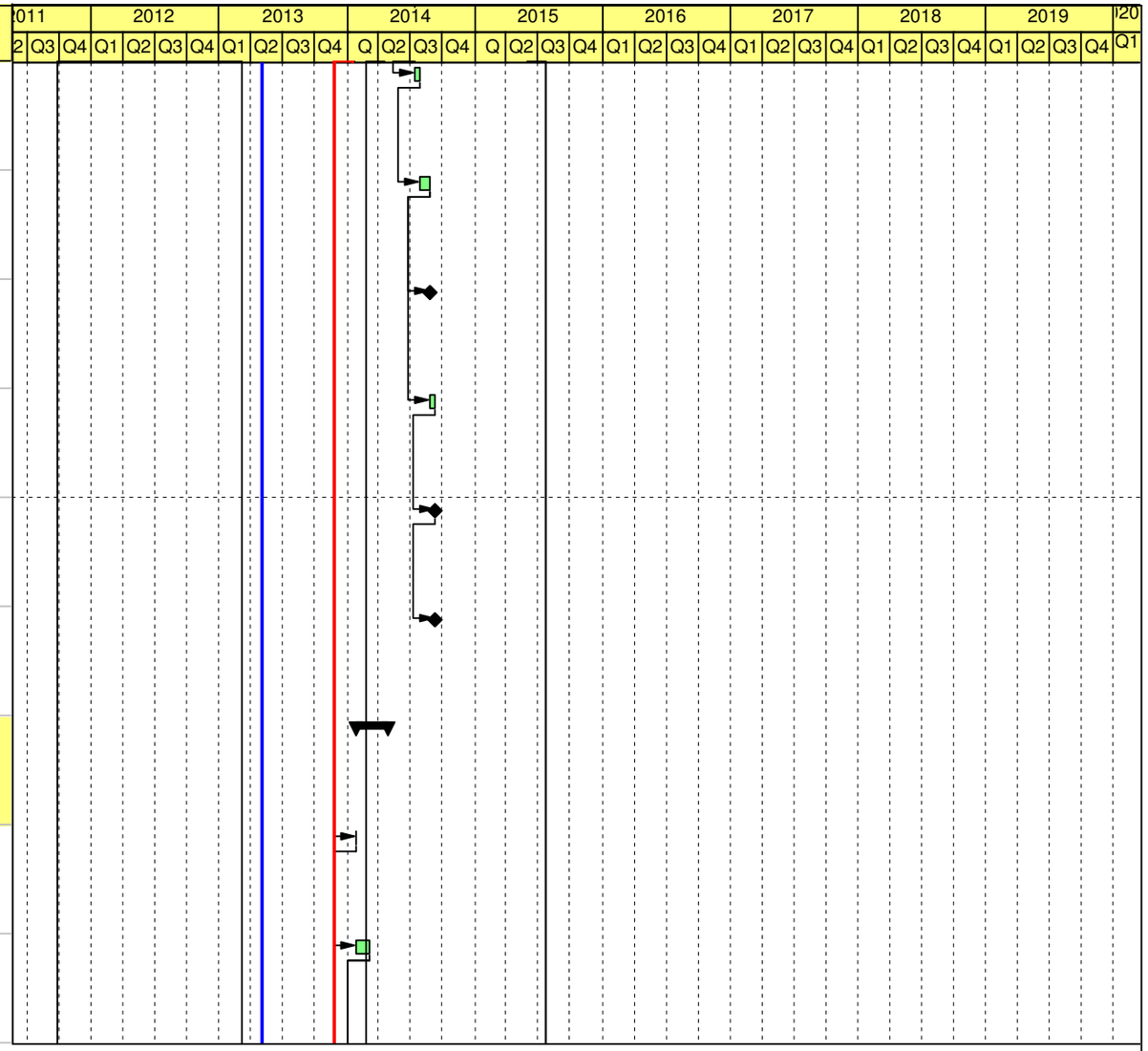
Summary

Activity ID	Activity Name	Original Durati...	Start	Finish
03400110	Incorporate Comments / Submit Draft-Final Remedial Action Report	14	14-Jul-14	27-Jul-14
03400115	USEPA, NYDEC and Bureau of Environmental Exposure Investigation Review Draft-Final Remedial Action Report	30	28-Jul-14	26-Aug-14
03400115PM	Payment Milestone: Approval / Acceptance of Draft-Final Remedial Action Report	0		26-Aug-14
03400120	Incorporate Comments / Submit Final Remedial Action Report	14	27-Aug-14	10-Sep-14
03400120M-WP	Approval / Acceptance Final Remedial Action Report	0		10-Sep-14
03400120PM	Payment Milestone: Approval / Acceptance of Final Remedial Action Report	0		10-Sep-14
Task 5. Installation of An Engineered Cap		92	25-Jan-14	27-Apr-14
03500100	Subgrade Grading	2	25-Jan-14	26-Jan-14
03500200	Installation of Cap Bedding Layer	36	27-Jan-14	04-Mar-14



Remaining Level of Effort
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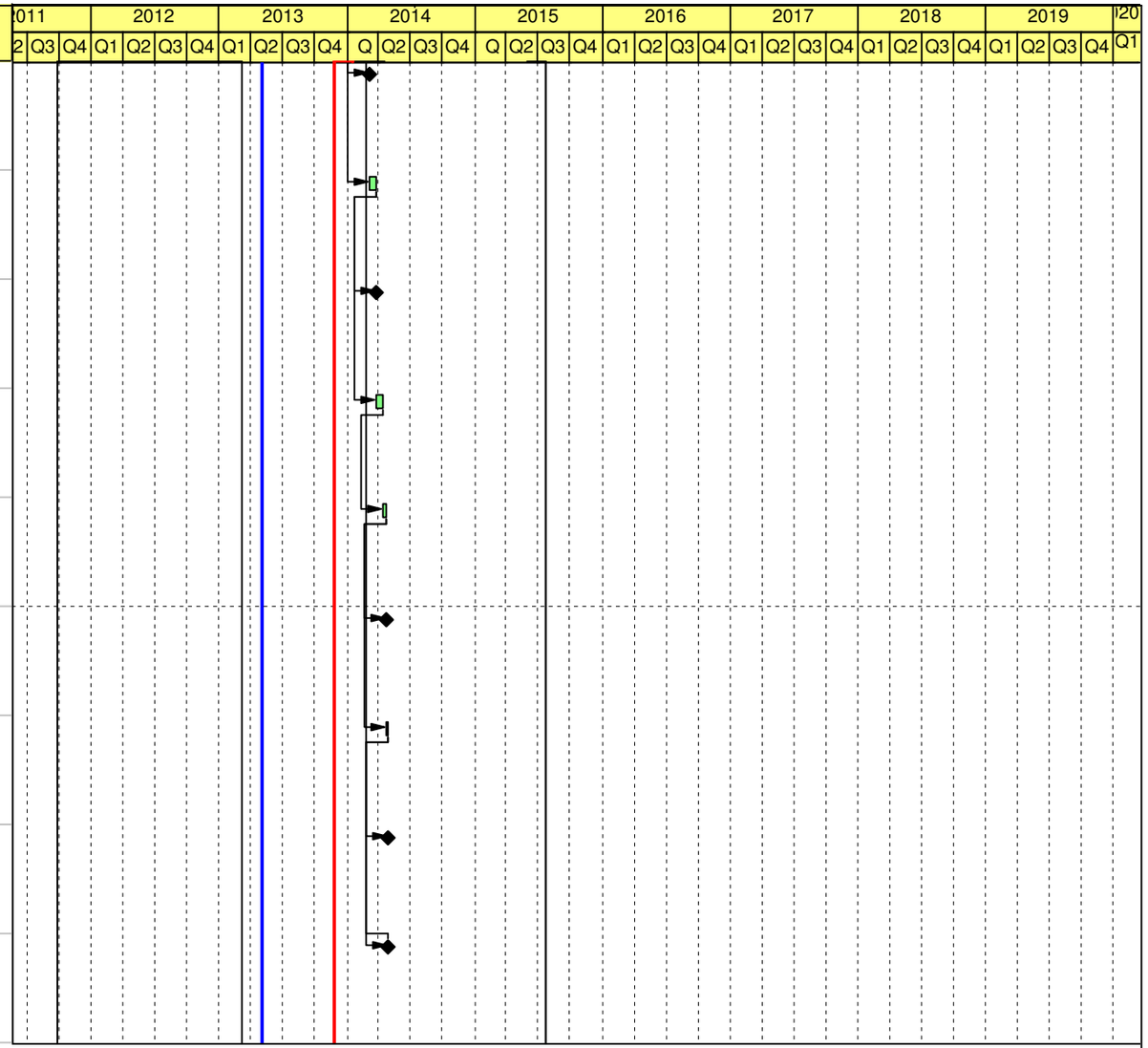
Remaining Work
Critical Remaining Work
Milestone
Start Milestone
Summary

Activity ID	Activity Name	Original Durati...	Start	Finish
03500200PM	Payment Milestone: Acceptance of QC Documentation for Completion of Cap Bedding Layer Installation	0		04-Mar-14
03500300	Geosynthetic Cap & Drainage Layer Installation	21	05-Mar-14	25-Mar-14
03500300PM	Payment Milestone: Acceptance of QC Documentation for Completion of Geosynthetic Cap & Drainage Layer Installation	0		25-Mar-14
03500400	Protective Soil Layer Installation	20	26-Mar-14	14-Apr-14
03500500	Topsoil & Vegetation	8	15-Apr-14	22-Apr-14
03500500PM	Payment Milestone: Acceptance of QC Documentation for Completion of Topsoil and Vegetation	0		22-Apr-14
03500600	Drainage Appurtenances	5	23-Apr-14	27-Apr-14
03500610PM	Payment Milestone: Final Acceptance of Engineered Cap Installation	0		27-Apr-14
03500610M-EC	Engineered Cap Installation Complete	0		27-Apr-14



Remaining Level of Effort
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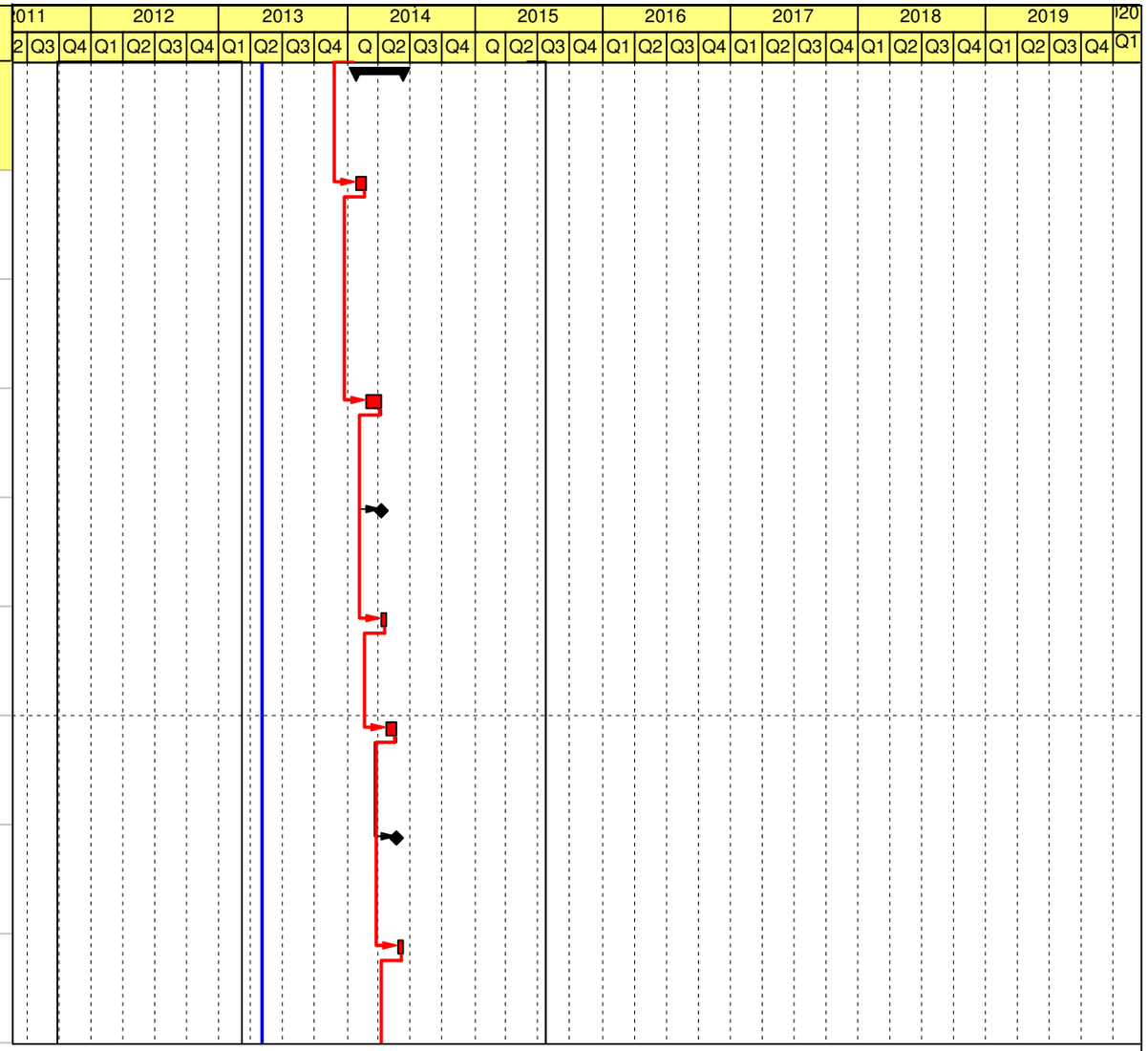
Remaining Work
Critical Remaining Work
Milestone
Start Milestone
Summary

Activity ID	Activity Name	Original Durati...	Start	Finish
Task 6. Preparation of A Long Term Monitoring Plan		**133**	**25-Jan-14**	**08-Jun-14**
03600100	**Draft LTM Work Plan**	**30**	**25-Jan-14**	**24-Feb-14**
03600	**LTM Work Plan**	**133**	**25-Jan-14**	**08-Jun-14**
03600115	**Huntsville, NY District Corp, Seneca Army Depot & US Army Public Health Command Review Draft LTM Work Plan**	**45**	**25-Feb-14**	**10-Apr-14**
03600115PM	**Payment Milestone: Approval / Acceptance of Draft LTM Work Plan**	**0**		**10-Apr-14**
03600200	**Incorporate Comments / Submit Draft-Final LTM Work Plan**	**14**	**11-Apr-14**	**24-Apr-14**
03600215	**USEPA, NYDEC and Bureau of Environmental Exposure Investigation Review Draft-Final LTM Work Plan**	**30**	**25-Apr-14**	**24-May-14**
03600215PM	**Payment Milestone: Approval / Acceptance of Draft-Final LTM Work Plan**	**0**		**24-May-14**
03600300	**Incorporate Comments / Submit Final LTM Work Plan**	**14**	**25-May-14**	**08-Jun-14**



Remaining Level of Effort
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Milestone
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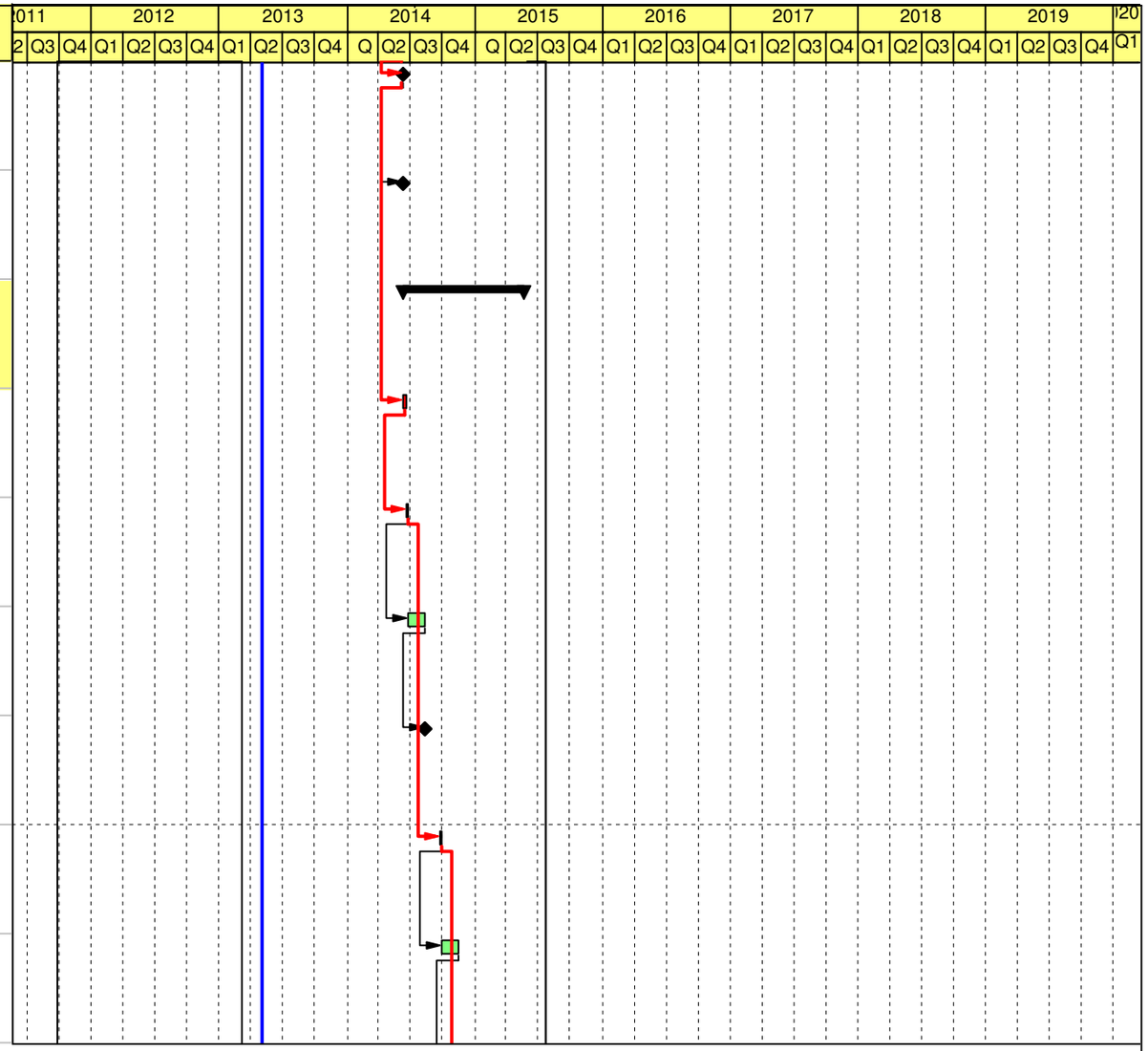
Summary

Activity ID	Activity Name	Original Durati...	Start	Finish
03600305M-WP	Approval / Acceptance Final LTM Work Plan	0		08-Jun-14
03600305PM	Payment Milestone: Approval / Acceptance of Final LTM Work Plan	0		08-Jun-14
Task 7. Performance of Long Term Monitoring		338	09-Jun-14	21-May-15
037001	Install 6 wells	11	09-Jun-14	19-Jun-14
03700100	1st Quarter LTM	5	20-Jun-14	24-Jun-14
03700110	1st Quarter LTM Report	45	25-Jun-14	09-Aug-14
03700110PM	Payment Milestone: Approval / Acceptance of 1st Quarter LTM Report	0		09-Aug-14
03700200	2nd Quarter LTM	5	25-Sep-14	29-Sep-14
03700210	2nd Quarter LTM Report	45	30-Sep-14	15-Nov-14



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Milestone
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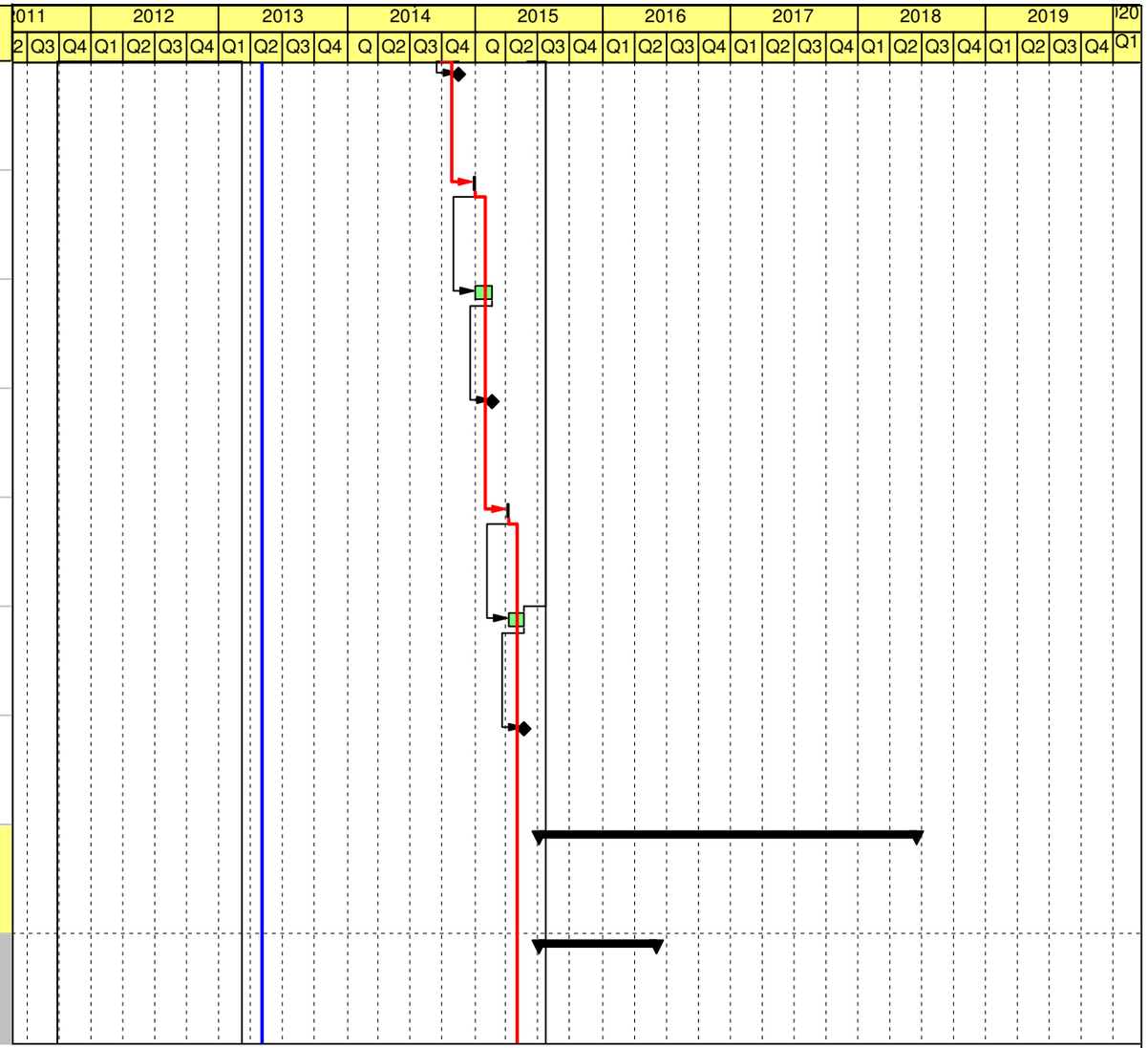
Summary

Activity ID	Activity Name	Original Durati...	Start	Finish
03700210PM	Payment Milestone: Approval / Acceptance of 2nd Quarter LTM Report	0		15-Nov-14
03700300	3rd Quarter LTM	5	28-Dec-14	02-Jan-15
03700310	3rd Quarter LTM Report	45	03-Jan-15	18-Feb-15
03700310PM	Payment Milestone: Approval / Acceptance of 3rd Quarter LTM Report	0		18-Feb-15
03700400	4th Quarter LTM	5	02-Apr-15	06-Apr-15
03700410	4th Quarter LTM Report	45	07-Apr-15	21-May-15
03700410PM	Payment Milestone: Approval / Acceptance of 4th Quarter LTM Report	0		21-May-15
Task 8. Performance of Additional Long Term Moni...		1054	02-Jul-15	18-Jun-18
Task 8.1 Performance of Additional Long Term Monitoring (O...		327	02-Jul-15	02-Jun-16



Remaining Level of Effort
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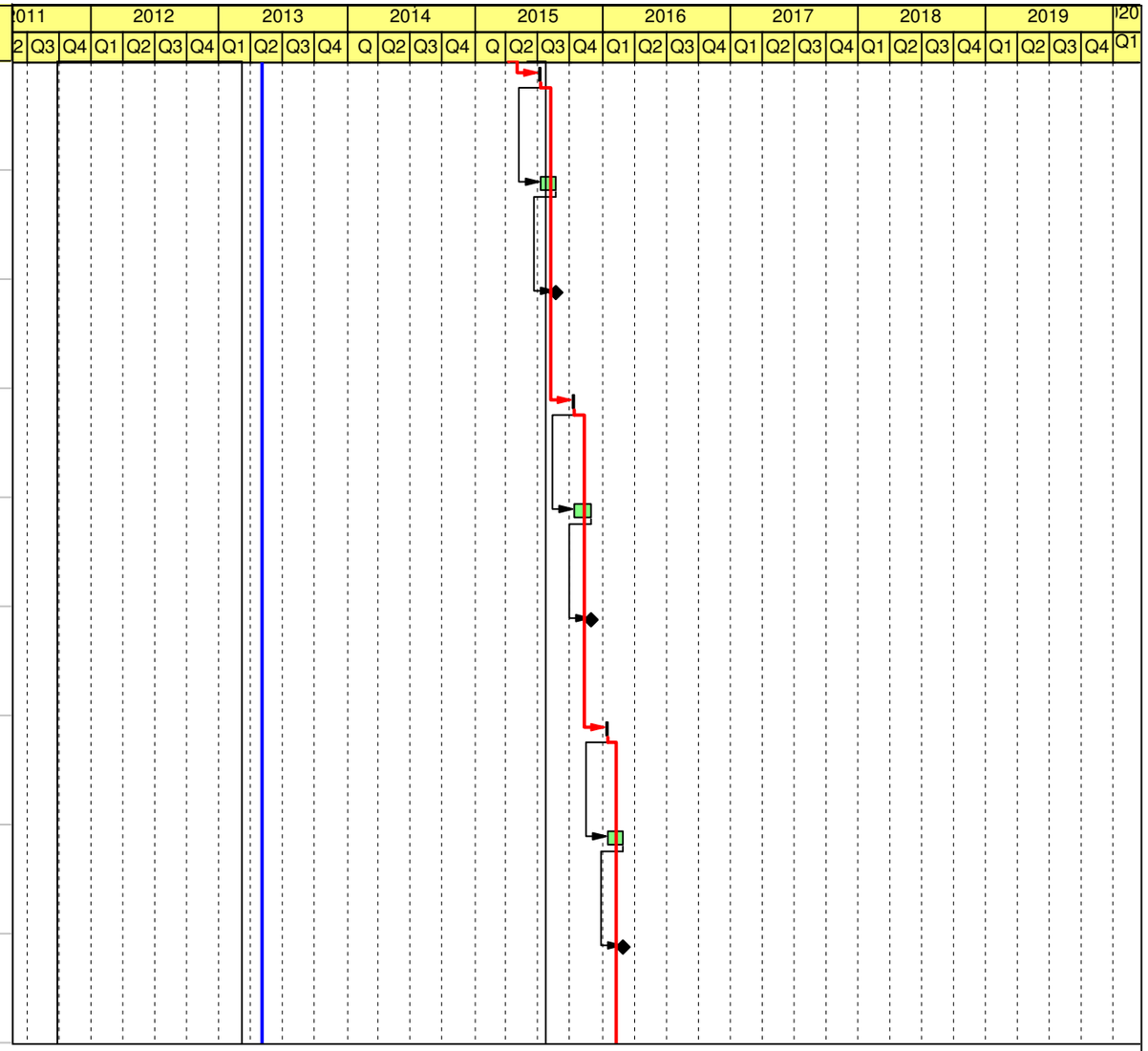
Critical Remaining Work
Milestone
Start Milestone
Summary

Activity ID	Activity Name	Original Durati...	Start	Finish
03800100	1st Quarter LTM	5	02-Jul-15	07-Jul-15
03800110	1st Quarter LTM Report	45	08-Jul-15	21-Aug-15
03800110PM	Payment Milestone: Approval / Acceptance of 1st Quarter LTM Report	0		21-Aug-15
03800200	2nd Quarter LTM	5	07-Oct-15	11-Oct-15
03800210	2nd Quarter LTM Report	45	13-Oct-15	28-Nov-15
03800210PM	Payment Milestone: Approval / Acceptance of 2nd Quarter LTM Report	0		28-Nov-15
03800300	3rd Quarter LTM	5	10-Jan-16	14-Jan-16
03800310	3rd Quarter LTM Report	45	15-Jan-16	01-Mar-16
03800310PM	Payment Milestone: Approval / Acceptance of 3rd Quarter LTM Report	0		01-Mar-16



Remaining Level of Effort
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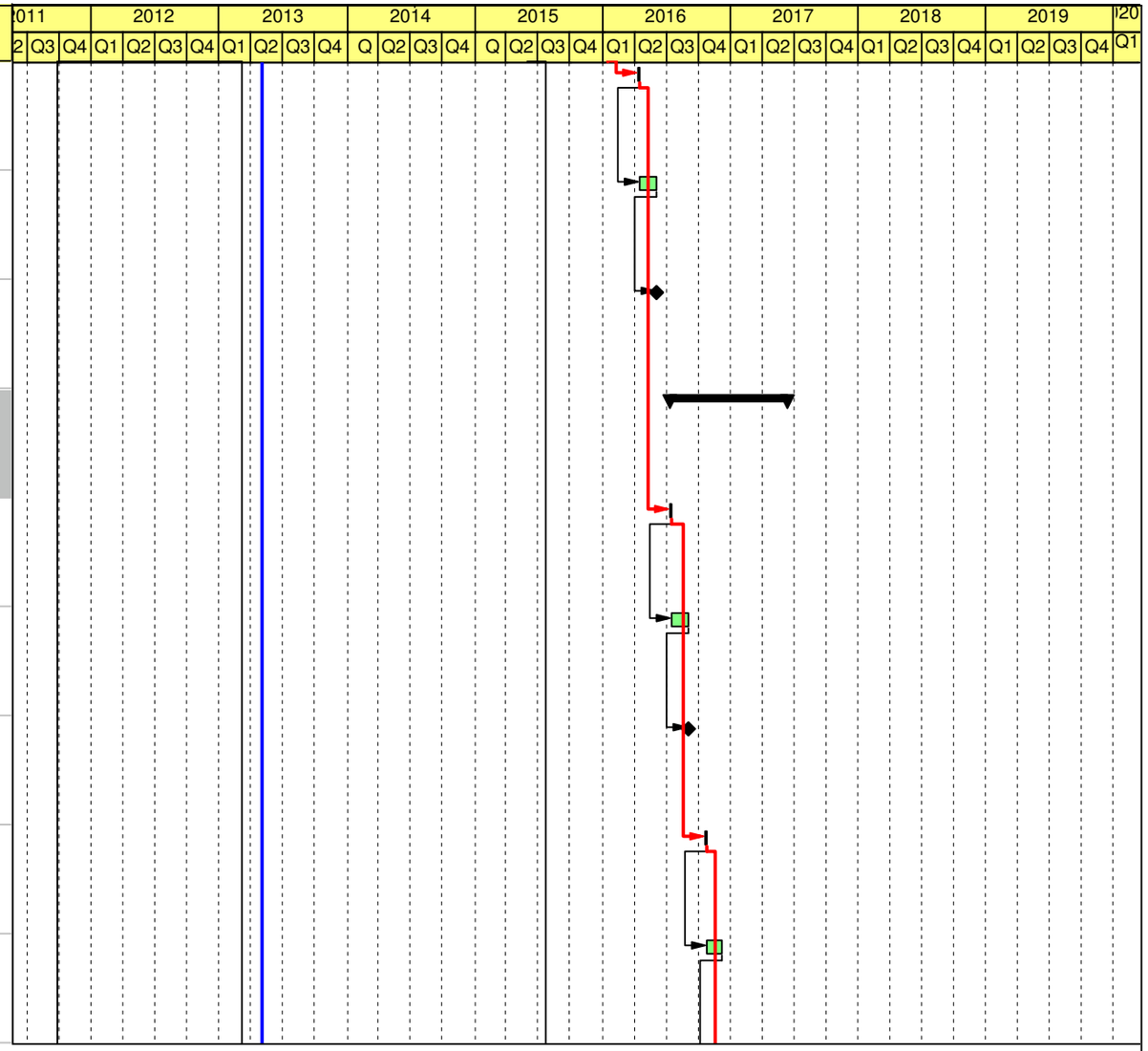
Remaining Work
Critical Remaining Work
Milestone
Start Milestone
Summary

Activity ID	Activity Name	Original Durati...	Start	Finish
03800400	4th Quarter LTM	5	13-Apr-16	17-Apr-16
03800410	4th Quarter LTM Report	45	18-Apr-16	02-Jun-16
03800410PM	Payment Milestone: Approval / Acceptance of 4th Quarter LTM Report	0		02-Jun-16
Task 8.2 Performance of An Additional Year of LTM (Optional)-1		327	14-Jul-16	14-Jun-17
03810100	1st Quarter LTM	5	14-Jul-16	18-Jul-16
03810110	1st Quarter LTM Report	45	19-Jul-16	01-Sep-16
03810110PM	Payment Milestone: Approval / Acceptance of 1st Quarter LTM Report	0		01-Sep-16
03810200	2nd Quarter LTM	5	19-Oct-16	23-Oct-16
03810210	2nd Quarter LTM Report	45	24-Oct-16	09-Dec-16



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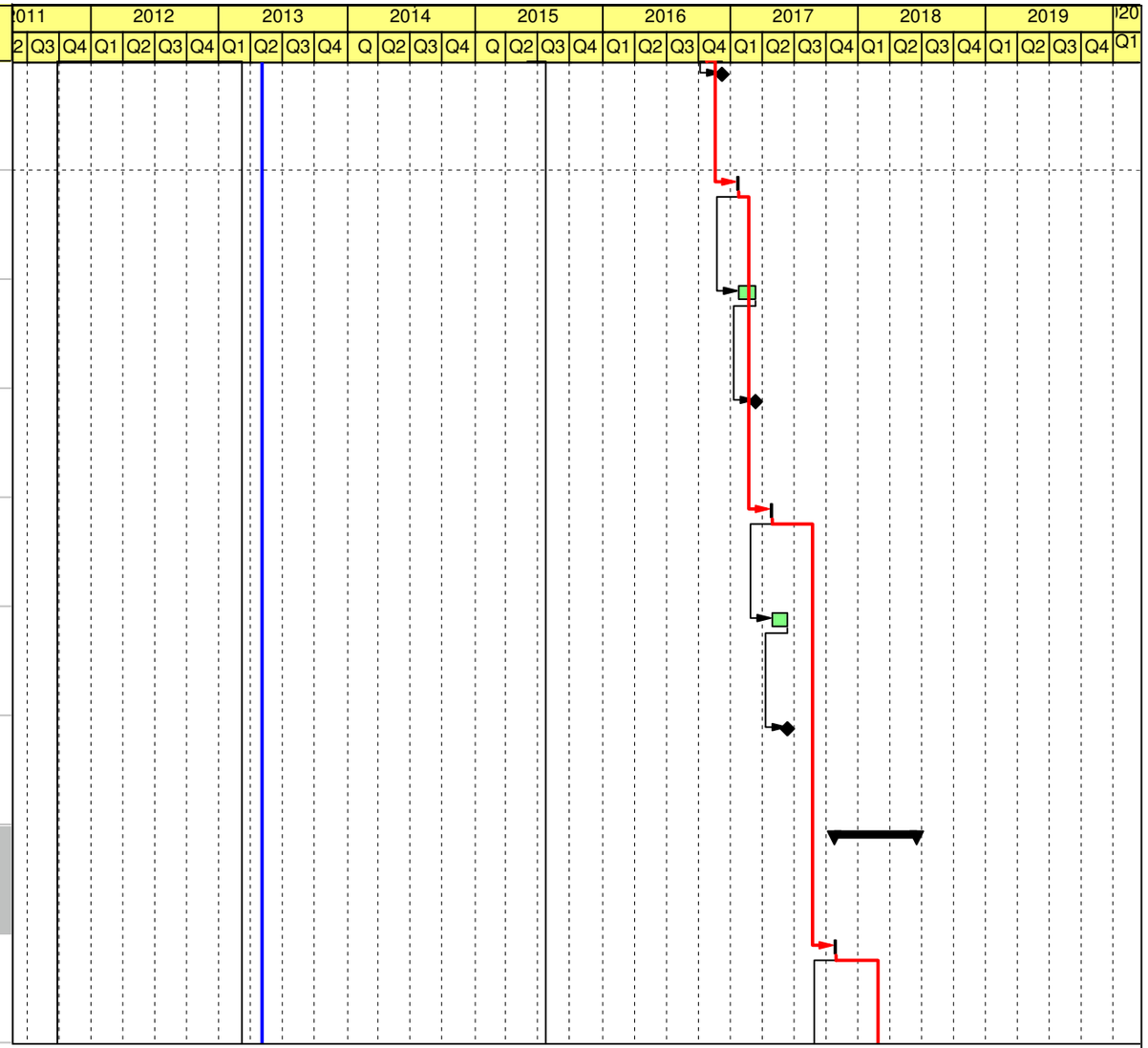
Milestone
Start Milestone
Summary

Huntsville WERS Contract #W912DY-10-D-0014

Remedial Action, Seneca Army Depot Activity, Open Detonation Ground

Romulus, New York

Activity ID	Activity Name	Original Durati...	Start	Finish
03810210PM	Payment Milestone: Approval / Acceptance of 2nd Quarter LTM Report	0		09-Dec-16
03810300	3rd Quarter LTM	5	22-Jan-17	26-Jan-17
03810310	3rd Quarter LTM Report	45	27-Jan-17	13-Mar-17
03810310PM	Payment Milestone: Approval / Acceptance of 3rd Quarter LTM Report	0		13-Mar-17
03810400	4th Quarter LTM	5	25-Apr-17	29-Apr-17
03810410	4th Quarter LTM Report	45	30-Apr-17	14-Jun-17
03810410PM	Payment Milestone: Approval / Acceptance of 4th Quarter LTM Report	0		14-Jun-17
Task 8.3 Performance of An Additional Year of LTM (Optional)		230	26-Oct-17	18-Jun-18
03820100	1st Semi-Annual LTM	5	26-Oct-17	30-Oct-17



Remaining Level of Effort
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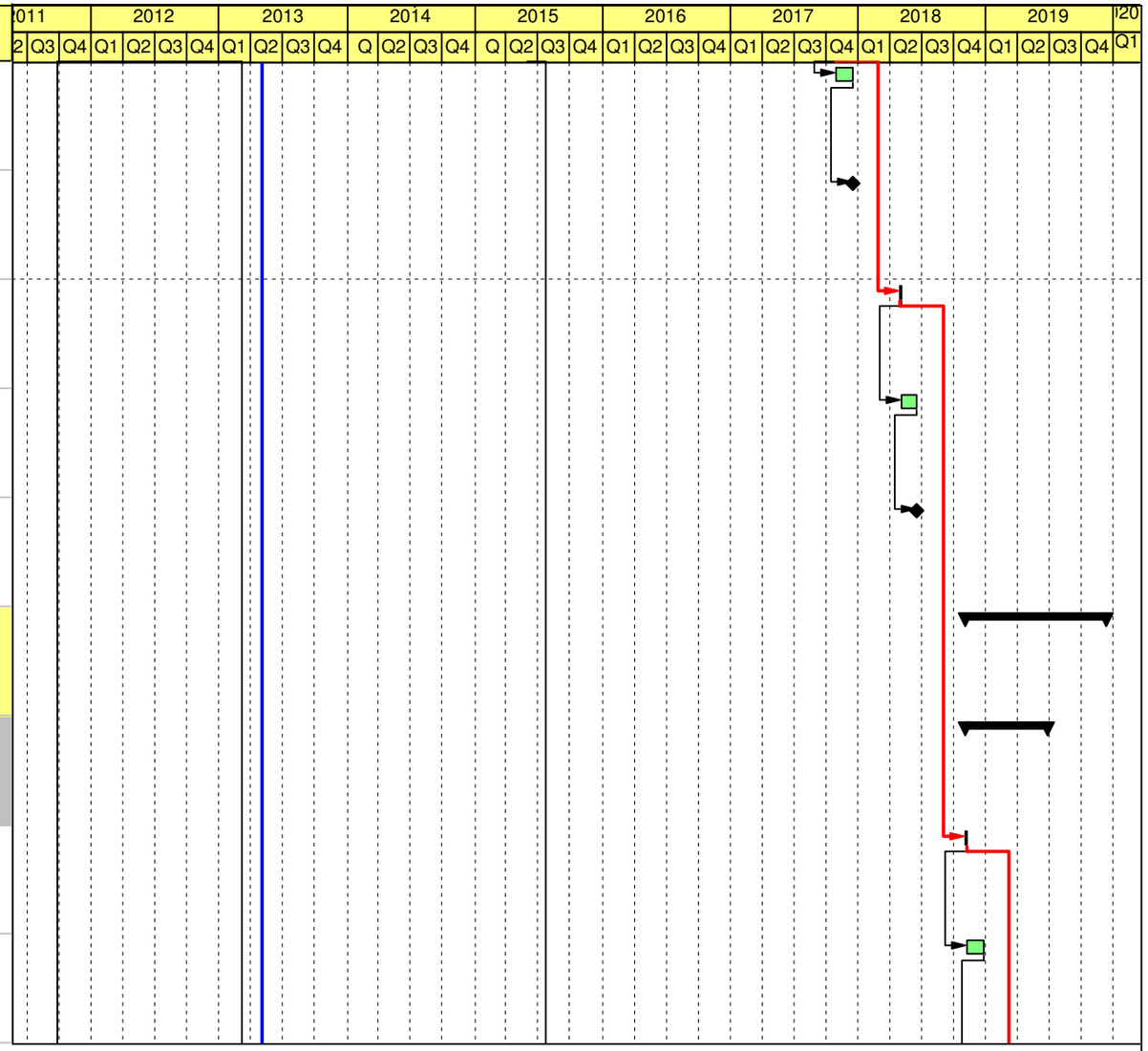
Actual Work
Remaining Work
Critical Remaining Work
Milestone
Start Milestone
Summary

Activity ID	Activity Name	Original Durati...	Start	Finish
03820110	1st Semi-Annual LTM Report	45	31-Oct-17	15-Dec-17
03820110PM	Payment Milestone: Approval / Acceptance of 1st Semi-Annual LTM Report	0		15-Dec-17
03820200	2nd Semi-Annual LTM	5	29-Apr-18	03-May-18
03820210	2nd Semi-Annual LTM Report	45	04-May-18	18-Jun-18
03820210PM	Payment Milestone: Approval / Acceptance of 2nd Semi-Annual LTM Report	0		18-Jun-18
Task 9. Performance of the Five Year Review (Opti...		393	04-Nov-18	12-Dec-19
Task 9. Performance of An Additional 5th Year of Semi-Annua...		230	04-Nov-18	27-Jun-19
03830100	1st Semi-Annual LTM	5	04-Nov-18	08-Nov-18
03830110	1st Semi-Annual LTM Report	45	09-Nov-18	24-Dec-18



Remaining Level of Effort
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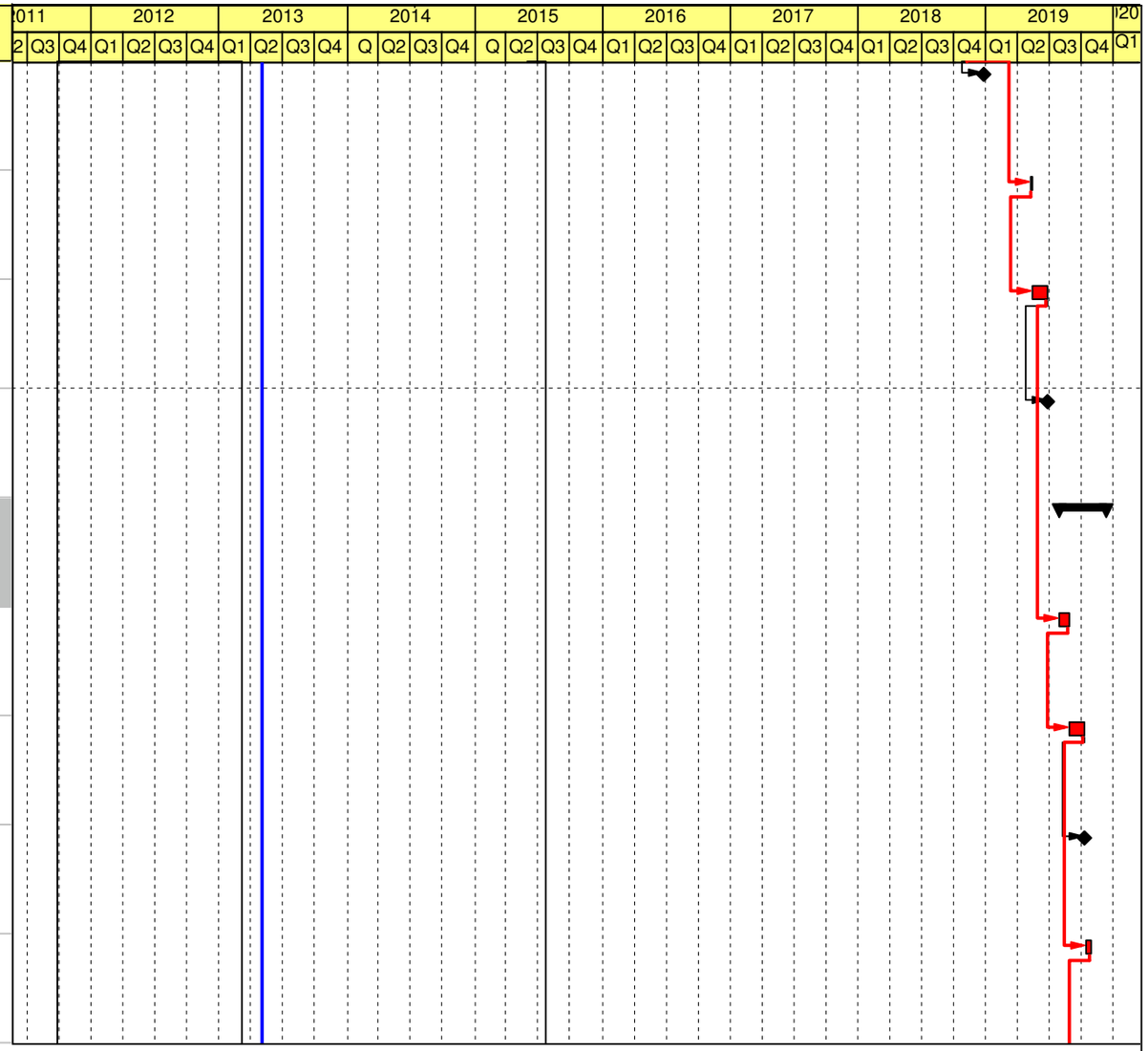
Actual Work
Remaining Work
Critical Remaining Work
Milestone
Start Milestone
Summary

Activity ID	Activity Name	Original Durati...	Start	Finish
03830110PM	Payment Milestone: Approval / Acceptance of 1st Semi-Annual LTM Report	0		24-Dec-18
03830200	2nd Semi-Annual LTM	5	08-May-19	12-May-19
03830210	2nd Semi-Annual LTM Report	45	13-May-19	27-Jun-19
03830210PM	Payment Milestone: Approval / Acceptance of 2nd Semi-Annual LTM Report	0		27-Jun-19
Task 9. Performance of the Five Year Review (Optional)		133	29-Jul-19	12-Dec-19
03900100	Draft Five Year Review	30	29-Jul-19	27-Aug-19
03900110	Huntsville, NY District Corp, Seneca Army Depot & US Army Public Health Command Review Draft Five Year Review	45	28-Aug-19	12-Oct-19
03900110PM	Payment Milestone: Approval / Acceptance of Draft Five Year Review	0		12-Oct-19
03900200	Incorporate Comments / Submit Draft-Final Five Year Review	14	13-Oct-19	27-Oct-19



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Remaining Work
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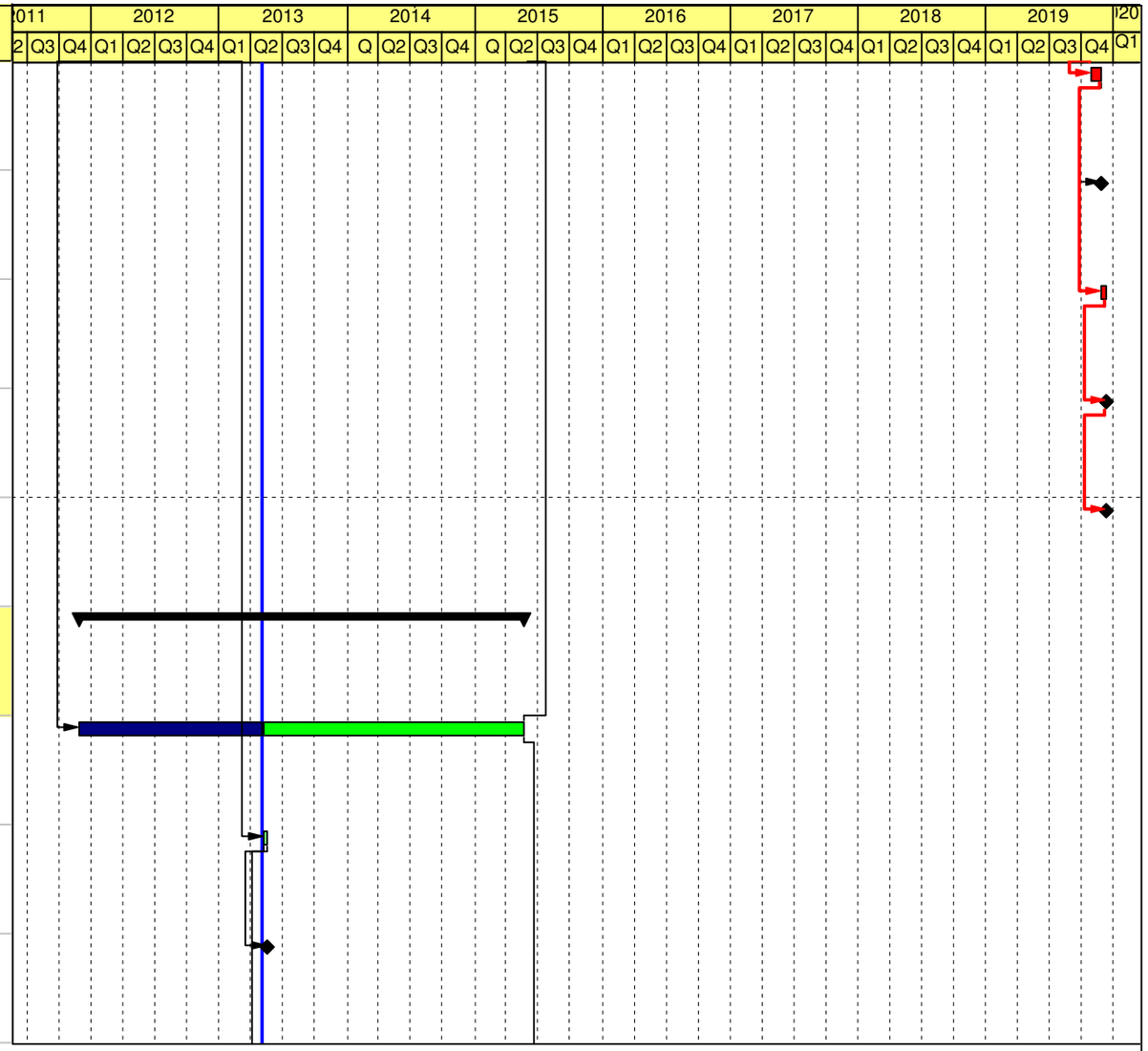
Milestone
Start Milestone
Summary

Huntsville WERS Contract #W912DY-10-D-0014

Remedial Action, Seneca Army Depot Activity, Open Detonation Ground

Romulus, New York

Activity ID	Activity Name	Original Durati...	Start	Finish
03900210	USEPA, NYDEC and Bureau of Environmental Exposure Investigation Review Draft-Final Five Year Review	30	28-Oct-19	27-Nov-19
03900210PM	Payment Milestone: Approval / Acceptance of Draft-Final Five Year Review	0		27-Nov-19
03900300	Incorporate Comments / Submit Final Five Year Review	14	29-Nov-19	12-Dec-19
03900310M-FYR	Approval / Acceptance Final Five Year Review	0		12-Dec-19
03900310PM	Payment Milestone: Approval / Acceptance of Final Five Year Review	0		12-Dec-19
Task 10. Project Management		1205	28-Nov-11 A	21-May-15
03101001	Management Support Activities	680	28-Nov-11 A	21-May-15
03101011	September 2011 Monthly Progress Report	10	06-May-13	15-May-13
03101011PM	Payment Milestone: Approval / Acceptance of September 2011 Progress Report	0		15-May-13



Remaining Level of Effort
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Milestone
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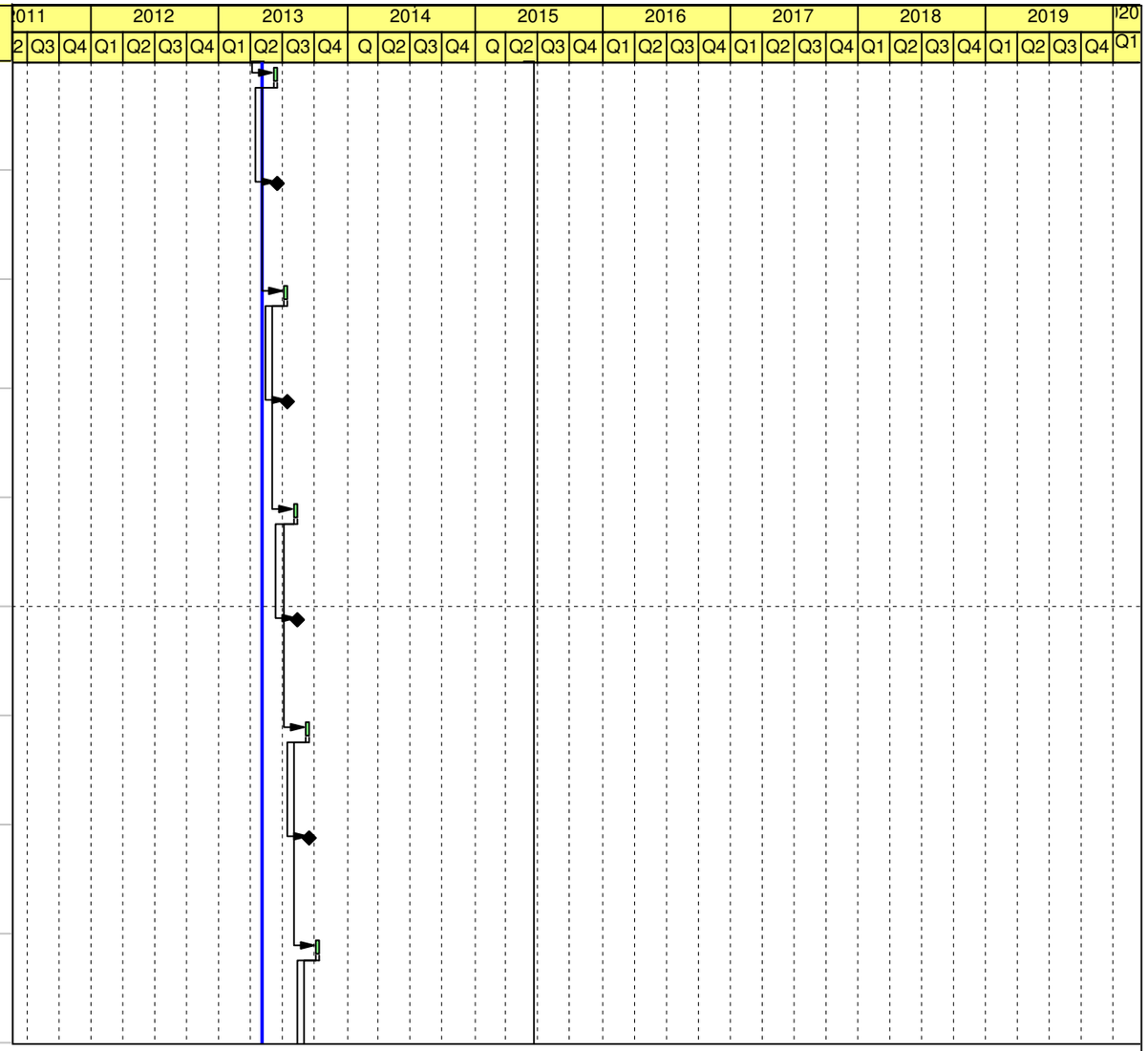
Summary

Activity ID	Activity Name	Original Durati...	Start	Finish
03101021	October 2011 Monthly Progress Report	10	05-Jun-13	14-Jun-13
03101021PM	Payment Milestone: Approval / Acceptance of October 2011 Progress Report	0		14-Jun-13
03101031	November 2011 Monthly Progress Report	10	06-Jul-13	15-Jul-13
03101031PM	Payment Milestone: Approval / Acceptance of November 2011 Progress Report	0		15-Jul-13
03101041	December 2011 Monthly Progress Report	10	03-Aug-13	12-Aug-13
03101041PM	Payment Milestone: Approval / Acceptance of December 2011 Progress Report	0		12-Aug-13
03101051	January 2012 Monthly Progress Report	10	04-Sep-13	13-Sep-13
03101051PM	Payment Milestone: Approval / Acceptance of January 2012 Progress Report	0		13-Sep-13
03101061	February 2012 Monthly Progress Report	10	04-Oct-13	13-Oct-13



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Milestone
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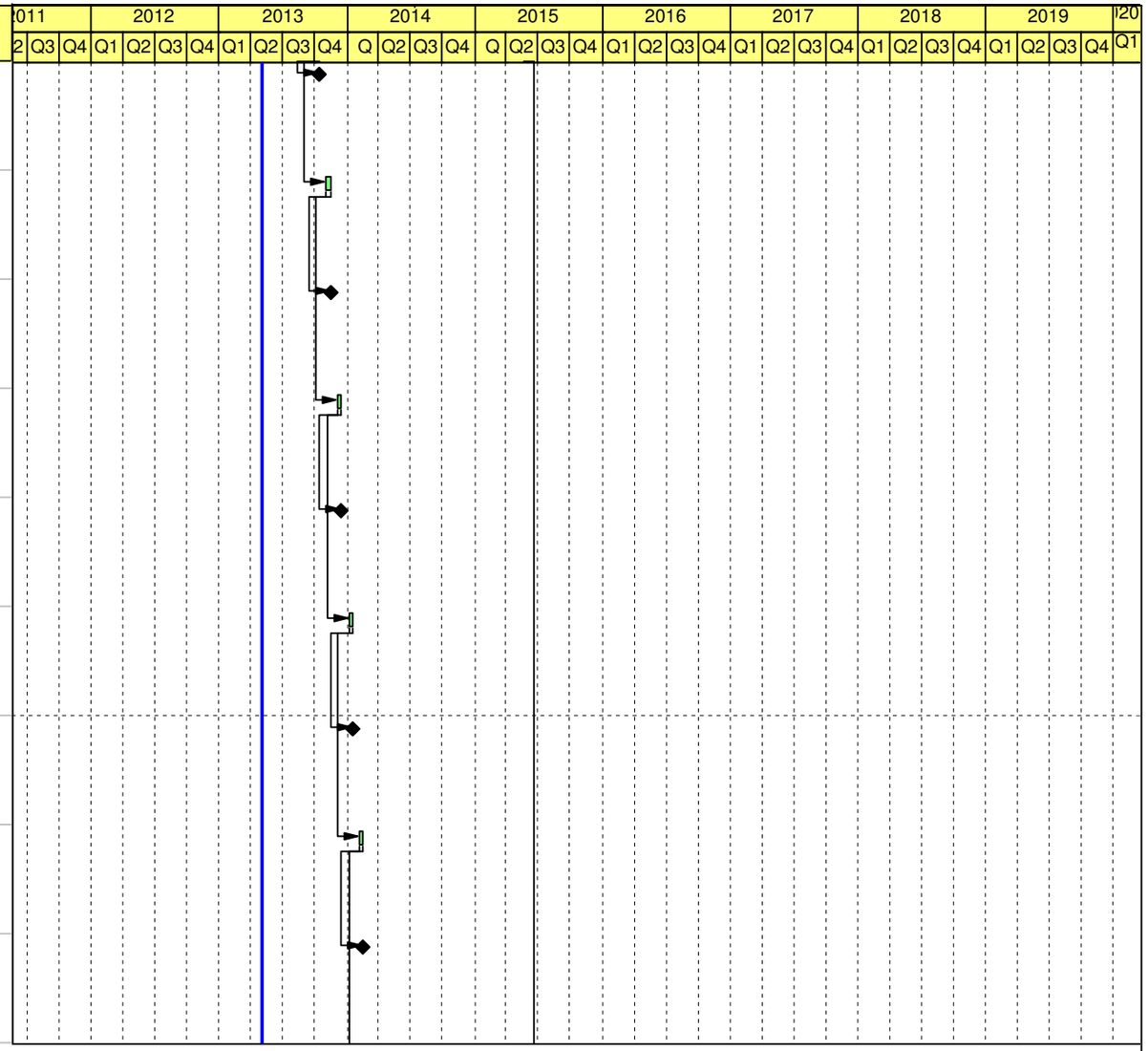
Summary

Huntsville WERS Contract #W912DY-10-D-0014

Remedial Action, Seneca Army Depot Activity, Open Detonation Ground

Romulus, New York

Activity ID	Activity Name	Original Durati...	Start	Finish
03101061PM	Payment Milestone: Approval / Acceptance of February 2012 Progress Report	0		13-Oct-13
03101071	March 2012 Monthly Progress Report	10	04-Nov-13	14-Nov-13
03101071PM	Payment Milestone: Approval / Acceptance of March 2012 Progress Report	0		14-Nov-13
03101081	April 2012 Monthly Progress Report	10	05-Dec-13	14-Dec-13
03101081PM	Payment Milestone: Approval / Acceptance of April 2012 Progress Report	0		14-Dec-13
03101091	May 2012 Monthly Progress Report	10	07-Jan-14	16-Jan-14
03101091PM	Payment Milestone: Approval / Acceptance of May 2012 Progress Report	0		16-Jan-14
03101101	June 2012 Monthly Progress Report	10	07-Feb-14	16-Feb-14
03101101PM	Payment Milestone: Approval / Acceptance of June 2012 Progress Report	0		16-Feb-14



Remaining Level of Effort
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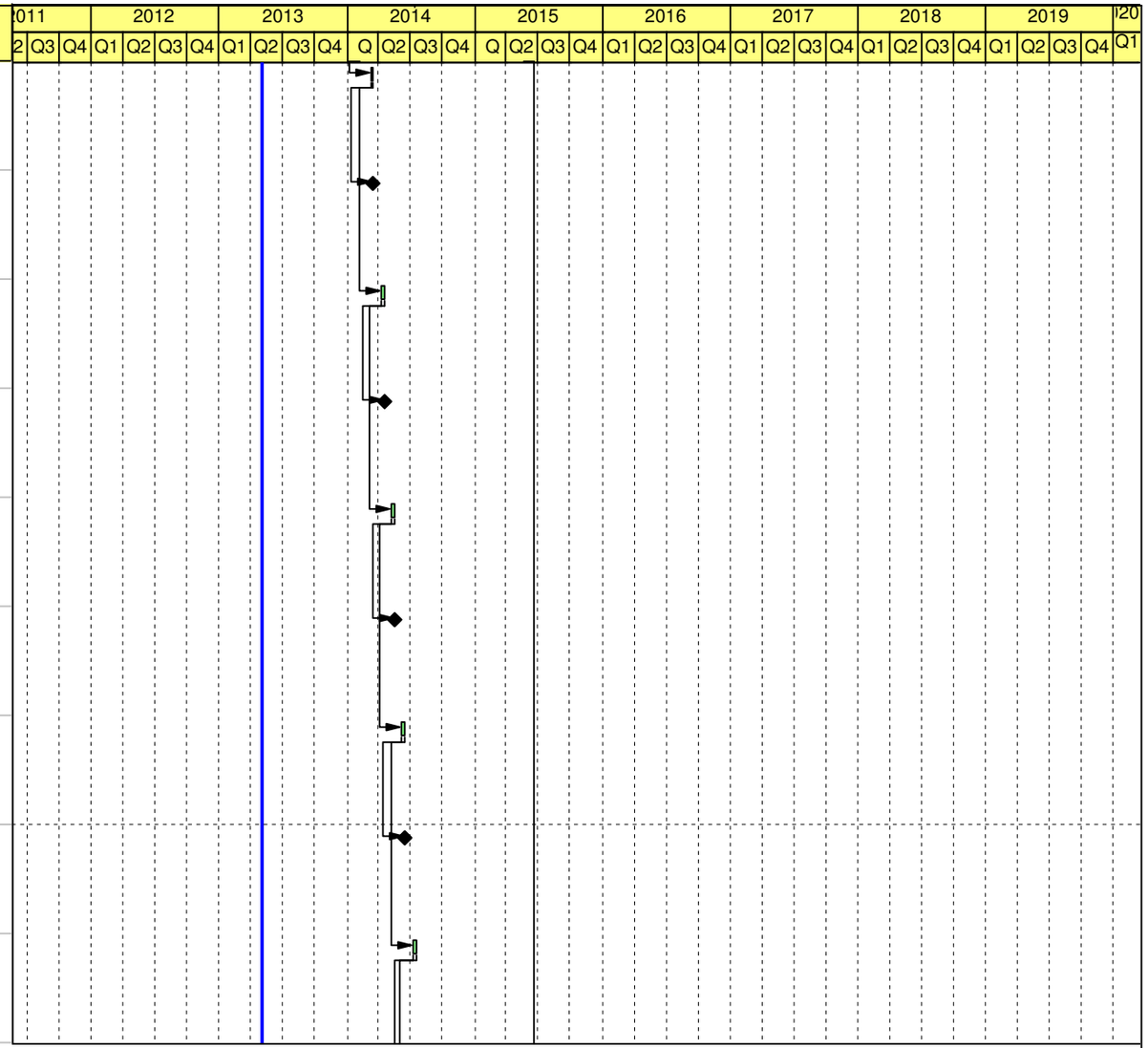
Actual Work
Remaining Work
Critical Remaining Work
Milestone
Start Milestone
Summary

Activity ID	Activity Name	Original Durati...	Start	Finish
03101111	July 2012 Monthly Progress Report	10	09-Mar-14	18-Mar-14
03101111PM	Payment Milestone: Approval / Acceptance of July 2012 Progress Report	0		18-Mar-14
03101121	August 2012 Monthly Progress Report	10	09-Apr-14	18-Apr-14
03101121PM	Payment Milestone: Approval / Acceptance of August 2012 Progress Report	0		18-Apr-14
03111011	September 2012 Monthly Progress Report	10	08-May-14	17-May-14
03111011PM	Payment Milestone: Approval / Acceptance of September 2012 Progress Report	0		17-May-14
03111021	October 2012 Monthly Progress Report	10	07-Jun-14	16-Jun-14
03111021PM	Payment Milestone: Approval / Acceptance of October 2012 Progress Report	0		16-Jun-14
03111031	November 2012 Monthly Progress Report	10	08-Jul-14	17-Jul-14



Remaining Level of Effort
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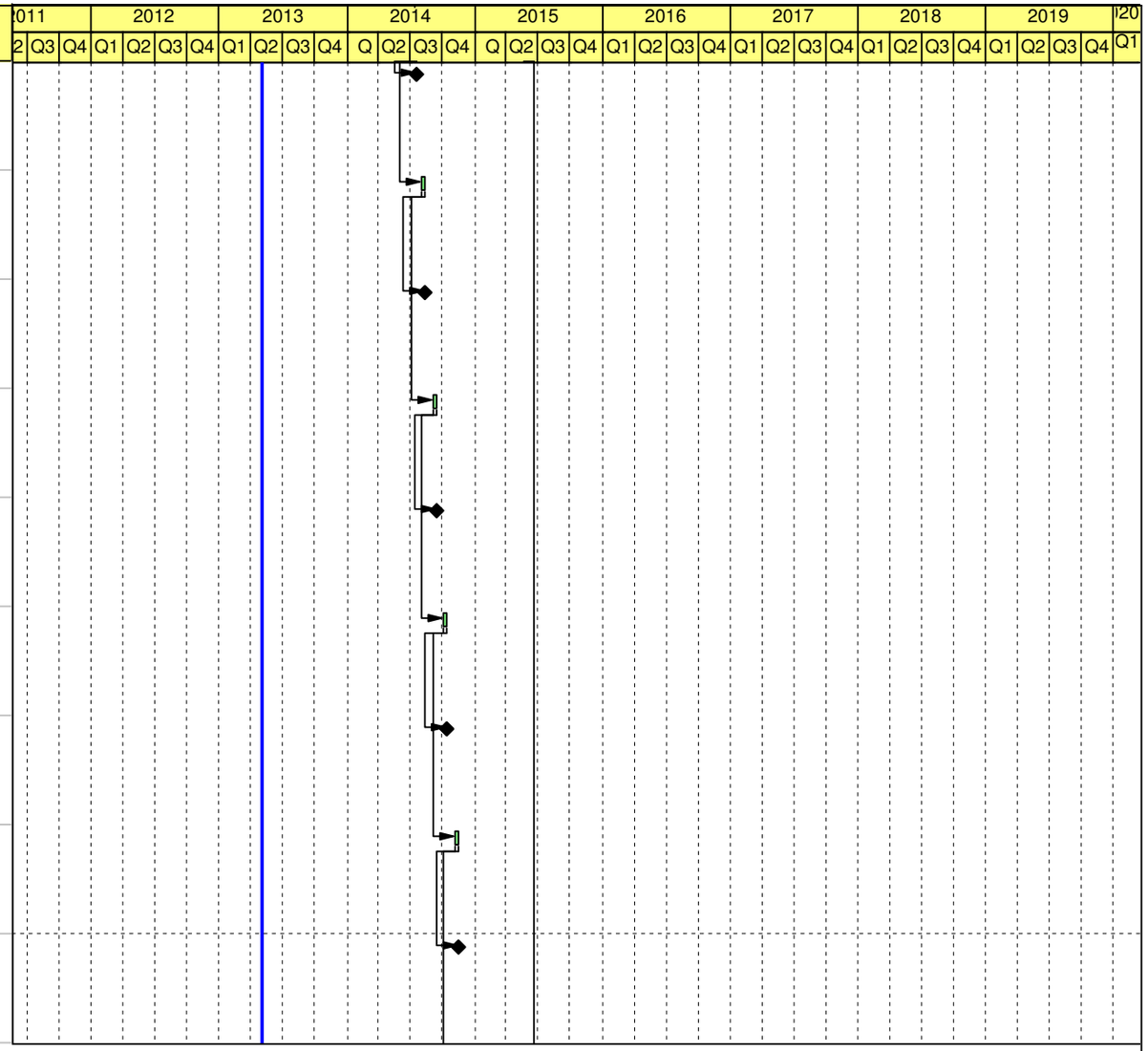
Remaining Work
Critical Remaining Work
Milestone
Start Milestone
Summary

Activity ID	Activity Name	Original Durati...	Start	Finish
03111031PM	Payment Milestone: Approval / Acceptance of November 2012 Progress Report	0		17-Jul-14
03111041	December 2012 Monthly Progress Report	10	04-Aug-14	13-Aug-14
03111041PM	Payment Milestone: Approval / Acceptance of December 2012 Progress Report	0		13-Aug-14
03111051	January 2013 Monthly Progress Report	10	05-Sep-14	14-Sep-14
03111051PM	Payment Milestone: Approval / Acceptance of January 2013 Progress Report	0		14-Sep-14
03111061	February 2013 Monthly Progress Report	10	05-Oct-14	15-Oct-14
03111061PM	Payment Milestone: Approval / Acceptance of February 2013 Progress Report	0		15-Oct-14
03111071	March 2013 Monthly Progress Report	10	05-Nov-14	15-Nov-14
03111071PM	Payment Milestone: Approval / Acceptance of March 2013 Progress Report	0		15-Nov-14



Remaining Level of Effort
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Remaining Work
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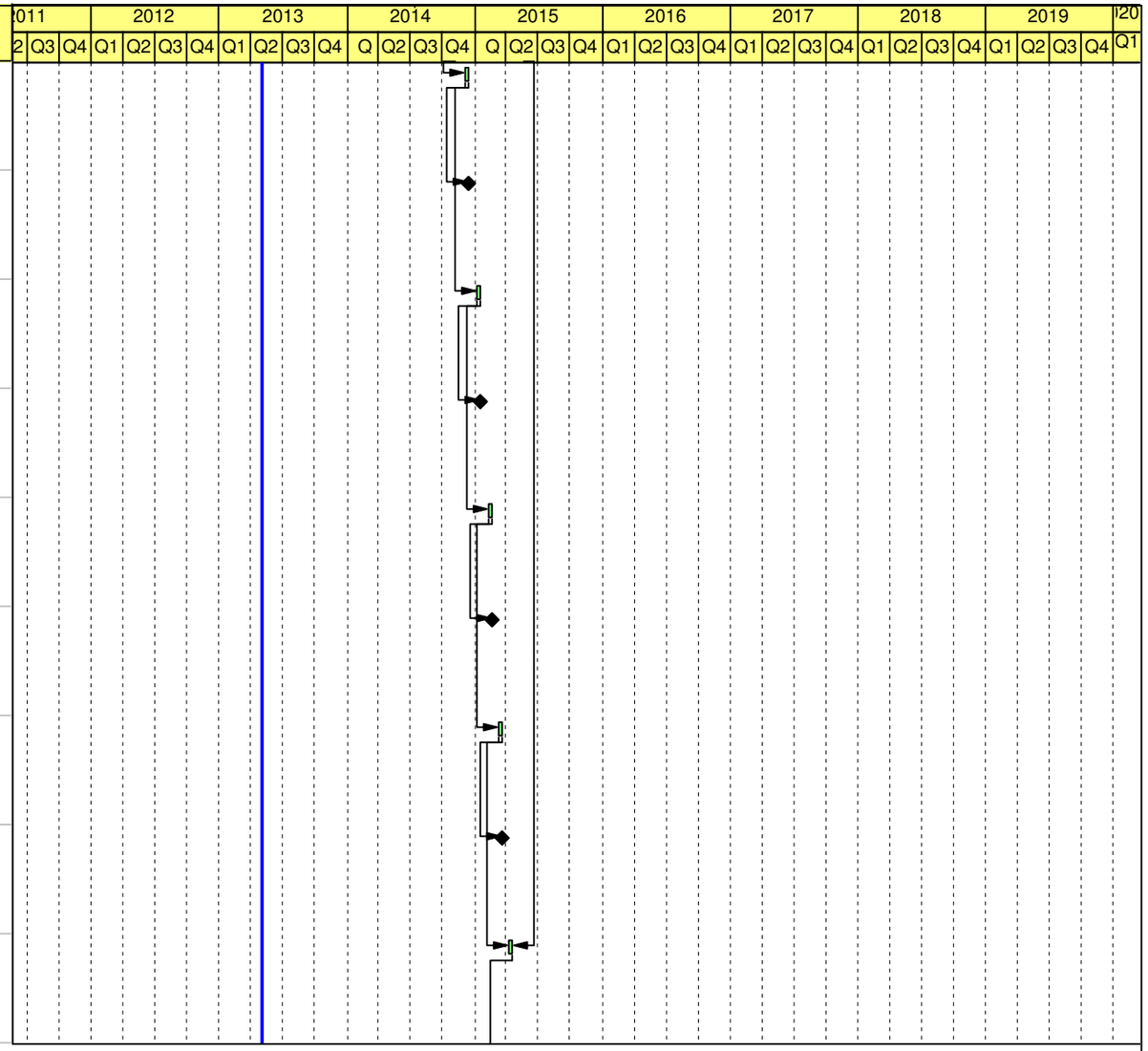
Milestone
Start Milestone
Summary

Activity ID	Activity Name	Original Durati...	Start	Finish
03111081	April 2013 Monthly Progress Report	10	06-Dec-14	15-Dec-14
03111081PM	Payment Milestone: Approval / Acceptance of April 2013 Progress Report	0		15-Dec-14
03111091	May 2013 Monthly Progress Report	10	08-Jan-15	17-Jan-15
03111091PM	Payment Milestone: Approval / Acceptance of May 2013 Progress Report	0		17-Jan-15
03111101	June 2013 Monthly Progress Report	10	08-Feb-15	18-Feb-15
03111101PM	Payment Milestone: Approval / Acceptance of June 2013 Progress Report	0		18-Feb-15
03111111	July 2013 Monthly Progress Report	10	11-Mar-15	20-Mar-15
03111111PM	Payment Milestone: Approval / Acceptance of July 2013 Progress Report	0		20-Mar-15
03111121	August 2013 Monthly Progress Report	10	09-Apr-15	18-Apr-15



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Remaining Work
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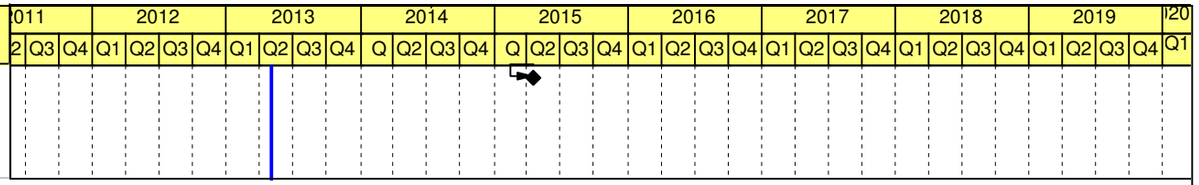
Milestone
Start Milestone
Summary

Activity ID	Activity Name	Original Durati...	Start	Finish
03111121PM	**Payment Milestone: Approval / Acceptance of August 2013 Progress Report**	0		18-Apr-15



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Remedial Action, Seneca Army Depot Activity, Open Detonation Ground

Romulus, New York

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3.0 FIELD INVESTIGATION PLAN

3.1 Overall Approach to Munitions Response Activities

3.1.0.0. The primary objective of the MEC portion of this project is to remove MPPEH from the 0- to 1,000-ft radius at the OD Grounds and close the Open Burning Tray. This will be accomplished in two stages. First, a munitions removal action will be conducted for the 0- to 1,000-ft radius. This will entail preferentially geophysically mapping the 0- to 1,000-ft radius (excluding the area of the OB Ground which has already been remediated and areas where steep terrain or vegetative cover prohibit the use of EM-61). Areas of steep terrain or vegetative cover that precludes EM-61 survey will be cleared by mag and dig. Areas where metallic saturation is observed in the geophysical dataset will be excavated to 6 inches and then resurveyed with EM61. Areas of metallic saturation will be defined as surveyed areas where individual targets of 50 mV or greater cannot be discriminated from one another. The areas of metallic saturation will be identified by Shaw in consultation with the Army team and approved by the Army. Excavated soils from the saturated areas will be windrowed to remove moisture prior to being transported to the soil-screening area. The stockpiled material will be processed through a screening plant to remove all MPPEH prior to being staged within the anticipated landfill cap footprint. This soil will be rough graded within this area to facilitate final grading once the design of the cap is approved. The formerly saturated areas will be resurveyed using EM-61. If the areas still exhibit metallic saturation another six inches will be excavated. In non-saturated areas individual targets will be reacquired and excavated. This process will be repeated until all anomalies have been investigated in the 0- to 1,000-ft radius. Additionally, all targets with an EM-61 response greater than 50 mV identified outside of the geophysically-saturated areas will be removed. The OD Hill will be rough graded and all MPPEH will be removed from the surface. After the surface clearance is complete, the OD Hill will be covered with one foot of soil in preparation for capping as identified in the CERCLA Record of Decision (under preparation).

3.1.0.1. Following this, closure of the Open Burning Tray will be completed IAW the approved work plan (Parsons, 2005). The closure of the Open Burning Tray will be conducted after the completion of all other MEC operations in order to utilize the burning tray for burning any propellants or explosives that may be identified during the MPPEH removal portion of the project.

3.1.1 Removal Action Goals

The goal of the MEC portion of the field activities at OD Grounds is to remove all MEC from the surface within the 0- to 1,000-ft radius and investigate and remove all targets exhibiting a geophysical response greater than 50 mV from the 0- to 1,000-ft radius and to

close the Open Burning Tray. Additional details regarding the specific goals for these activities are presented in subsequent sections of this work plan. The project goal of constructing a cap to inter contaminated soils will take place in a separate phase of the project and will be discussed in a subsequent design document.

3.1.2 Data Quality Objectives

3.1.2.0.0. Data quality objectives (DQOs) are qualitative and quantitative statements that specify the quality and the level of the data needed to support the decision-making processes during each project. Guidance for the DQO development process is contained in Guidance for Performing Site Inspections under CERCLA (USEPA, 1992) and Data Quality Objectives for Superfund (USEPA, 2000). The data collection objectives, the data uses, and the appropriate analytical data quality levels are identified in this section. Additionally, the sampling required for the project will be performed in agreement with the Generic Site-Wide SAP (Parsons, 2006) and the UFP-QAPP (**Appendix E**). Because the soil sampling locations will be dependent upon the results of the MEC removal, locations cannot be selected at this time. After completion of the MEC removal, soil sampling locations will be selected and submitted for approval prior to initiating the MC sampling. DQOs have been established using the USEPA 7-step method:

1. State the Problem
2. Identify the Decision
3. Identify inputs to the Decision
4. Define the Study Boundaries
5. Develop a Decision Rule
6. Specify Limits on Decision Error
7. Optimize the Design for Obtaining Data

3.1.2.0.1. **Table 3-1** identifies the DQO process for the OD Grounds. The DQOs proposed for geophysical surveys are identified in **Section 3.6**. The DQOs for MC sampling are presented in **Appendix E**.

3.1.3 Data Incorporation into the Remedial Action

3.1.3.0.0. Field data (including DGM surveys and results of intrusive investigations and analytical results) will be collected as part of this effort. Data used in the RAR will be reduced and summarized as necessary, and the reduction method will be documented in the report.

3.1.3.0.1. Data review will be performed on all data collected as part of the MEC clearance. Data validation of geophysical data will be performed IAW DID WERS-004.01.

3.1.3.0.2. GIS will be used to map site data. Two types of data will be evaluated to support the GIS effort: graphic data contained within the GIS dataset and tabular data contained within a relational database. The GIS effort will involve preparation, analysis, processing, and interpretation of data acquired from the geophysical surveys and intrusive investigations. GIS data layers will be constructed to evaluate MEC contamination at the sites. All files contributing to the GIS data sets will be backed up prior to editing or manipulation. The GIS coordinator will be responsible for registering and processing all data collected in the field, and also for preparing maps depicting specific attributes for the sites. The pre-MEC removal action GIS analysis of data is incorporated into this work plan and the post-MEC clearance GIS analysis will be provided with the RAR.

3.1.4 Follow-On Activities

An RAR will be prepared and submitted which fully documents the fieldwork effort and will provide an evaluation of residual risks. The RAR will describe the site history, the work conducted under this task order, any deviations from this Work Plan, the findings from the field effort, documentation of the disposal of materials from the site, and an evaluation of the residual risks at the conclusion of the field effort. The report will be supported as necessary with accompanying maps, charts, and tables to fully describe and document all work performed and all conclusions presented.

3.2 Identification of Removal Action Areas

The remedial activities under this work plan will be limited to the 0- to 1,000-ft radius in the OD Grounds (excluding the area of the OB Grounds which were previously remediated) and the Open Burning Tray. The location of the OD Grounds and the Open Burning Tray is presented in **Figure 1-2**. The total area to be evaluated is approximately 90 acres. Area descriptions and the investigative approach are discussed in detail in **Sections 3.6 through 3.11**.

3.3 Mobilization/Demobilization Plan

3.3.0.0. This sub-plan details the activities necessary to mobilize personnel and equipment for site work, as well as those activities necessary to shut down the site at the conclusion of the field work. As part of mobilization, the following general activities are required for the project to proceed:

a. Site access;

b. Site preparations;

c. Establishment of command post (CP);

d. Equipment mobilization;

e. Training and briefing;

f. Communications; and,

g. Work zone preparations.

3.3.0.1. Demobilization will consist of the performance of the same activities (or their undoing) in reverse order. In general, staging areas will be demobilized last, so that they can be used as a staging area for the demobilization efforts.

3.3.1 Preparations

Preparations for mobilization will not commence until receipt of the notice-to-proceed from USAESCH. Upon receipt, the field team will be notified, travel and lodging arrangements made, and the requisite copies of the applicable documents assembled (i.e., Project Management Plan, Work Plan, Standard Operating Procedures, and Historical Records Review). The field team will have already reviewed these documents, and any additional data obtained during previous site visits.

3.3.2 Establishment of Command Post

A CP will be established which will consist of an office facility and equipment storage facility. The CP will be equipped with electricity and phone service, and will serve as the primary location for personnel training and equipment storage.

3.3.3 Equipment Mobilization

Equipment and materials will be sent to the site via commercial carrier, transported to the site by the field team, or obtained locally. Equipment will include: Minelab Explorer all metals detector or equivalent, DGM instruments (e.g., EM61 MK2), repeater station with handheld 2-way radios, GPS, personal digital assistants (PDAs), digital cameras (if not incorporated within the PDA), intrusive investigation equipment, environmental sampling tools and supplies, documents, first aid kits, fire extinguishers, office trailer, portable toilets, potable water, mini-excavator, and other materials/supplies needed for site operations and MEC clearance activities. Mobilization of personnel, equipment, and supplies will be conducted in a safe, secure, and orderly fashion. Site vehicles will be from the Shaw fleet or rented and in most cases will be four-wheel drive sport utility vehicles or pickup trucks that will accommodate site personnel and equipment. Larger equipment such as a mechanical excavator, sifting plant, or mechanical brush cutting equipment will either be rented from a local vendor or supplied by subcontractors.

3.3.4 Training and Briefing

3.3.4.0.0. Prior to field activities, team members will be trained in:

a. Activities to be performed;

b. Threatened and endangered species habitat awareness;

c. MEC known and suspected to be present at the sites;

d. Action to take upon encountering MEC; and,

e. Safe work practices.

3.3.4.0.1. The field team will be briefed each day prior to commencement of field activities. Daily briefings will include a discussion of weather conditions, the previous day's findings (if related to safety issues), emergency response and evacuation procedures, and a review of the general procedures to deal with MPPEH, if encountered.

3.3.5 Communications

Two forms of equipment will be used to ensure effective communication between site members. HT750 Motorola radios will be the primary means of communications. Cell phones will be the secondary means of communication. Communication equipment will be checked each day after the morning safety briefing. Each field team will remain together throughout the field activities.

3.3.6 Work Zone Preparation and Support

Prior to the initiation of the field activities, affected areas will be cleared of brush and debris as discussed in **Section 3.4**. For intrusive investigations, anomalies identified from the geophysical data interpretation will be reacquired in phases so as to optimize conduct of the intrusive phase of work. Additional details for layout of the OD Grounds are included in subsequent sections.

3.3.7 Demobilization

Several demobilizations or partial demobilizations may be required as part of this effort. In general, personnel and rental equipment, unless otherwise needed for the demobilization effort, will be demobilized as early as possible upon completion of use for its intended purpose. The CP and any temporary waste storage area established for investigative-derived waste (IDW) will be dismantled only after the landfill cap is installed and all IDW is transported off site. Other areas (e.g., magazine, sifting plant) may be dismantled/demobilized when no longer needed. Site restoration will be coordinated through SEDA and USAESCH.

3.4 Site Preparation Plan

3.4.1 Site Survey and Grid Layout

A New York-licensed surveyor escorted by a UXO Technician using avoidance techniques will initially establish semi-permanent site control as required across the site, using existing monuments where practical. Following setup of the site control network, the surveyor will stake-out the pre-designed 100-ft by 100-ft grid system around the perimeter of the 1,000-ft radius with both wooden laths and steel pins. The metal nails (or pins) placed at the grid corners are a valuable quality tool to check positioning for the DGM investigation. In areas of high anomaly density it may be necessary to remove grid corner markers when investigating nearby and/or deeper anomalies. In the area around the perimeter of the 1,000-ft radius, wooden laths with flagging will be placed every 100 ft at the grid nodes. Closer to the center of the circle a line of stakes running north to south and east to west will be placed dividing the site into quarters. The crew will then take a 500-ft line marked every 100 ft, stretch it between the lath to conduct the surface and geophysical surveys. The wooden laths and steel pins will be marked with a unique alpha-numeric identification (ID) grid in the southwest corner of each grid as a reference for the field teams. Each team will have access to maps displaying the grid and labeling system for navigation purposes throughout the removal area. The grid system developed for the OD Ground MEC clearance is provided on **Figure 3-1**.

3.4.2 Vegetation Removal Plan

3.4.2.0.0. The purpose of this sub-plan is to present procedures necessary to perform brush clearing at the OD Grounds in preparation for performing geophysical surveys and intrusive operations.

3.4.2.0.1. Vegetation may be removed through brush cutting. Vegetation removal activities will be coordinated with SEDA in advance. Photographs will be taken occasionally during the brush clearing activities for the project record to document site conditions. Trees larger than 4 inches in diameter (typically measured at a distance chest high from the ground will not be cleared. In addition, there are approximately 14 acres of dense tree stands. These dense tree stands will not be removed as part of this scope, and those areas will be addressed using mag, flag and dig techniques as discussed in **Section 3.11**. For the remaining area, vegetation removal will consist of manual and/or mechanical removal (brush hog) with a UXO Tech 2 providing MEC avoidance as discussed in the following subsections.

3.4.2.0.2. Any MPPEH encountered during vegetation clearing operations will be clearly marked (e.g., cross pin flags or caution tape) and its position annotated on the appropriate map. At this point, on-site supervisory personnel will implement the MEC demolition procedures detailed in **Section 3.11.4**.

3.4.2.1 Manual Brush Cutting

3.4.2.1.0.0. Manual vegetation clearance team(s) will work in areas as directed by the SUXOS. A UXO-qualified escort (UXO Technician II or higher) will support each team for UXO avoidance purposes. A handheld metal detector (Minelab Explorer or equivalent) will be used for health and safety reasons to prevent accidental contact with surface MPPEH. The amount of brush removal required will be the minimum amount necessary to enable the planned activities for that area to be completed. Cut brush (i.e., small limbs) will be moved out of the work area, just off of the work area.

3.4.2.1.0.1. Manual vegetation clearance team(s) may be equipped with power chippers, powered weed cutters, chainsaws, and a variety of hand tools. The foreman of each team will ensure that personnel engaged in brush cutting activities wear protective clothing and accessories appropriate for the equipment being operated (e.g., chainsaw chaps). The activity hazard analysis for brush clearing is provided in Attachment 2 to the APP (**Appendix D**) and includes specific personal protective equipment (PPE) requirements. Manual brush teams will clear no closer than 6 inches from the ground surface.

3.4.2.2 Mechanical Brush Cutting

3.4.2.2.0.0. Mechanical vegetation removal will be accomplished when environmental concerns and terrain permit. A brush clearing team, comprised of the equipment operator and a UXO-qualified individual (UXO Technician II or higher), will conduct the operation.

3.4.2.2.0.1. Mechanical brush removal may be accomplished using a "brush hog," land-clearing machine (e.g., Hydro-axe), or other motorized tractor, as appropriate. Cutting blades shall not be placed lower than six inches above the ground surface to minimize safety hazards. Mechanical equipment (i.e., land-clearing machines) used for brush cutting will be of the type which chips or shreds vegetation in place.

3.4.2.3 Personnel Training

Personnel conducting the brush clearing operations will receive training in the site-specific procedures including explosives safety, environmental protection and appropriate construction safety procedures. An activity hazard analysis for vegetation removal is provided in Attachment 2 to the APP (**Appendix D**).

3.4.3 Surface Sweep

3.4.3.0.0. Following completion of preparatory activities, a surface clearance will be conducted for the 58.6-acre section of the 0- to 1,000-ft radius which will be geophysically surveyed, as a formal surface sweep is not being performed during the vegetation clearance (only MPPEH avoidance is required) and the amount of metal present in this area is likely to prevent accurate geophysical data collection without its removal. **Figure 3-1** shows the

project area boundaries (DGM area, mag and dig area, and area already cleared [OB Grounds]). The boundary between the mag and dig area and DGM acreage is approximate and will be adjusted based on field conditions. The SUXOS will assign each UXO Sweep Team grids to be cleared on a daily basis. UXO Sweep Teams will be made up of a UXO Technician III (Team Leader), UXO Technician II, and UXO Technician I or sweep personnel. Surface clearance team composition will be IAW USACE EM 385-1-97, 15 Sept 2008 w/errata.

3.4.3.0.1. The UXO Sweep Team will first locate the southwest grid corner marker to identify and confirm they are in the specific pre-assigned grid. Each grid's boundary will then be marked with flagging, marking paint, or non-metallic pin flags to guide the sweep line as they traverse the grid.

3.4.3.0.2. The UXO Sweep Team member on the leading edge of the sweep line will again mark this boundary. Upon completion of one sweep line, the sweep line will swing around and return in the opposite direction using the new marker row as a guide.

3.4.3.0.3. UXO Technicians and sweep personnel will be spaced at a minimum of 5 ft apart during each traverse. Sweep lines will be conducted so that full coverage of each grid is achieved. Each UXO Technician and sweep person will be equipped with a GA-52Cx, Minelab Explorer all metals detector or equivalent for safety considerations. The purpose of the surface clearance is visual in nature, which means that only items visible (fully or partially) will be removed and managed. No subsurface or intrusive work is anticipated, with the exception that items that are partially exposed will be excavated.

3.4.3.0.4. When a UXO Sweep Team member observes a visible surface item, the item will be assessed by a UXO Technician to determine if it is MPPEH, MD, or other metallic material. If the item is determined to be MPPEH, the UXO Team Leader will determine its type and condition. The MPPEH item will be marked with a red pin flag with a unique identifier written on the pin flag. The item will be logged in the Shaw Munitions Information Management System (ShawMIMS) data collection system, including nomenclature, date, time found, unique identifier which will consist of the grid number and a sequential number and the items disposition. All MPPEH items will be reported to the SUXOS. If the item proves to be large enough to impede the geophysical survey (i.e., larger than a 20mm projectile) and is an identifiable piece of MD, the weight and other identifying characteristics of the item will be recorded in the field log and entered in the project GIS. Other metal items that are determined to require removal to support the geophysical survey will be consolidated and reported by bulk weight and grid number in which they were located. Only UXO qualified personnel will perform these inspections and characterizations.

3.4.3.0.5. Details regarding the reporting and disposition of MPPEH, MD, and scrap management are provided in **Section 3.11.5**.

3.4.3.0.6. Any partially visible item would be intrusively investigated by UXO-Qualified Personnel. UXO Technicians will use hand tools to excavate an item. Care will be taken when digging on an item to ensure that the item is not disturbed until it can be determined that the item is safe for removal.

3.5 Instrument Verification Strip Plan

3.5.0.0. Shaw proposes to use an Instrument Verification Strip (IVS) approach to validate the EM61 MK2 sensor, positioning methods, and data acquisition protocol for the DGM survey effort. To ensure continuity across SEDA projects one IVS will be used for the 0- to 1,000-ft radius (Shaw) and the 1,000- to 2,000-ft radius (Parsons). Parsons is responsible for performing anomaly reacquire on existing targets identified during a previous DGM survey by Weston, and Shaw is responsible for the collection of DGM data, anomaly reacquire, and subsequent investigation of anomalies. Design and construction of the IVS will be performed jointly by both contractors under the oversight of USAESCH and USACE NY District. Prior to construction of the IVS by the geophysicists, a surface and vegetation clearance of the proposed IVS location will be performed. After the clearance activities have been completed, a background geophysical survey will be performed over an area of approximately 1/8 acre using the proposed DGM system in order to optimize placement of the IVS. Anomalies that are detected may be removed prior to construction of the IVS by UXO-Qualified Personnel.

3.5.1 Design

The IVS will consist of two small industry standard objects (ISOs). The ISOs will be buried at approximately 0.33 to 1 foot depths at horizontal (long axis perpendicular to IVS centerline) and vertical orientations, respectively, approximately 15 to 20 feet apart in a "background" area (i.e., area void of subsurface metal and electromagnetic interference). The positions of the IVS items will be recorded or certified by Parsons using a survey-grade RTK GPS. The ISOs will consist of 1-inch by 4-inch pipe nipples made from Schedule 40 black carbon steel from McMaster Carr Hardware (or equivalent) as shown in **Table 3-2**. The IVS construction will follow the guidelines in Chapter 3 of the DGM QC Guidance (USACE, 2003c).

3.5.2 Field Program

3.5.2.0.0 A minimum of three parallel lines will be collected over the IVS. Data will be collected along the centerline and two opposite sides at a line spacing of 1.25 feet, which is one half of the proposed line spacing for the production surveys. Additional lines may be

collected at larger offsets from the centerline in order to provide a complete, two-dimensional view of the anomaly characteristics during the initial IVS survey. A "noise" line will be collected parallel to the IVS centerline at an offset distance of approximately 10 feet to assess the background noise at the site. Metal nails placed flush with the ground surface will be placed at the start and end of the IVS centerline and "noise" line.

3.5.2.0.1 If the deployment form for the DGM system is modified during the production field program the IVS must be rerun. In addition, if multiple DGM systems are used (e.g., real-time kinematic [RTK] GPS, robotic total station [RTS], or fiducial positioning) each individual system must be run through the IVS. This will be performed during the IVS that will occur twice per day during the production survey. For the IVS surveys that occur on a daily basis, the DGM team will collect data over the centerline of the IVS and the "noise" line.

3.5.2.0.2 As part of the IVS effort, all instrument functional and quality tests will be digitally documented and stored in the project MS Access Database for review by the client and stakeholders.

3.5.2.0.3 Shaw assumes that a USAESCH representative will be on site during the initial IVS to discuss results and provide real-time concurrence. Concurrence of the IVS results will be based on meeting the following metrics:

a. **Background static geophysical sensor check.** 95 percent of the static measurements for the EM61 MK2 will be within 2.5 mV of background after instrument nulling.

b. **IVS check.** The responses for the EM61 MK2 from both ISOs will not fall below a secondary detection band placed 25% below the lower boundary of the respective Naval Research Laboratory (NRL) detection curves, The allowable position offset will be +- 1.2 feet based on the location of the Channel 2 peak response compared to the location of the center of each ISO. 1.2 feet is one-half of the line spacing that will be attempted for the full coverage DGM grids. If the position of the item is evaluated based on the gridded data, the location of the item will be within 2.4 feet of the actual location.

c. **Background dynamic geophysical sensor check.** The standard deviation for dynamic noise at the IVS (i.e., areas where no metal is present) for all EM61 MK2 data channels will not exceed 1.0 mV, based on a leveled data set.

d. **Known location check.** The acceptable difference in location measurement at a grid corner, survey monument, or control point at the IVS in static mode will be less than or equal to 0.5 feet.

3.5.3 Data Processing and Interpretation

3.5.3.0.0 The IVS data will be processed and analyzed using Geosoft Oasis Montaj. The final processed data for the IVS will be delivered to the client within two days, and the raw data will be uploaded to the FTP site each day during the IVS program. The ISOs will be used to confirm the sensitivity of the geophysical instrumentation and adequacy of the data acquisition parameters (line spacing, sampling frequency, positioning system accuracy and precision, and sensor height above the ground surface) by comparing the sensor responses from the ISOs to standardized, physics-based models of the ISOs created specifically for munitions response projects by the NRL. A "noise" line will be collected at an offset distance of approximately 10 feet from the IVS centerline in order to determine the site-specific "noise," which is an important component in determining the anomaly selection criteria.

3.5.3.0.1 It is anticipated that the minimum threshold for anomaly selection will be 50 mV (sum of channels 1-4). The final anomaly selection criteria will be based on the directive from the project delivery team (PDT). If aboveground power line interference is present near any of the geophysical survey areas, static geophysical sensor data will be acquired prior to the initiation of survey activities so that the information can be incorporated into the anomaly selection criteria.

3.5.4 Quality Program

At the commencement of the project prior to data acquisition activities at the IVS, the following pre-project instrument-specific tests will be performed and the results documented:

a. **Equipment Warm-Up.** Most instruments require a few minutes to warm up before data collection begins to minimize sensor drift due to thermal stabilization effects. All instruments will be allowed to warm up for at least 5 minutes before data collection. This procedure will be followed each time the instrument is powered up (e.g., at the start of the day, after breaks). This requirement will be documented in the field activity daily log (FADL).

b. **Record Sensor Position.** At the beginning of the survey, and thereafter at any changes in form factor, the relative positions of the geophysical sensors with respect to the positioning system antenna or prism will be measured (tolerance ± 1 inch) and documented, as will the platform or sensor height above the ground surface. This requirement will be documented in the FADL.

c. **Personnel Test.** The Personnel Test is performed to ensure that no relatively larger metal items are present on data acquisition personnel (e.g., keys, boots, belt buckles). With the instrument held in static position, the operator(s) move adjacent to the sensor while measurements are being recorded for a period of 15 seconds. The

measurements for all data channels of the EM61 MK2 will remain within 2.5 mV of background. The results of the test are digitally documented with the project MS Access Database.

d. **Cable Shake Test.** The cable shake test is performed to document any cable or connection problems. With the instrument motionless and recording data, each data cable is gently shaken and cable connector is wiggled to test for shorts or bad connections. Data collected during the Cable Shake Test will be free from spikes greater than 3 mV for all EM61 MK2 data channels. The results of the test are digitally documented with the project MS Access Database.

e. **Static Background Test.** The Static Background monitors the instrument background readings and electronic drift, and identifies potential interferences. With the instrument held in a static position, measurements are recorded for a period of 30 seconds (the initial test at the start of the project may be recorded for a duration of 3 to 5 minutes). Static background readings for all data channels of the EM61 MK2 will remain within 2.5 mV of background. The results of the test are digitally documented with the project MS Access Database.

f. **Static Response (spike) Test.** The Static Spike Test monitors the impulse response and repeatability of measurements over a standard test item. The standard test item is a 1-inch by 2-inch or 1-inch by 4-inch pipe nipple. For the EM61 MK2, the standard test item is placed at a predefined location on the man-portable unit on a rigid bracket or tube and measurements are recorded for a duration of 30 seconds. Measurements for the response of the standard test item will be within 10 percent after subtraction of the sensor baseline response. During project execution, the baseline response will be calculated as the average of the first four project tests (2 days). The results of the test are digitally documented with the project MS Access Database.

g. **IVS Repeat Data.** The repeatability of geophysical mapping data is monitored by the collection of replicate data over the IVS items. During the initial test, 10 runs of the IVS centerline will be performed, and an average response will be calculated for each IVS item. The responses for the EM61 MK2 from both ISOs will not fall below a secondary detection band placed 25% below the lower boundary of the respective NRL detection curves. The allowable position offset for each ISO or inert MEC item will be +- 1.2 feet based on the location of the Channel 2 peak response compared to the location of the center of each ISO. 1.2 feet is one-half of the line spacing that will be attempted for the full coverage DGM grids. If the position of the item is evaluated based on the gridded data, the location of the item will be within 2.4 feet of the actual location. If any items buried along the IVS produce an EM61 MK2 response characterized by two peaks, the trough between the two peaks will be used as the

basis for the position offset. The results of the test are digitally documented with the project MS Access Database.

3.5.5 Reporting

The results of the pre-project instrument tests and the initial IVS will be submitted in a letter report to USACE for review and approval and will include, at a minimum, the following information:

a. As-built map of the IVS;

b. Digital photographs of the inert and ISO seed items as used and in the open hole;

c. Graphical plots of the EM61 MK2 DGM system responses for the ISOs superimposed on the NRL standardized curves;

d. Summary table of EM61 MK2 instrument responses for each IVS item

e. Color-coded maps of the geophysical data with track path superimposed;

f. Geophysical interpretation, including initial anomaly selection criteria;

g. Proposed geophysical equipment, techniques, and methodologies;

h. Recommended QC performance metrics; and

i. Digital data and project MS Access database.

3.6 Geophysical Investigation Plan

This section was developed IAW the DID MMRP-09-004, DID WERS-004.01, EM 1110-1-4009, and DGM QC Guidance (USACE, 2003). It is anticipated an EM61 MK2 geophysical sensor will be used in conjunction with an RTK GPS, RTS, or fiducial positioning method for the DGM survey, which be performed in full coverage grids.

3.6.1 DGM Survey

DGM surveys will be performed over 100-ft by 100-ft grids over the project area, with the exception of wooded, severely overgrown, or sloped terrain areas where DGM surveys cannot be accomplished. Accordingly no DGM will be conducted on the OD Hill. The technical approach for remediation of OD Hill is presented in Section 3.10.

3.6.2 Personnel

3.6.2.0.0. The Shaw Project Geophysicist will have overall responsibility for design, implementation, and management of all geophysical elements required for the work effort. This individual, (Sandra Takata), will be the project geophysicist-of-record and will primarily be responsible for planning location survey activities, data collection and

processing logistics, and coordinating data interpretation. The Site Geophysicist (TBD) will manage the day to day DGM activities at the site and be primarily responsible for directing the data collection activities for the DGM survey.

3.6.2.0.1. The Shaw QC Geophysicist, (Jeremy Flemmer, PGP), will be responsible for oversight of location surveying, anomaly reacquisition and excavation activities, data interpretation, blind seeding, and ensuring compliance with geophysical QC requirements. Intrusive excavation results will be verified by the Project Geophysicist with the concurrence of the QC Geophysicist.

3.6.3 Production Rates

It is anticipated that approximately 1.5-2 acres of DGM data will be acquired per day per two-person DGM team.

3.6.4 Depth Anticipated

Based on previous investigations conducted at the OD grounds, the anticipated maximum depths for MEC/MPPEH are all expected to be less than 24 inches (Parsons, 2011).

3.6.5 Site Conditions

3.6.5.1 Geology/Soils

Refer to **Section 1.5.4**.

3.6.5.2 Topography and Vegetation

Refer to **Sections 1.5.1 and 1.5.3**.

3.6.5.3 Manmade Features

3.6.5.3.0.0. The OD Grounds is generally located within undeveloped areas and there are no major buildings or significant roads with traffic. There are some man-made features existing within or in close proximity to the DGM survey areas have the potential to negatively impact geophysical surveys. These features include, but are not limited to, utility corridors; buried wire conduit formerly used for demolition operations, cables, and radio transmitters; aboveground power lines, fences, and monitoring wells. All of these features may introduce noise in the DGM data; therefore, the position of these features will be accurately documented with the proposed positioning system(s) so that they can be accounted for during the interpretation.

3.6.5.3.0.1. In areas where power lines or radio transmitters are present, static noise tests may be performed prior to production mapping efforts in the specific area in order to assess the impact of these features on the DGM data. Modifications to the existing DGM system (e.g., data acquisition platform, data processing parameters, and interpretation criteria) may

be performed in areas where the source of the noise can be mitigated by changes to existing protocol. Any changes to the DGM system during the project will be documented in the digital project files (e.g., FADL, Oasis Montaj processing log).

3.6.5.4 Site-Specific Dynamic Events

Dynamic events (e.g., rain, lightning, solar flares) may temporarily impact geophysical data collection and/or data quality. Procedures for these anticipated events are as follows:

a. **Rain.** Depending on its intensity, rain may be an impediment to survey operations. The Site Geophysicist will assess the intensity of rainfall and its effects on survey instrumentation and safety (slip, trip, fall) considerations to determine when or how to proceed. General guidance for common conditions is as follows:

   – **Drizzle or Intermittent Light Rain.** Check electrical tape around electronic connections and continue.

   – **Continuous Medium or Heavy Rain.** As necessary, take cover and cease operations until conditions improve.

b. **Lightning.** Because most geophysical instruments contain sufficient metal and geometry to pose a preferred pathway for electrical discharge (lightning rod effect), observed lightning in the area will be deemed a safety hazard and will be cause for the cessation of survey activities until the lightning activity has ceased. Site personnel and equipment will shelter in a safe area. The Site Geophysicist will make the determination that lightning is present and will log the times when DGM survey activities are shut down and resumed.

3.6.5.5 Potential Worker Hazards

All site personnel will adhere to the practices, procedures, and training and monitoring requirements mandated by the APP and SSHP (**Appendix D**). Because of the potential MEC hazard, qualified UXO personnel will perform a surface sweep of 0-1000 ft radius as described in **Section 3.4.3** prior to DGM activities. Therefore, all MPPEH and/or metal on the ground surface that would impede the DGM survey will be removed prior to completing the survey. A UXO Technician II or higher will provide UXO escort for the geophysical survey activities as necessary.

3.6.5.6 Access Issues

Site conditions pose challenges in terms of accessibility. The following general site conditions and remedies are expected:

a. **Remote Access.** The site will be accessed by vehicles daily. All vehicles will stay on hardened roads or trails.

b. **Poisonous Plants.** To the maximum extent possible, poisonous plants will be avoided during the surveys. If poison ivy contact occurs, the personal hygiene measures described in Section 2.7.4 of the SSHP (**Appendix D**) will be followed.

c. **Sensitive Habitats.** Shaw will coordinate with the SEDA and USACE prior to conducting activities that may impact sensitive habitats (i.e., forested areas, wetlands, streams, ponds, grasslands, areas with threatened and/or endangered species, etc.).

d. **Thick Vegetation.** The removal of any thick vegetation from forested areas or grasses will be coordinated with the SEDA and USACE prior to activities.

e. **Wooded Areas.** Approximately 14 acres of the 0- to 1,000-ft radius of the OD Grounds is densely forested. DGM activities will not occur in these densely forested areas. They will be cleared using mag and dig techniques. The requirements specified in **Section 6.0** will be followed in the event that cutting of trees or other vegetation is required to facilitate completion of the DGM survey.

f. **Surface Water Features (i.e., ponds, wetlands, and streams).** Reeder Creek transverses the northeast corner of the 0- to 1,000-ft radius of the OD Grounds. Reeder Creek will be cleared using mag and dig techniques. Other than Reeder Creek, significant surface water features such as ponds, wetlands, and streams are not anticipated in the OD Grounds. However, if identified, no vehicles or heavy equipment will access surface water features on the facility.

3.6.6 Survey Control

3.6.6.0.0. A preexisting survey monument established or verified by a licensed New York surveyor of third order horizontal accuracy or better (residual error less than or equal to 1 part in 10,000) will be used to provide position information for the DGM survey either directly or by using the monument as a source to generate additional control points near the DGM survey areas. If control points are generated during the DGM activity, they will be validated by occupying at least one other independent control point within the site. The tolerance for this procedure is ± 0.5 ft when RTK GPS or RTS is used.

3.6.6.0.1. A system of 100-ft by 100-ft grids will be generated over the survey area. The location of each grid corner will be pre-defined using the project GIS system, and the coordinate data will be uploaded to a survey-grade RTK GPS or RTS system for stakeout in the field by the Shaw field crew. A metal nail or 6- to 8-inch rebar section will be placed at the southwest corner of each 1-acre area and a unique grid identifier written on a section of survey lathe or a small tag. The actual survey coordinates as staked in the field will be digitally recorded and uploaded to the project database.

3.6.6.0.2. The metal nails, where established, will be used as control point locations for the RTS (if used) as well as a QC check for the positioning accuracy and repeatability of the DGM surveys. As discussed in **Section 3.4.1**, grid corners will not be established for every grid in areas which may be excavated. Grid corners will established on at the southwest corner of 1 acre areas, at the periphery of the 1,000-ft radius and crossing the site from north to south. All mapping will be developed in the North American Datum of 1983 (NAD 83) New York Central State Plane Coordinates.

3.6.7 DGM System

Based on the results of previous work and knowledge of site conditions, Shaw will use an EM61 MK2 geophysical sensor coupled with an appropriate positioning methodology for the DGM effort.

3.6.7.1 Deployment Platform

The EM61 MK2 DGM system will be deployed as a standard-height (i.e., lower coil 42 cm above the ground surface) wheeled cart system.

3.6.7.2 EM61 MK2 Geophysical Sensor

3.6.7.2.0.0. The Geonics EM61 MK2 is a four-channel high-sensitivity time domain electromagnetics (TDEM) sensor designed to detect ferrous and non-ferrous metallic objects with good spatial resolution and minimal interference from adjacent metallic features. TDEM sensors work by utilizing a transmitter that generates a pulsed primary electromagnetic field in the earth, which induces currents in nearby metallic objects. The current decay produces a secondary magnetic field measured by the receiver coils of the EM61 MK2. Measurements are acquired a relatively long time after the primary pulse at specified time gates, which allows the current induced in the ground to dissipate, leaving only the current in the metal to still produce a significant secondary field.

3.6.7.2.0.1. A single EM61 MK2 unit consists of two 1 meter by 0.5 meter rectangular coils arranged in a coaxial geometry and separated by 40 cm. Half meter coils have a higher sensitivity and spatial resolution than the larger 1 meter by 1 meter EM61 coils. Secondary voltages induced in the bottom and top coils are measured in mV by the instrument electronics and recorded to a Juniper Allegro data logger.

3.6.7.2.0.2. The EM61 MK2 measures four time gates from the lower coil (216, 366, 660, and 1,266 microseconds – "4" mode) or the first three time gates from the lower coil and the 660 time gate from both the lower and upper coil, also known as "D" mode. For this project, four channels of the EM61 response from the lower coil will be recorded.

3.6.7.2.0.3. The EM61 MK2 was designed to detect individual small items at shallow depths and relatively larger items (e.g., 155mm projectile) at depths approaching 5 ft. The resulting data can be used to differentiate, in simplistic fashion, the relative size and distance (or depth) of metal items when the anomaly density is relatively low. In cluttered areas where the anomaly density is relatively high (e.g., areas of metallic saturation where individual anomalies over 50 mV [sum of channels 1-4] cannot be differentiated) and the anomaly signatures overlap, the determination of size and depth is much more difficult.

3.6.7.3 Positioning Methods

3.6.7.3.0.0. DGM data will be collected using the 100 ft by 100 ft grids as a general guide for navigation. It is anticipated that a very high percentage of the DGM survey area is "open" and void of tall vegetation and canopy, and therefore RTK GPS will be used to provide position information for the DGM system. As necessary, an RTS will be used in areas where vegetation and / or canopy preclude the use of the RTK GPS.

3.6.7.3.0.1. A Leica RTK GPS System 1200 will be used for spatial positioning over a high percentage of the open areas at OD Grounds. The proposed RTK GPS utilizes a base station that is set-up on a known position. Once the base station is set-up, it determines its location using satellites and then applies a correction based on the offset from the known coordinates at the location. The correction information is used by a rover that is in direct communication with the base station through a radio link. The Leica System 1200 RTK GPS units are capable of recording survey-grade measurements in real time and providing immediate accuracy to within approximately 1-2 inches.

3.6.7.3.0.2. In addition to providing position data for the geophysical sensor measurements, the RTK GPS will be used for other location tasks including:

a. **Feature Identification.** The RTK GPS will be used to augment geophysical data and improve geophysical mapping by capturing of visual observations made during the site reconnaissance. During this process, the RTK GPS will be used to record the location of thick vegetation, extreme topography, and manmade features such as wells, fences, etc., so that these features can be accounted for during the analysis and interpretation of the geophysical data.

b. **Anomaly Reacquire.** RTK GPS will also be used for anomaly reacquire. The coordinates for each interpreted anomaly on the digsheet will be uploaded to the RTK GPS rover and the "stakeout mode of operation will be used to reacquire each location to an accuracy of +- 0.5 ft.

3.6.7.3.0.3. Position data for the project will be reported in the NAD 83 New York Central State Plane coordinate system in units of meters (or U.S. Survey feet) in order to be compatible with existing information and data.

3.6.8 Sampling Rates and Data Density

EM61 MK2 data will be acquired at a rate of 12-15 hertz (Hz). Position data will be streamed into the Juniper Allegro data logger using a National Marine Electronics Association data string at 1-2 Hz. The recording rates translate into a geophysical sensor measurement along the ground surface at approximately 0.3- to 0.4-ft intervals. Performance metrics for platform speed and along-track data coverage are reviewed in **Section 3.7.5**.

3.6.8.1 Data Acquisition Procedures

A system of 100 ft by 100 ft grids will be used for DGM. General procedures for full coverage DGM include the following:

a. Conduct tailgate safety meeting. Remind crews to use project-specific file naming protocol for all files.

b. Set up the RTK GPS or RTS at a location within the survey parcel. If RTS is used, determine the coordinates of the RTS using minimum of two control points. Perform a final setup check by using a third control point to verify setup coordinates (see **Section 3.7.4**, DGM Quality Control).

c. Perform daily morning instrument functional checks at IVS.

d. The lead field geophysicist for the DGM team will review the intended survey area on a daily basis for proper vegetation removal and safety hazards. Set up visual navigation aids (fiberglass measuring tapes, traffic cones, spray paint, etc.) as necessary to assist team in acquiring data at regular intervals over the survey area.

e. Commence DGM data acquisition over area of interest (AOI); review static data for 15 to 30 seconds.

f. Systematically survey the site in the most effective pattern. Traverse intended survey area at a consistent pace of less than 3 miles per hour; minimize sensor bounce and sway, especially over rougher terrain. To ensure that the spatial coverage necessary is achieved, the instrument operator will navigate using pin flags, spray paint, or other marks placed at regular intervals along or adjacent to each acquisition line.

g. Review static data for 15 to 30 seconds at end of acquisition session.

h. Perform end of the day instrument functional checks at IVS.

i. Fill out Field Activity Daily Log (FADL).

j. Download DGM data to the dedicated geophysics field computer and immediately back up to digital versatile disc (DVD) or a USB drive and transfer to the Shaw DGM processing center using the secure Shaw FTP site.

k. Review all traverse data in the field and overlay on the survey grid layout map to validate coverage.

3.7 Data Processing

3.7.0.0. Shaw's standard data processing includes review of data in the field for general quality followed by more intensive analysis at the data processing center to include latency and drift correction, statistical assessment of the DGM performance metrics, and generation of color coded images of the EM61 MK2 data channels and track path. Shaw will use the equipment manufacturers' software, in-house software, and Geosoft's Oasis Montaj UX Process software to complete all processing tasks.

3.7.0.1. Shaw will use the following software to process the data:

a. Geonics Dat61MK2 for review of data ranges and output of a merged file with positions in American Standard Code for Information Interchange (ASCII) format;

b. Geosoft Oasis Montaj for latency and drift corrections, interpolation and generation of color-coded images, and statistical analysis of the data in terms of the performance metrics such as spatial sample density, static, static spike, and IVS results; and,

c. Leica GeoOffice may be used for location survey and cultural feature mapping tasks, as well as for statistical review of position data.

3.7.0.2. Geosoft Oasis Montaj will be the primary software used for most data processing tasks. The Oasis processing log file (process.log) will be recorded by the software and serve as the digital documentation for the processing parameters used for each data acquisition session.

3.7.1 Data Organization, Initial Processing, and Data Tracking

3.7.1.0.0. The data processing begins by organizing the data on the Shaw server using the following structure:

SEDA_ODG
    Geodata
        061412 (June 14, 2012)
            Raw
            Proc

3.7.1.0.1. The raw data for the DGM sensors will be copied to the "proc" directory for further processing and will never be compromised so the sequence of events can be reconstructed in the future, if necessary. The raw binary data are converted to an ASCII format using Geonics Dat61MK2 software and concurrently reviewed to ensure the sensor and positioning equipment are functioning properly, that the data are accurately positioned along survey lines and corrected for acquisition geometry. The final step of the process includes output of an ASCII "XYZ" file that includes the coordinates (NAD 83 New York Central State Plane Coordinates, US Survey feet or meters), sensor measurements for each data channel, and a quality indicator for the positioning device. The format of the "XYZ" file will be consistent for the project and compatible with Oasis Montaj.

3.7.1.0.2. Each data acquisition file name is digitally documented using the project MS Access Database. Other information recorded in the database includes the responsible geophysical crew, the grid(s) that the file covers, terrain, vegetation, weather, geophysical sensor and positioning system, and the initials of the data processor.

3.7.1.1 Review of Instrument Functional Checks

3.7.1.1.0.0. The ASCII data from the initial processing are imported into Oasis Montaj using a pre-defined processing script. The QC data for each morning and afternoon test sequence are reviewed by the data processor to document compliance with the performance metrics. The general steps performed include the following:

a. **Review of Geophysical Sensor QC Data.** Sensor QC test results (static background and spike tests, cable shake test, personnel test, and IVS data) will be reviewed to ensure proper system function. This step validates the repeatability and sensitivity of the geophysical sensor and the standard response to known items in both static and dynamic modes of operation, as well as provides information on the background noise in the survey area. Conformance with the performance metrics specified in **Section 3.7.5** is digitally documented for each data acquisition session.

b. **Review of Position and Spatial Sampling QC Data.** Positioning system and spatial sample density QC test results (sensor velocity, comparison with a known control point, and along and across track measurement spacing) will be reviewed to ensure proper system function. This step validates the repeatability and accuracy of the positioning system as well as the overall data acquisition protocol in terms of the navigation procedures. Conformance with the performance metrics specified in **Section 3.7.5** is documented digitally for each data acquisition session.

3.7.1.1.0.1. For each data acquisition file, a unique line code will be entered into the Oasis Montaj database (GDB) that documents the date of acquisition and responsible crew.

3.7.1.2 Final Data Processing

3.7.1.2.0.0. The data processor will use a pre-defined Oasis Montaj script for each data acquisition file to interpolate the EM61 MK2 data channels to generate color-coded images used for analysis and interpretation. The minimum curvature or nearest neighbor (i.e., Tinning) gridding routine will be used to interpolate the data using a cell size, blanking distance and initial search radius determined after assessing the IVS data. The color-coded images will be transcribed onto the plan map of the site for analysis and interpretation.

3.7.1.2.0.1. The Oasis Montaj processing log file contains the data processing parameters used and will be recorded during the processing of each data acquisition session. The Oasis Montaj processing logs will be maintained throughout the duration of the project on the secure Shaw server.

3.7.1.2.0.2. Additional tasks during the final data processing include deletion of turnarounds and overlapping data past the edge of the defined data acquisition area (i.e., grid edges) and examination of the data with respect to the location of cultural or natural features (wells, trees, utilities, etc.) observed on site base map. If any data gaps are present, the data processor will digitize the area and transfer the coordinates to the Site Geophysicist for subsequent data acquisition. The location of data gaps will be recorded in an Oasis Montaj database or polygon file.

3.7.1.2.0.3. The final processed data will be copied to a "master" Oasis Montaj database for the project to track the data acquisition process on a daily basis and to allow continual review of the data by the QC and Project Geophysicists in an efficient manner.

3.7.1.2.0.4. The raw and final processed data for each data acquisition session will be provided to the USACE for independent interpretation/evaluation at intervals specified in DID WERS-004.01 Attachment C and at the end of the geophysical phase of the project. Final processed data from the initial IVS effort will be transferred to the client within 2 days of data collection. A secure collaborative web portal for the SEDA project will be used to transfer the DGM data.

3.7.2 Anomaly Selection

3.7.2.0.0. A dig sheet will be generated that contains, at a minimum, the required information specified in DID WERS-004.01.

3.7.2.0.1 The PDT has determined a 50 mV threshold will be used to select potential targets for investigation. As stated in the ESS, only those anomalies that exceed a 50 mV response threshold will be reacquired and investigated. The 50 mV signal is based on the sum of channels 1-4 of the EM61 MK2. The first step during the interpretation is automated

anomaly selection using the UX Process Blakeley Test based on the pre-defined signal intensity threshold. Automatic selection of anomalies using a computer algorithm is implemented as a QC tool to minimize the occurrence of human error in the decision process.

3.7.2.0.2. The manual selection process follows the automatic target selection process and uses the anomaly density information to distinguish regions of individual anomalies versus contiguous areas of high anomaly density (i.e., saturated areas where individual anomalies > 50 mV are not distinguishable from one another). A "target" geodatabase (Oasis Montaj GDB) is created for the individual anomalies within each one acre grid during this process. The data analyst will use a digital polygon to denote regions of anomaly saturation within each grid. These areas will be excavated to a depth of 6 inches and resurveyed with DGM, and the process repeated until individual anomalies can be selected over the entire area. A flow chart depicting the anomaly selection process is presented on **Figure 3-2**. The final product is a dig sheet for each area that includes at a minimum the grid ID, a unique identifier for each individual anomaly location, easting and northing coordinates, and sensor data for the sum channel of the EM61 MK2.

3.7.3 Anomaly Reacquire

3.7.3.0.0. Reacquisition consists of relocating the interpreted coordinates for each individual anomaly on the dig sheet. To locate the ground position of the interpreted anomaly coordinates, the navigational system "Waypoint Location" mode will be used for the RTK GPS or RTS positioning system. A non-metallic pin flag, labeled with the unique anomaly ID, will be placed in the ground at the interpreted location. The boundaries of the areas of anomaly saturation will also be staked in the field during the anomaly reacquire task.

3.7.3.0.1. Reacquisition of the interpreted location of the individual anomalies will be performed to ± 0.5 ft of the coordinates specified on the dig sheet (please note that a 2-3 ft radius around the reacquired location will be cleared during the intrusive program to ensure the anomaly is unambiguously resolved as per USAESCH requirements). At each location a non-metallic flag or other suitable mark (e.g., spray paint on road surfaces) will be placed with the unique target ID. The reacquisition team will be provided with a color-coded image of the sum channel sensor data and individual target locations to facilitate the efficient reacquisition of each anomaly. The color-coded image will also assist the reacquire team with their specific reacquire protocol in areas adjacent to regions of high anomaly density.

3.7.4 DGM Quality Control

3.7.4.0.0. The geophysical QC system consists of a battery of pre-project tests as well as tests performed on a daily basis to ensure the data are of sufficient quantity and quality to meet the project objectives. The performance metrics proposed for the EM61 MK2 sensor are derived from a combination of DID WERS-004.01 and the USACE Table "Performance

Requirements for Removal Action Activities using DGM methods." These performance metrics are documented and tracked using the project MS Access Database.

3.7.4.0.1. The project MS Access Database will be used to digitally document the activities associated with the DGM process for the entire project duration. The information will be updated on a daily basis by the data processor.

3.7.4.1 Test Site Establishment

An instrument functional check area near the IVS will be established at a convenient location determined to have "background" characteristics (e.g., free of large sources of metal or man-made interference). The test area will consist of a marked reference area where instrument function checks may be performed.

3.7.5 Daily Tests

3.7.5.0.0. Instrument functional checks for the DGM system that occur on a daily basis during field operations include the following:

a. Instrument warm-up;

b. Instrument operator(s) metal check (visual and frisk as necessary - ensure no metal present on data acquisition personnel);

c. Personnel Test;

d. Cable shake test;

e. Static background geophysical sensor check;

f. Static spike geophysical sensor check;

g. IVS check; and,

h. Known location check (occupation of survey monument, control point, or grid corner).

3.7.5.0.1. Some of the field tests discussed above are quantitatively evaluated during the initial data processing that occurs each day. The project MS Access Database will be used to document the results of the daily tests, spatial sampling analyses that occur during data processing, and the results of the anomaly selection and resolution processes. Based on the pre-project tests and our experience in using the EM61 MK2, the following initial performance metrics are proposed for the project:

a. **Personnel Test.** The measurements for all data channels of the EM61 MK2 will remain within 2.5 mV of background. The test is performed twice daily, prior to the

first data acquisition session and after completion of data collection. Prior to the Personnel Test, the data acquisition team members will check each for metal.

b. **Cable Shake Test.** The cable shake test is performed for each man-portable sensor at the beginning and end of each day to document any cable or connection problems. With the instrument motionless and recording, each data cable is gently shaken and cable connectors are wiggled to test for shorts or bad connections. During the Cable Shake Test, no data spikes that exceed 3 mV will be evident on any EM61 MK2 data channel.

c. **Static background geophysical sensor check.** Static background readings for the EM61 MK2 will remain within 2.5 mV of background for all EM61 MK2 data channels. The test is performed twice daily, prior to the first data acquisition session and after completion of data collection.

d. **Static spike geophysical sensor check.** The criteria for the entire project will be based on the average of the first four instrument functional tests performed (approximately 2 days of instrument functional checks). The test is performed twice daily, prior to the first data acquisition session and after completion of data collection. Measurements for the response of the standard test item will be within 10 percent after subtraction of the sensor baseline response.

e. **IVS (dynamic response geophysical sensor check).** The repeatability of geophysical mapping data is monitored by the collection of replicate data over the IVS at the beginning and end of each day. At the beginning of the project, ten independent "runs" of the IVS will be performed. The signal intensity of the ISOs will be greater than 75 percent of the average determined during the first ten runs (dynamic detection repeatability). The position of each ISO will be within 2.4 ft of the known position (dynamic positioning repeatability). For production data, grid corner nails or blind seed items will be used to demonstrate dynamic detection repeatability. The grid corner nails or blind seed items will be within 1.2 ft of the known position, and the peak response will be greater than 75 % of the value determined during the initial IVS.

f. **IVS (dynamic background geophysical sensor check).** The standard deviation for dynamic noise (i.e., areas where no metal is present) for the EM61 MK2 will remain within 1.0 mV of background for all data channels based on the noise line at the IVS. This metric may be modified based on the examination of the IVS data. If the metric is modified, the revised metric will be documented in the IVS letter report.

g. **Known position check.** The acceptable difference in location measurement at a grid corner, control point, or survey monument is less than or equal to 0.5 ft when the

DGM system positioning unit (RTK GPS or RTS) is coincident with the known location.

3.7.5.0.2. In addition to the analysis of the daily instrument tests during data processing, quantitative criteria are proposed for the following spatial sampling components of the DGM system:

a. **Sensor velocity check (speed).** 95 percent of the EM61 MK2 sensor measurements will be acquired at a speed of less than or equal to 3.3 miles per hour for each data acquisition session. The Oasis Montaj histogram tool will be used to evaluate this metric.

b. **Along Track Sampling.** 98 percent of the EM61 MK2 sensor measurements will be less than or equal to 0.8 ft for each data acquisition session. The Oasis Montaj histogram tool will be used to evaluate this metric.

c. **Across Track Sampling.** 95 percent of the data will be acquired at a spacing of less than or equal to 2.5 ft for each one acre grid. The line spacing attempted will be 2.5 ft. Areas that exceed 3.3-ft line spacing, excluding data gaps from trees or other obstacles that preclude the survey platform from providing complete coverage, may be identified by the data processor as potential "fill-in" areas; data gaps will be not be specified by the processor where the collection of additional data will not provide useable information (e.g., areas of anomaly saturation, buildings, adjacent to cultural features, etc.). This metric is intended to control data gaps from inconsistent navigation that are not associated with trees or other obstructions.

3.7.5.0.3. The color-coded images generated from the final processed data must be representative of the MRS conditions. During the interpretation phase, checks performed to ensure the representativeness of the data include the following:

a. **Latency Correction.** The EM61 MK2 sensor data will be aligned to one sample increment (approximately 0.5 ft).

b. **Data Consistency.** Consistent channel naming conventions, processing parameters and methods will be used for all datasets and channels within each dataset by utilizing Oasis Montaj scripts.

3.7.5.0.4. After the geophysical data are interpreted, individual anomalies are reacquired prior to the intrusive investigation. In order to ensure the anomaly resolution phase of the project produces data of sufficient quality, the following checks related to the DGM system are performed:

a. **Anomaly Reacquisition.** Reacquisition of all individual anomalies specified on the dig sheet (i.e., interpreted location) will be performed to ± 0.5 ft when RTK GPS or RTS is used.

b. **Feed Back Process.** For individual anomalies that are intrusively investigated during the project, the Site Geophysicist or designee will review the excavation results with respect to the geophysical anomaly characteristics and anomaly selection criteria. If there are potential discrepancies they will be documented in the project MS Access Database.

c. **Anomaly Selection.** All anomalies included on the dig sheet will meet the anomaly selection criteria as established at the beginning of the project. If the anomaly selection criteria are modified during project execution based on the intrusive findings or direction of the PDT, USAESCH will be notified in advance via a field change order prior to implementation.

3.7.6 Blind Seeding

3.7.6.0.0. Blind seed items will consist of small ISOs and will be placed throughout the full coverage DGM grids so that each team encounters a minimum of one blind seed item per day. Based on the current PDT directive to use a sum channel threshold of 50 mV, it is anticipated that blind seed items oriented horizontally will be placed at a maximum depth of 0.2 feet and those oriented vertically will be buried at depths up to 1.4 feet. The burial depths were determined using the NRL detection curves for a small ISO. The Shaw QC geophysicist and / or UXOQCS will utilize a separate version of the project MS Access Database to document the blind seed item type, depth, orientation, and actual coordinates. These data will be merged with the results from the interpretation which include the EM61 MK2 signal intensity and interpreted coordinates. After the interpretation for a grid is submitted to the client, the blind seed information for that grid or area may be released to the data interpreter, if necessary.

3.7.6.0.1. If a blind seed item is not selected as a potential target of interest during the interpretation, or does not meet the blind seed item dynamic detection or positioning metrics, (greater than 75% of the predicted response from the NRL detection curves or within 2.4 ft of any part of the item projected to the surface, respectively), a root cause analysis will be performed. Based on the analysis of the information, corrective action(s) will be proposed to the Shaw PM and USAESCH. Corrective actions may consist of re-processing or re-collection of data, or adjustment of the interpretation criteria and / or protocol.

3.7.6.0.2. The results of the blind seeding program will be tracked in the project MS Access Database.

3.7.7 Intrusive Anomaly Verification

3.7.7.0.0. After anomaly locations have been reacquired, the following procedures will be used for the intrusive verification and reporting of the individual target anomalies. The Site Geophysicist will report the anomalies to the SUXOS as ready for excavation and identification. The SUXOS will assign a UXO team to excavate and identify the anomaly and record the required information as per DID WERS-004.01.

3.7.7.0.1. The ShawMEC software will be used to record the relative offset between the flagged dig sheet location and the actual location of the excavated item(s) and to note any anomalies that could not be excavated. Examples of instances where an anomaly may not be excavated are when the anomaly occurs below concrete/asphalt (not anticipated at this site) or in saturated areas where water fills the hole and prevents visual identification of the item(s).

3.7.7.0.2. After the UXO team has completed the excavation and recording process, an independent team will check specific excavation locations with an EM61 MK2 detector to ensure that the source of the anomaly has been removed. The metric for acceptance will be a signal intensity of less than 50 mV for the sum channel. Shaw anticipates using a "lot" size of 200 or 500 anomalies and will randomly select and check 137 or 184 excavations, respectively, to ensure there is a 90% confidence that less than 1% of the remaining holes in the lot are unresolved (default for a removal action). If one excavation location in a "lot" does not achieve the signal intensity metric the remaining excavation locations in the "lot" will be checked with the EM61 MK2. If project logistics or safety concerns prevent "lots" from being determined by numbers of anomalies, "lots" will be designated based on a grid size of 1 acre. In this case, the number of excavation locations to check will be determined for each one 1 acre "lot" based on the number of individual anomalies on the dig sheet.

3.7.7.0.3. If when checking the specific excavation locations after removing the target, the EM61 MK2 indicates a sum channel signal intensity of less than 50 mV the target will be considered to have been successfully removed and the excavation will be backfilled. If following the target removal the signal intensity is still above 50 mV, the excavation will continue.

3.7.8 Corrective Measures

3.7.8.0.0. In the event of a failure of the DGM performance metrics, Shaw's Project Geophysicist and QC Geophysicist will perform a root-cause analysis to identify the reason for the failure and how much data have been affected, and whether corrective actions can be taken to correct, mitigate, or eliminate the cause of the failure. The root-cause analysis will be submitted to USAESCH.

3.7.8.0.1. Specific corrective measures are dependent on the type of geophysical equipment used during an operation and will be developed on a site-specific basis. However, the following are the basic corrective measures Shaw will employ for the DGM program:

a. Replace sensors or instrumentation if they fail to meet performance metrics;

b. Re-excavate anomaly locations if the Project or QC Geophysicist determines that the excavated item(s) are not associated or consistent with the initial individual target anomaly; and,

c. Re-collect field data.

3.7.9 Interim DGM Reporting

3.7.9.0.0. Access to interim DGM data will be provided via a secure project SharePoint or FTP site. All digital data will be provided in formats compatible with the USAESCH computer systems. Interim data will include the following:

a. Raw and processed DGM data, with associated README files;

b. Final processed / interpreted data for each 1 acre grid as Oasis packed maps and GDBs;

c. Anomaly resolution information in the project MS Access Database.

3.7.9.0.1. At the beginning of the project, the client will be supplied with shape files of the geophysical survey area boundaries and grids as well as the coordinate information for all monuments, control points, and grid corners.

3.7.9.0.2. Raw and processed data will be delivered to the client per the guidance in Attachment C of DID WERS-004.01. The MS Access table requirement specified in Attachment B of WERS-004.01 will be used during the project. Final processed data for the project will be delivered within five weeks of the end of DGM data collection activities.

3.8 Geospatial Information and Electronic Submittals

The Geospatial Information and Electronic Submittals Plan is used to describe the methods, equipment, and accuracy for conducting location surveys and mapping during the MEC clearance activities at the OD Grounds, and the subsequent development of the project GIS databases to support the mapping and document production process. Survey and/or DGM activities will be performed as part of the MEC clearance activities at the OD Grounds. All geospatial data generated during the course of this project will be incorporated into the project GIS. This section was drafted using the general instructions outlined in DID WERS-007.01, Geospatial Information and Electronic Submittals.

3.8.1 MEC and Sample Tracking

3.8.1.0.0. Shaw will automate and ensure accuracy of the data by utilizing mobile data collection devices equipped with the ShawMIMS data management system to record and track MPPEH, MD, and other metallic items identified during the course of the MEC clearance activities. ShawMIMS is Shaw's proprietary, automated data management system and was developed specifically for collecting and managing munitions-related data. It improves data quality by enforcing standard nomenclatures during field data collection for data normalization and referential integrity, and directly associates data with geophysical anomalies, where applicable. The system maintains data quality and accuracy from planning through completion of field activity.

3.8.1.0.1. ShawMIMS will be populated with the DGM anomalies selected for reacquisition. UXO Teams will be able to link the DGM anomaly with the dig results electronically, in real-time, while in the removal grid. In addition, ShawMIMS has the capability of recording the type, weight, size, and other characteristics of MPPEH, MD, and other metallic items observed during the field effort. The northing and easting locations of all MPPEH will be recorded and tracked in ShawMIMS.

3.8.1.0.2. Sample and analytical data from closure of the Open Burning Tray will be managed using Shaw Environmental Information Management System (ShawEIMS), a database system designed specifically to handle environmental data that provides power and flexibility in sample planning, data management, and reporting (including Army Environmental Restoration Information System submittals).

3.8.1.0.3. All geospatial data generated during the course of this project will be incorporated into the geodatabase.

3.8.2 Accuracy

Semi-permanent and permanent control monuments established by a licensed New York surveyor will be of Class I, Third Order accuracy.

3.8.3 GIS Incorporation

3.8.3.0.0. Geo-referenced information generated during the course of the project will be incorporated into the project GIS. The project GIS will be used for map development and progress tracking. The project GIS will be used to quickly plot MPPEH locations and determine the most appropriate minimum separation distances (MSDs) for MPPEH disposal/demolition activities.

3.8.3.0.1. A project-specific GIS will be used to integrate data from ShawMIMS and ShawEIMS using the ESRI ArcGIS suite of software. Shaw will collect and/or locate

appropriate sources of geospatial data not provided by DoD. Shaw-generated data will comply with all applicable DIDs. All spatial data will be consolidated into a single GDB repository.

3.8.3.0.2. Site data will be mapped using GIS. The GIS dataset will be accompanied by metadata conforming to the Federal Geographic Data Committee National Standard for Spatial Data Accuracy; it will be provided in ArcGIS, which is compliant with Federal Geographic Data Committee's Content Standard for Digital Geospatial Metadata, and in a GDB that is compliant with the Spatial Data Standards for Facilities, Infrastructure, and Environment. The horizontal accuracy of any GIS data created by Shaw will be tested IAW the National Standard for Spatial Data Accuracy then recorded in the metadata. The GIS effort will involve preparation, analysis, processing, and interpretation of data acquired from MC sampling and analysis during closure of the Open Burning Tray, geophysical surveys, and intrusive investigations. The GIS coordinator will register and process all survey and intrusive field data into the SEDA GIS, and prepare maps depicting site-specific attributes. Shaw's GIS process has been developed so that integrated data can be used for analysis in updating the conceptual site model for the OD Grounds and supporting future long-term monitoring requirements. The GDB will be used for map development, decision making, project analysis, and progress tracking. The project GIS will also be used to quickly plot MPPEH locations and determine the most appropriate MSDs for demolition activities. The strength of using this approach lies in the ability to provide procedures for quality data collection, the capacity to integrate data, and processes for delivering information.

3.8.4 Mapping

All data will be provided in NAD 83 New York Central State Plane Coordinates.

3.8.5 Computer Files and Digital Data Sets

All GIS files will be compatible with ArcGIS. Data will be available electronically on CD or DVD upon request.

3.9 Intrusive Investigation

3.9.1 General Methodology

3.9.1.0.0. The proposed MEC clearance activities involve collecting geophysical data to identify metallic anomalies to be excavated by Shaw UXO personnel. Areas that cannot be discriminated due to metallic saturation will be excavated to a depth of 6 inches and resurveyed. This process will be repeated until the entire area can be discriminated and anomalies selected. The excavated soils will be screened through a sifting plant to remove all MPPEH prior to being returned to the 0- to 500-ft radius in order to cap the soil (capping will be discussed in a separate Landfill Cap Design Plan). In addition, Shaw will perform a

mag and dig survey of wooded, severely overgrown, or sloped terrain areas where DGM surveys cannot be accomplished. Mag and dig activities are discussed in **Section 3.11**. The mag and dig area will include Reeder Creek. This section presents the procedures to be followed for the anomaly intrusive investigations, mechanical excavation/sifting, and mag and dig survey.

3.9.1.0.1. Intrusive investigations will be performed IAW procedures outlined in the U.S. Army's EP 1110-1-18, *Military Munitions Response Process*, and the Occupational Safety and Health Administration (OSHA) requirements for excavations in 29 CFR 1926 Subpart P. MEC disposal operations will be performed IAW EM 385-1-97, *Explosives – Safety and Health Requirements Manual*, and Technical Manual (TM) 60A-1-1-31, *Explosives and Ordnance Disposal (EOD) Disposal Procedures*. The SSHP developed for the OD Grounds (Attachment 1 of **Appendix D**) will be followed at all times, as will procedures outlined in DoD 6055.09-M, *Ammunition and Explosives Safety Standards* and the ESS in **Appendix G** (USACE, 2010).

3.9.2 Team Composition

The field operations will be conducted by personnel divided into teams. Each team will have assigned duties. In some instances, individuals may be considered a member of more than one team.

3.9.2.1 Down Range Teams

The Down Range Teams are responsible for work within the EZ. Each Down Range Team will consist of a UXO Tech III, (the Team Leader who acts as the safety observer and is responsible for the overall direction of the team and for radio communications), and up to six UXO team members IAW EM 385-1-97. The number of team members will vary depending on the work being performed and equipment being used. If excavation equipment or other heavy equipment is required, one or two workers will be the equipment operators, while other workers act as ground guides.

3.9.2.2 Soil Excavation and Sifting Team

The Soil Excavation and Sifting Team will be composed of the UXO Technicians, equipment operators, and field laborers.

3.9.2.3 Other Workers

Other workers may be present at the site including escorted visitors, geophysical survey teams, geophysical anomaly reacquisition teams, surveyors, and other subcontractors. This work must all occur outside the EZ when the Down Range Team is active.

3.9.3 Personnel Qualifications

3.9.3.0.0. UXO teams will consist of qualified personnel approved by USAESCH. Non-UXO qualified personnel will not perform any excavation nor handle MPPEH. All project personnel will complete the OSHA 40-hour training course for hazardous waste site workers as required by the specific task. Additional site-specific training, IAW 29 CFR 1910.120, EM 385-1-1 (*USACE Safety and Health Requirements Manual*), ER 385-1-92 (*Safety and Occupational Health Document Requirements for Hazardous, Toxic, and Radioactive Waste and Ordnance and Explosive Waste Activities*) and this Work Plan, will be provided to all personnel upon their initial mobilization. A medical surveillance program will be in place for each member of the field personnel, with the most recent exam for each member having occurred within the last 12 months.

3.9.3.0.1. All UXO personnel will meet the requirements set forth in DoD Explosives Safety Board (DDESB) Technical Paper (TP) 18, *Minimum Qualifications for UXO Technicians and* Personnel (DDESB, 2004). All UXO personnel, regardless of their labor category, must have the following credentials:

a. Graduate of a military EOD school of the United States;

b. Graduate of a military or EOD school of Canada, Great Britain, Germany, or Australia; or,

c. Graduate of a formal training course of instruction (as defined in Chapter 3 of DDESB TP 18) or EOD assistant course.

3.9.4 Exclusion Zones

3.9.4.0.0. The applicable MSDs for subsurface removals at OD Grounds are shown in the ESS in **Appendix G (USACE, 2010)**. The M374 81mm mortar was selected as the munition with the greatest fragmentation distance (MGFD) for OD Grounds and its maximum fragment range - horizontal is 1,270 ft. During disposal operations (i.e., intentional detonations) of MEC, the maximum fragmentation distance of the actual UXO or discarded military munitions (DMM) being destroyed will be used unless approved engineering controls are incorporated to reduce this distance. During the course of this investigation, if a MEC item with a greater fragmentation distance is encountered, the minimum separation distance (MSD) will be adjusted IAW Department of Defense Explosives Safety Board (DDESB) Technical Paper (TP) 16, Revision 3, Methodologies for Calculating Primary Fragment Characteristics; operations will continue; and an amendment to the ESS submitted expeditiously for approval (a copy of this document will be available on-site). The Q-D arcs will be adjusted accordingly.

3.9.4.0.1. The hazard fragmentation distance (HFD) is a protective distance based on the maximum blast effect and the distance a piece (i.e., fragment) can travel at a velocity which could render damage to equipment or injury to individuals. An HFD of 239 ft has been established in the event of an unintentional detonation for non-essential personnel. The calculated HFD and associated safety criteria are provided in **Appendix G**.

3.9.4.0.2. During excavation and screening operations, only essential personnel (excavator operator, off-road truck driver, and UXO Technicians) will be allowed within the MSD, which is the designated Explosive Safety Exclusion Zone which is the HFD of 239 ft. Essential personnel during excavation and screening operations will be adequately protected behind appropriate Plexiglas or Lexan® and/or steel shields (**Section 3.9.7.1**). The shielding will provide K24 protection to essential personnel. The K24 distance for the M374 81mm mortar is 32 ft. However, the K18 distance of 24 ft will be used since essential personnel will be wearing hearing protection that provides ≥ 9 decibel attenuation.

3.9.4.0.3. During excavation and screening operations, the excavator operator, off-road truck driver, and UXO Technician will remain behind the shields and wear hearing protection as described above, and maintain the K18 distance of 24 ft.

3.9.4.0.4. During intrusive operations, roads that lead to OD Grounds will be barricaded to prevent entry of non-essential personnel. Flaggers may also be posted where the MSD crosses any roads and the roads are uncontrolled. Flaggers will stop and prevent the entry of non-essential personnel.

3.9.5 Daily Operations and Project Work Flow

The schedule of daily operations, which governs all activities necessary to complete the intrusive excavation, is presented in **Table 3-4**. This table provides a quick reference summary of procedures to be followed each day. Many of these activities are described in detail in the applicable chapters of this Work Plan.

3.9.6 Intrusive Anomaly Excavation Procedures

3.9.6.0.0. As described earlier in this chapter, metallic anomalies will be identified in 100-ft by 100-ft grids, reacquired and marked in preparation for the intrusive investigation. The investigation of DGM anomalies will be conducted by up to three two-person UXO teams, each two-person dig team consisting of a UXO tech II and a UXO tech I, supervised by a UXO tech III team leader. Excavation will initially be performed to the side of the anomaly using hand tools. A visual and electronic search of the excavation will then be made. This process will be repeated until the audible signal from the analog metal detector indicates the object is close to the surface of the excavation. Mechanical equipment may be used to support the excavation of the anomaly. The excavator bucket will be used no closer

than 1 ft of the anomaly source. The remaining excavation will be performed by using hand tools. Once the depth of the excavation is alongside the anomaly, additional soil will be removed by hand until the anomaly is located. Anticipated excavation depth is 2 feet; however, clearance to depth of detection will be achieved. Anticipated excavation diameter is 3 feet. Excavations greater than 4 ft in depth will be considered a confined space and not be made without prior approval of the OESS.

3.9.6.0.1. The UXO team will evaluate the source of the anomaly to determine whether it is MPPEH. MPPEH will be treated IAW the guidelines found in **Section 3.11.4**. Once an anomaly is identified and any necessary operations are completed, the excavation will be filled in and tamped to the approximate consistency of the surrounding soil. All trash (e.g., sandbag debris) will be removed from the site and the excavation site will be restored to surrounding conditions to the extent practicable.

3.9.7 Saturated Soil Excavation and Sifting Procedures

3.9.7.1 Armoring and Shielding

Armoring and shielding will take place IAW the ESS (**Appendix G**) (USACE, 2010). Armoring and shielding will take place during excavation of areas of metallic saturation and operation of the screening plant. Armoring and shielding are based on Minimum Thicknesses to Prevent Perforation provided in the Fragmentation Data Review Forms. Additional information and the Fragmentation Data Review Forms are presented in the ESS (**Appendix G**) (USACE, 2010). Shielding will include the following:

a. The front of the excavator (windshield) will be protected with 2.77 inches of Plexiglas or 4.26 inches of Lexan® mounted on brackets welded on to the excavator for the MGFD which is the M374 81mm mortar.

b. The tractor will be protected with 2.77 inches of Plexiglas or 4.26 inches of Lexan® mounted on brackets welded on to the tractor for the MGFD which is the M374 81mm mortar.

c. The dozer will be protected with 2.77 inches of Plexiglas or 4.26 inches of Lexan® mounted on brackets welded on to the tractor for the MGFD which is the M374 81mm mortar.

d. The UXO Technician will be protected behind a combination of mild steel equal to or greater than 0.65 inch in thickness equipped with a 4.26-inch thick Lexan® or 2.77-inch Plexiglas window.

e. The back of the off-road cab will be protected with mild steel equal to or greater than 0.65 inch in thickness.

3.9.7.2 MEC Safety Controls during Excavation and Screening Operations

3.9.7.2.0.0. Soil remediation at OD Grounds where the DGM data indicate metallic saturation will be excavated to 6 inches and screened prior to placement in the 0- to 500-ft radius beneath the location of a future landfill cap.

3.9.7.2.0.1. The following safety controls will be implemented during the screening operation:

a. A UXO Technician will continually monitor the process from behind the blast shield to observe any MPPEH. The UXO technician will have a remotely operated "kill switch" such that the screening operation will be immediately halted if potential MEC has been observed. The technician will also have a remotely operated start switch in order to restart the plant from behind the blast shield. A second UXO technician will be observing the stockpiles on the opposite side of the plant. Up to three additional technicians will be sorting the metallic material on the conveyor belt. The following procedure will be implemented:
   - Only essential personnel will be on site.
   - The item will be inspected to confirm if it is MEC.
   - If the item is MEC, it will be moved by the UXO Technician. The item will be moved to the consolidation area for further inspection.
   - If the item is MD, then the MD will be placed into a lockable bin for later certification.

b. Non-essential personnel will be adequately protected by maintaining the Explosive Safety Exclusion Zone (see **Appendix G**).

c. During excavation and screening operations, the excavator operator, off-road truck driver, and UXO Technician will remain behind the shields and wear hearing protection equipped with radio sets to maintain communication, and maintain the K18 distance of 24 ft (see **Section 3.9.4**). The requirements for radio sets/communications are presented in the Activity Hazard Analysis.

d. The screening plant will be remotely operated by the excavator operator.

e. A long reach excavator will be used to maintain the K18 distance of 24 ft from the cab to the screening plant hopper. The front, side, and rear of the long reach excavator will be armored so the operator is protected when he turns the machine to get the next load.

3.9.7.3 Screening Plant Specifications

3.9.7.3.0.0. The screening plant will have the following specifications:

a. Remote kill and restart switches for excavator operator and UXO Technician on ground will be equipped with remote controls capable of reaching 100 ft;

b. Self cleaning electro magnet;

c. Dust suppression sprays;

d. Hopper;

e. 6-inch Grizzly – finger screen; and

f. 5/8-inch trommel screen.

3.9.7.3.0.1. **Figure 3-3** shows a schematic diagram of the screening plant.

3.9.7.4 Soil Excavation and Screening Plant Operations

3.9.7.4.0.0. The screening plant will be placed within the 0- to 1,000-ft radius in an area that has been cleared of MPPEH through anomaly reacquisition and dig. The location of the screening plant will be selected based on the results of the geophysical survey. The plant location will be selected based on a relatively low number of geophysical targets to be excavated and proximity to the areas to be excavated. While the screening plant will be mobile and can be relocated to other areas within the site boundary if necessary, it is likely that the plant will remain in the same location for the duration of the project. After completion of the MEC clearance, the screening plant site will be leveled and gravel will be placed in high traffic work areas.

3.9.7.4.0.1. During excavation and screening operations, the excavator operator, off-road truck driver and UXO Technician will remain behind the shields and wear hearing protection equipped with radio sets to maintain communication, and maintain the K18 distance of 24 ft (**Section 3.9.4**). Hearing protection will provide ≥ 9 decibel attenuation. The field procedures are summarized below:

a. Mow the vegetation as low as possible and shred the cut vegetation.

b. Rip the root mass in multiple directions using a rake or disc towed by an armored tractor. The ripped soil and root mass will be left to dry prior to windrowing.

c. Soil will be excavated within remediation areas in a maximum of 0.5-ft lifts. The soil will be windrowed to remove moisture.

d. Soil will be loaded from windrows into off road dump trucks for transportation to the screening plant.

e. Soil will be placed into the screening plant using a long reach excavator. Soil will be placed onto a hopper equipped with a 6-inch finger grizzly. Vegetation and objects

larger than 6 inches will drop off the back of the grizzly, while soil and debris smaller than 6 inches will drop into the hopper.

f. A UXO Technician will monitor the greater than 6-inch oversized materials dropped to the ground from the grizzly. The UXO Technician will be equipped with a "kill switch" to halt the screening plant if potential MPPEH are observed.

g. The material that passes through the grizzly will continue to a low speed de-lumper for further size reduction.

h. Once the material passes through the delumper, it will be transported on conveyor belt past a self cleaning magnetic belt to remove ferrous material.

i. Material will pass through an opening in a blast shield of .65" minimum steel on a conveyor system for inspection by three UXO technicians protected by the blast shield. The Shield will be placed at a minimum 24' from the delumper.

j. The UXO technicians will be stationed in such a way that the debris can be removed from belt as it passes in front of them. The debris will be separated into the bin based on the type of debris. MD will be placed in a lockable container for further certification; MEC will be placed in a bin pending transport to the consolidation area for future disposal. This bin will be a suitable container immobilized with sand bags. All other non MPPEH debris will be placed in a separate bin for non hazardous disposal. The UXO technicians will ensure that the NEW limit of 213 pounds, based on the HFD for the MGFD (M374 81mm mortar) and the K40 overpressure distance is not exceeded. When the amount of MEC in the bin causes the NEW limit to be approached, the bin will be emptied. MEC items in the storage bin will either be disposed that day or placed in the OB/OD service magazine or a lockable connex to await disposal. MEC items will be immobilized with sand bags and periodically transported to the MEC holding area.

k. The Inspection conveyor personnel will have a remote kill switch to stop the Grizzly screen in the event of an emergency.

l. If the speed of the inspection conveyor is such that loading of the grizzly is slowed down the inspection conveyor will be moved to a separate location within the 1000' OD area and operated separate from the screening operation.

m. If the operation is separate from the screening operation a hopper will be added to the inspection conveyor.

n. Magnetic material will be dropped by a conveyor into lockable bins. The bins will be taken to the lay-down area by the excavator for later sorting (**Section 3.9.7.8**).

o. After passing the magnetic belt, the material will enter a 5/8-inch trommel screen.

p. Oversized material between 5/8-inch and 6 inches will be dropped by a conveyor onto the ground. A UXO Technician will monitor the oversized materials for potential MEC. The UXO Technician will be equipped with a "kill switch" to halt the screening plant if potential MEC are observed (**Section 3.9.7.8**).

q. MEC-free soil and debris less than 5/8-inch in diameter will be dropped by a conveyor into an off-road truck and transported to an on-site stockpile to be maintained within the anticipated capping footprint.

r. Stockpiled soil will be encircled with silt fencing and sediment erosion control measures. Stock piles which will be maintained for greater than 4 weeks will be seeded.

3.9.7.4.0.2. Work activities will be performed utilizing safe work practices as detailed in the APP in **Appendix D**.

3.9.7.5 Dust Control

Shaw will use appropriate engineering measures to control dust during excavation, hauling, and grading activities. The primary method of control will be to spray water using water trucks. In high winds, Shaw will implement production controls or stop operations as necessary if water spraying is insufficient to control dust. Dust from equipment sources will be controlled on an individual basis and will be wetted as needed to limit migration from the EZ. Dust control on roadways may be enhanced for longer durations through the use of a calcium chloride solution.

3.9.7.6 Dust Monitoring

3.9.7.6.0.0. An air monitoring and employee exposure assessment plan has been developed to protect the workers and potential off site receptors during clearance and remedial actions at SEDA. This plan is in accordance with DER-10 Technical Guidance for Site Investigation and Remediation. Worker and public health and safety are ensured by monitoring within the work zone and perimeter upwind and down areas. Work zone and perimeter air monitoring will be conducted in accordance with the NYSDOH Generic Community Air Monitoring Plan (CAMP) during all intrusive investigation. Based on requirements specified in Appendix 1A of DER-10, the perimeter air monitoring program will consist of real-time perimeter measurements for airborne dust particulates (particulate matter less than 10 microns – PM10). A Data RAM 2000 aerosol monitor or equivalent industry standard will be used for particulate monitoring. The temporary up and downwind stations will be established at the perimeter of the EZ. The instruments will be mounted on a post at an elevation between 5 to 6 feet, representative of breathing zone heights. The measurements will be saved in the data loggers, downloaded daily, and maintained in the project records. The data logger will be capable of 15-minute time weighted average

calculations. Previous site investigations did not identify VOCs as a contaminant of concern therefore VOC monitoring will not be required as a component of the CAMP.

3.9.7.6.0.1. A real time aerosol monitor will also be deployed in the immediate intrusive and soil operations handling areas to evaluate worst case scenario for employee exposure to airborne particulate matter potentially containing metals that were identified as COC from previous investigations at the OD area. Additional monitoring stations shall be established at the upwind and downwind perimeter of the exclusion zone as previously described. A minimum of one upwind and 2 downwind area stations shall be maintained during intrusive activity. The DER-10 Appendix 1A established perimeter action levels of 100 ug/m^3 has been selected for use on the project. It should be noted that the downwind perimeter action level required by the Generic CAMP is approximately 58 times more protective than the calculated exposure limit for the sum of the COC and current occupational exposure guidelines. An action limit of 2,977 ug/m^3 has been selected for respirable dust in the immediate work area.

3.9.7.7 Equipment Decontamination Procedures

Equipment used to excavate contaminated soil will be decontaminated after use to minimize the spread of contaminants. Mechanical decontamination of the equipment will be performed and the material that comes off the equipment will be transported to the area where the soil cap will be placed. Soil collected from decontamination procedures will be containerized or staged under tarps prior to transport to the capping area. Decontamination procedures will include scraping, shoveling and sweeping heavy equipment prior to removing it from the job site.

3.9.7.8 Oversized and Magnetically Separated Material Inspection

3.9.7.8.0.0. Oversized materials generated from the screening operations will be inspected by UXO Technicians when a significant amount of material has accumulated according to the discretion of the UXO Technician safety observer or a minimum of once per day. Oversized material (e.g. vegetation, root balls, MPPEH, MD, etc.) to be inspected includes the greater than 6-inch and the 5/8- to 6-inch stockpiles. Each stockpile will be inspected separately.

3.9.7.8.0.1. Oversized material inspection will be conducted using the following procedures:

a. Spread material on the ground surface inside the remediation area in 1-ft lifts.

b. After material is spread, place the excavator bucket away from the material to be inspected and shut down the excavator.

c. Conduct technology-aided inspection of material such as, but not limited to, root balls, clumps of soil, and vegetation:

   - If a MPPEH is identified, the item will be inspected to confirm if it is MEC or MD. If confirmed as MEC then a determination will be made if it is safe to move.
   - If it is deemed safe to move then the item will be moved to the consolidation area for further action.
   - If it is deemed unsafe to move, then the item will be blown-in-place (BIP) with engineering controls.
   - If the item is MD, then the MD will be placed into a locked bin for later certification.

d. Load MEC-free material into an off-road truck and transport to the on-site stockpile.

3.9.7.8.0.2. MD collected and stored in lockable bins at the lay-down area will be demilitarized and disposed.

3.9.7.8.0.3. MD will be placed in lockable containers in the lay-down area, which will be subsequently subjected to a second round of inspections. Following the second MD inspection, the UXO Team Leader will notify the SUXOS and UXOQCS of the inspection results. Both the SUXOS and UXOQCS will perform additional inspection of the MD to ensure its proper reclassification as MDAS.

3.9.7.8.0.4. Other oversized materials such as, but not limited to, vegetation, and root balls will be placed in the 0- to 500-ft radius and capped.

3.9.7.8.0.5. Any oversized rocks (greater than 6 inches) will be set aside and will later be incorporated into stormwater control features as riprap. Small rock will be mixed with larger rocks. Should boulders be encountered which are too large to use as rip rap, they will be set aside and incorporated into the landfill cap. If boulders are to be incorporated into the cap, they will require special backfilling to avoid voids forming around them.

3.9.7.8.0.6. Root balls and other organic oversized material will be set aside for later incorporation into the cap. Prior to capping, root balls and other organic matter will be reduced in size to approximately 1 inch and uniformly blended in with other soil to about 15 percent organic content, (two inches per foot of soil) around the center area, and roller compacted. The oversized material will have been inspected previously and will be free of MPPEH. The material can then be further processed by the excavator bucket or tub grinder depending on the amount or nature of the material.

3.10 OD Hill Clearance Operations

3.10.0.0. The OD Hill will be rough graded to the level required for the landfill cap. The OD Hill will be regraded with either an armored excavator or dozer. After completion of the rough grade, the entire OD Hill will be surface cleared to remove all MPPEH. Once surface clearance is performed, the hill will be covered with one foot of soil. The one foot soil will serve as a buffer so that tracked equipment can be run over the area during landfill cap construction.

3.11 Mag and Dig Procedures

3.11.0.0. In areas where it is not feasible to conduct geophysics and for geophysical target reacquisition and investigation, the following procedures will be followed. For safety purposes, UXO-qualified personnel conducting subsurface clearances will use the Schonstedt GA52Cx, Minelab Explorer all metals detector or equivalent to locate and investigate anomalies. The metal detector will be used to confirm that the excavation is free of dangerous items. The depth of detection is limited by the size and orientation of the target and by soil characteristics. The instrument is not capable of classifying anomalies; it will only indicate the presence or absence of a magnetic anomaly.

3.11.0.1. Prior to mag and dig operations, a brief test program will be performed and documented at the IVS test strip. The objectives of the test program are to 1) validate the handheld sensor meets the project objectives, 2) ensure the instrument settings and survey parameters are optimized and the sensor is functioning properly on a daily basis, and 3) certify the UXO technicians performing the mag and dig survey task. This will ensure that consistent data is collected of known quality.

3.11.0.2. The UXOQCS will conduct a test program using experienced operators, whereby the handheld detector settings will be optimized and documented for the site soil conditions and reliable detection of the seed items. A test strip, separate from the IVS strip, will constructed for the analog instruments. The strip will be "blind" to personnel and will be reconfigured periodically throughout the course of the project.

3.11.0.3. The locations of the items in the analog test strip will initially be "blind" and each instrument operator will be required to detect 100 percent of the items. This process will be documented by the UXOQCS. The following performance metrics will be monitored to establish project settings and ensure detection capabilities are known and verified:

a. **Instrument Settings.** The UXOQCS will evaluate and establish instrument settings for the detector at a level that allows reliable detection of the test strip items. These will become standard settings for the project.

b. **100 Percent Detection of Blind Seed Items.** The UXOQCS will ensure that each instrument operator sweeps the test strip and detects 100 percent of the items.

3.11.0.4. A letter report will be delivered to USAESCH stating the proposed instrument settings and proposed sweep speed and technique based on the results of the test strip. While daily instrument tests will be performed, only changes to the proposed instrument settings and proposed sweep speed and technique based on the daily instrument tests will be provided in separate letter reports.

3.11.1 Analog Performance Metrics

3.11.1.0.0. The following analog performance metrics will be used for the mag and dig and surface clearance:

a. **Repeatability.** Instrument functionality will be sufficient to detect 100 percent of the items in the analog test strip. At the beginning of each day, each instrument operator will be required to sweep the test strip using the sweep techniques and instrument settings proposed for the project, and detect 100 percent of the items".

b. **Dynamic Repeatability.** Instrument operators will consistently recover all anomalies. Ongoing testing will consist of re-sweeping at least 10 percent of each full coverage grid by the UXOQCS to verify that no additional items of a similar size/mass to the items of concern are found. If such an item is found during the re-sweep, the entire grid may require rework.

c. **Coverage.** Instrument operators will search all areas within each sweep lane. Ongoing testing will consist of coverage seeds (small pieces of metal that are easy to detect) placed within sweep lanes at a rate of two per grid per operator. All seeds must be recovered by the team; otherwise, the entire grid will be reworked.

d. **Detection and Recovery.** Ongoing instrument and operator functionality will be sufficient to detect anomalies of similar size to the items of concern. Ongoing testing will consist of blind seeds placed within sweep lanes at a rate of one large/deep and one small/shallow per grid per operator. All seeds must be recovered by the team; otherwise, the entire grid will be reworked.

e. **Anomaly Resolution.** Ongoing instrument and operator functionality will be sufficient to clear all holes of items of concern. Ongoing second party anomaly resolution verification is integral to the anomaly excavation process, as anomalies are investigated by a two-person team. For each one acre grid where mag and dig is performed, ongoing testing of anomaly resolution will ensure that there is a 90 percent confidence that less than 1 percent of the anomalies are unresolved.

3.11.1.0.1. The UXO Team will be made up of a UXO Tech III, three UXO Tech IIs, and three UXO Tech Is. The UXO Team will first locate the southwest grid corner marker to identify and confirm they are in the specific pre-assigned grid. The UXO technicians will be spaced at a minimum of 5 ft apart during each traverse. Lines will be conducted so that full coverage of each grid is achieved. When an anomaly is identified, a UXO Technician will unearth the item using hand tools or a mechanical excavator if the density of trees and terrain allow its use. Use of a mechanical excavator is described in **Section 3.9.6**. As the excavation progresses toward the anomaly source, the UXO technician will continue to use the Minelab Explorer or equivalent to determine item location both horizontally and vertically.

3.11.1.0.2. Once the UXO Sweep Team member uncovers an item, the item will be assessed to determine if it is MPPEH or other metallic material. If the item is determined to be MPPEH, the Team Leader will determine its type and condition, and report all findings to the SUXOS. Only UXO qualified personnel will perform these inspections and characterizations. Details regarding the reporting and disposition of MPPEH management are provided in **Section 3.11.5**.

3.11.1.0.3. If the subsurface contact proves to be MD or other metallic material, the metal will be removed from the excavation and the hole rechecked with a Minelab Explorer or equivalent by the UXO Team to verify the area has been cleared."The vicinity around the excavation will also be checked to ensure other anomalies were not masked by the recovered item. Once the check is completed, the hole will be backfilled using native material from the hole.

3.11.2 MEC Removal

3.11.2.0.0. If the excavated anomaly is considered to be MPPEH, it will be uncovered sufficiently to obtain a positive ID of the item to include its fuzing. The item may be moved for consolidation with other MPPEH in order to reduce the number of demolition shots required. A determination on disposal will be made by a Tech III for each occurrence. If the condition of the item cannot be determined or if a BIP is required it will be inspected by the SUXOS and UXOSO. If MPPEH cannot be safely BIP under the existing conditions, the PM and the OESS will be notified and a determination made as to how to safely resolve the issue.

3.11.2.0.1. Any DMM encountered in the form of small arms will not be subjected to demolition procedures. All other MEC and MPPEH will be subjected to demolition procedures. If necessary, demolition of the item will be conducted using a jet perforator or other suitable explosive, as determined by the SUXOS. In all cases, the jet perforator will be the preferred means of disposal. This will result in one of the following operations:

a. Detonation of a live item; or,

b. Venting of an item that possesses a hidden cavity potentially with HE, black powder, WP, or other energetic material.

3.11.3 Conventional MEC Storage

MEC that is acceptable to move will be stored in the OB/OD service magazine or a lockable connex.

3.11.4 MEC Disposal

Shaw will be responsible for destroying MEC encountered. Consolidated shots will take place on one day a week. Explosives will be stored on site in a permitted magazine.

3.11.4.1 Area Notification/Evacuation Procedures

Prior to any detonation, a pre-established notification procedure will be initiated. As soon as it is determined that a detonation will be required, the SUXOS will initiate this procedure. The SUXOS will schedule the demolition to allow sufficient time to complete all notifications, approvals, and evacuations as required. **Table 3-5** lists the team members that will be notified as part of this procedure.

3.11.4.2 Demolition Procedures

During demolition activities, the SUXOS will maintain overall control of the MRS. An EZ will be established around the demolition area according to the MSD for intentional detonations stated in **Section 3.9.4**. Evacuation, if necessary, will be coordinated with SEDA personnel. Based on the limited site access of the OD Grounds, the only personnel with access to the site will be SEDA, USACE, or contractor personnel (Shaw, Parsons, or subcontractors). Only the SUXOS, the OESS, the UXO demolition team, and UXO-qualified safety personnel will be allowed within the EZ once the demolition operations have begun. The UXOSO will ensure safe work practices are observed, and the UXO Tech III will perform the necessary steps to safely dispose of the MEC. The following procedures will be followed for all demolition operations:

a. Prior to conducting any demolition activities, Shaw will coordinate with SEDA and USAESCH.

b. The MEC Disposal Checklist (**Appendix F**) will be completed for each disposal operation.

c. There are no active subsurface utilities within the 0- to 1,000-ft radius; therefore, it is not anticipated that utility clearances will be necessary for demolition operations.

d. Donor explosives will be drawn from the explosive storage magazine. The transportation vehicle will be loaded with the demolition materials, and other required equipment.

e. The UXO Team comprised of the UXO Team Leader and a UXO Technician will inspect the location, condition, and net explosive weight (NEW) of the MPPEH to be treated.

f. The demolition team leader (assigned by SUXOS) will ensure that permission to detonate explosives has been obtained from the SUXOS.

g. The SUXOS will be responsible for scheduling the detonations and ensuring that all project personnel are accounted for before disposal operations begin.

h. As necessary, engineering controls IAW HNC-ED-CS-S-98-7 Amendment 1, *Use of Sandbags for Mitigation of Fragmentation and Blast Effects Due to Intentional Detonations of Munitions* (USACE, 2011), and the specification presented in DDESB TP 16 rev 2, *Methodologies for Calculating Primary Fragment Characteristics* (DDESB, 2005), will be used if necessary to reduce the fragmentation distance for the MEC item requiring disposal.

i. The demolition team leader will observe the UXO technicians as they position the explosive charges. Care will be taken to never bury the initiators (caps).

j. The demolition team leader will then inspect the disposal shot and return to the safe firing point.

k. Prior to initiation, the demolition team leader will ensure that authorized Shaw personnel are stationed at the roadblocks, will scan the EZ for personnel, and will sound three distinct blasts on an air or vehicle horn. He or she will then scan the area again and initiate the demolition charge if all is clear. All roadblocks will be coordinated with SEDA prior to implementation.

l. Techniques described in TM 60A-1-1-31, *EOD Disposal Procedures*, may be used during all demolition operations.

m. In the event of a misfire, a 60-minute wait time will be observed. A Misfire Checklist (**Appendix F**) will be completed by the UXO Tech III and filed with the daily logs.

3.11.4.3 Burn Operations

3.11.4.3.0.0. Burn operations may be conducted in order to achieve thermal certification of recovered small MPPEH and MD. The on-site burn pan is authorized for use. Burn operations will be conducted IAW TM 60A-1-1-31.

3.11.4.3.0.1. All notification procedures prescribed in the previous section will be followed.

3.11.4.3.0.2. No burns will be conducted in winds greater than 10 miles per hour (mph). No more than 5 lbs of bulk explosives will be burned in any one burn. Once a burn is completed, the area will be secured for 24 hours before any personnel may approach the burn for inspections.

3.11.4.4 Post-Demolition Operations

After successful initiation of the explosive charge, the UXO team will conduct an inspection of the shot to ensure complete destruction or demilitarization of the MPPEH or MEC. After verification that no more detonations will be required, an "all clear" notification will be sent to SEAD, USAESCH, and USACE, NY District. The demolition team leader will sign a certificate of destruct for all demolition and MEC destroyed. The UXO Team will collect all sandbag fragments, large munitions fragments, and other debris for disposal, and generally clean and restore the site. Water will be poured over the demolition area to cool any remaining hot metal that may initiate a fire.

3.11.4.5 Engineering Controls

Engineering controls such as sandbags will be used to reduce the fragmentation distance. If required, engineering controls outlined in HNC-ED-CS-S-98-7 Amendment 1, *Use of Sandbags for Mitigation of Fragmentation and Blast Effects Due to Intentional Detonation of Munitions* (USACE, 2011) and HNC-ED-CS-S-00-3 (USACE, 2000) for demolition operations will be used. Sandbags will be positioned at the MRS and used to assist in performing demolition operations as required.

3.11.4.6 Consolidated Shots

Consolidated demolition shots are the likely way that MPPEH will be disposed at this site. In this case, the K328 distance of all NEWs, both munitions and donor charges, cannot exceed the maximum fragment range-horizontal distance of the MGFD. All consolidated shots will be performed per USAESCH document, *Procedures for Demolition of Multiple Rounds (Consolidated Shots) on OE Sites* (USAESCH, 1998).

3.11.5 Accountability and Records Management for MEC

3.11.5.0.0. Shaw will maintain a detailed accounting of all MPPEH items encountered. Data from intrusive investigations will be entered in the GIS database and included in the RAR. The database will track all anomalies excavated and all surface and subsurface MPPEH recovered.

3.11.5.0.1. Data collected regarding MEC and MD found will include the standard official nomenclature, condition of the item, depth located, the orientation of item, location coordinates, and final disposition. The UXOQCS is responsible for the tracking, maintenance, and photographic records of all ordnance recovered during the project. A digital photograph of each MPPEH item identified and significant/unusual items recovered during the intrusive investigation will be taken and entered into the GIS database.

3.11.5.0.2. MD will be tracked in the database as well as the number and type of intact, inert munitions if any are discovered. The items shall be documented from the munitions and range debris turn-in procedure and documented in the final report.

3.11.6 Disposal Alternatives

If situations arise that are beyond the capabilities of the contractor, Shaw will coordinate with USAESCH and SEDA to request disposal assistance from military EOD.

3.12 Closure of Open Burning Tray

3.12.0.0. Shaw will close the Open Burning Tray IAW the approved work plan, *Closure Plan, Open Burning Tray in SWMU SEAD-23, Parson, 2005* and the UFP-QAPP (**Appendix E**). This plan specifies that all waste identified in the tray will be collected and drummed for transportation to an off-site facility for disposal after characterization. Drums containing hazardous liquids and sludges will be transported to a permitted and approved secure off-site facility for treatment or disposal. Waste sampling and analyses will be performed for the purpose of determining if the waste exhibits the characteristics of hazardous waste. RCRA hazardous waste characterization will include full TCLP analyses (TCLP VOCs, TCLP SVOCs, TCLP pesticides and herbicides, TCLP metals, plus ignitability, corrosivity, and reactivity). Any wastes exhibiting the characteristics of hazardous waste will be transported to an appropriately permitted and approved secure off-site facility for treatment or disposal (i.e., Subtitle C Landfill). Waste manifests will be prepared for signature by the designated government representative for SEDA. Non hazardous waste will be shipped using bills of lading, non hazardous manifest and/or military forms accurately describing the waste per State/Federal regulations and military guidelines. Empty drums will preferably be transferred to an approved drum reconditioning facility, or crushed/shredded and disposed off site at a scrap metal recycler.

3.12.0.1. Once emptied, the Open Burning Tray and the associated concrete pad will be decontaminated using a High Efficiency Particulate Air (HEPA) vacuuming process.

3.12.0.2. If any oily stain or residue is identified on the metal Open Burning Tray, it will be removed by wiping it clean with a rag wetted with the minimal amount of an appropriate solvent such as hexane (preferred), methanol, or isopropanol. Once obvious

stains are removed, the solvent wetted metal will be allowed to air dry, before the tray will be vacuumed clean using a vacuum fitted with a HEPA filter. Once vacuumed, tray will be recycled.

3.12.0.3. One sample of the top 1 to 2 inches of the concrete will be collected from random locations within each of 12 rectangular segments and sent to the laboratory for analysis of the Toxicity Characteristic (i.e., TCLP SVOCs, VOCs, chlorinated pesticide, chlorinated herbicide and metal compounds). All samples will be sent to an Environmental Laboratory Accreditation Program (ELAP) accredited laboratory.

3.12.0.4. Based on results, Shaw will dispose the concrete as construction debris and/or hazardous waste. The concrete pad will be demolished using a jack hammer or backhoe.

3.13 Munitions Constituents Sampling

3.13.0.0. MC sampling included in the scope of work is that associated with characterization of the 0- to 1,000-ft radius after the completion of the munitions remedial action and the closure of the Open Burning Tray, discussed in **Section 3.12**. This sampling will be performed IAW the approved work plan (Parsons, 2005), Generic Site-Wide SAP (Parsons, 2006), and the UFP-QAPP prepared for this project (**Appendix E**). The UFP-QAPP describes the analytical program but because the sampling locations for the 0- to 1,000-ft radius will be dependent upon the results of the munitions removal, sampling locations are unknown at this time. After completion of the munitions removal, sampling locations will be selected and a sample location map produced. The sample location map will be provided for approval prior to sample collection. The sampling includes the following:

a. Soil sampling for TAL Metals to confirm that all contaminated soils are placed beneath the landfill cap. Select soil samples will also be analyzed for explosives and perchlorate to evaluate the potential for these MCs. The samples are being collected for worst case analysis from the immediate location of MEC items; therefore, discrete samples will be collected for all analysis. The location and number of samples to be collected and analyzed for explosives and perchlorate will be presented in the memorandum report. It is expected that the number of explosively filled items to be found to be very low. Based on previous studies, the majority of items are expected to be MD. Soil samples will be collected and analyzed for explosives in any areas where Blow in Place operations are conducted during this removal. No sampling for explosives or perchlorate is proposed for the OD Hill (will be capped) or screened soil under the cap. A subset of the soil samples will be analyzed for Synthetic Leaching Precipitation Procedure (SPLP) Metals to evaluate the potential for impact to groundwater from soils remaining outside of the cap;

b. Surface water sampling downgradient of the landfill cap for TAL Metals to evaluate whether migration has occurred and impacted the stream;

c. Sampling pre-and post-removal of the Open Burning Tray to support closure of this area (concrete powder/dust chip sampling for TCLP VOCs, TCLP SVOCs, TCLP Pesticides, TCLP Herbicides, and TCLP Metals); and,

d. Long-term monitoring of groundwater. At the present time, this monitoring is assumed to be for metals only. However, if the results of the additional sampling indicate the potential for other contaminants in groundwater, sampling for these additional parameters will be added to the Long Term Monitoring Plan.

3.13.0.1. It is noted that the long-term monitoring requirements will be assessed in a Long-Term Monitoring Plan following completion of the MEC clearance activities.

3.13.0.2. A description of the field methods to be used for collection of the environmental samples is presented in the following subsections. All field sampling will be conducted IAW the Facility-Wide FSP (Parsons, 2006). Comparison criteria for all parameters planned for collection as part of the MC sampling are presented on **Table 3-6**.

3.13.1 Soil Sampling

3.13.1.0.0. Soil sample locations for laboratory analysis will be selected based on the locations of MPPEH/MD and/or based on historical sampling results. Anomaly avoidance procedures will be performed during the sampling activities. Soil sampling for TAL Metals, explosives, perchlorate (select samples), and SPLP Metals will be performed to confirm that all contaminated soils are placed beneath the landfill cap. The SPLP data will be used to evaluate potential impact to groundwater from soils which are not capped. If SPLP leachate concentrations are greater than NYSDEC GA GW Effluent concentrations then the potential for metals leaching to groundwater will be factored into the cap design. The samples are being collected for worst case analysis from the immediate location of MEC items; therefore, discrete samples will be collected for all analysis. The location and number of samples to be collected and analyzed for perchlorates will be presented in the memorandum report. It is expected that the number of explosively filled items to be found to be very low. Based on previous studies, the majority of items are expected to be MD. Soil samples will be collected and analyzed for explosives in any areas where Blow in Place operations are conducted during this removal. No sampling for explosives or perchlorate is proposed for the OD Hill (will be capped), screened soil under the cap, or the concrete material. The samples will be collected and analyzed for TAL metals. Samples will be biased to areas where MEC was found in greater density and removed. The sampling depths will be determined in light of the depth at which MEC items are located. Sample locations and number of samples will be selected following the completion of the MEC clearance activities with concurrence from

Stakeholders. Proposed sample locations and depths will be presented in a memorandum report and presented for concurrence.

3.13.1.0.1. Samples will be collected using a decontaminated stainless steel hand auger. The most likely depth interval to be sampled is the surface interval, 0-0.5 ft bgs. However, the depth of the samples will be evaluated following completion of the MEC clearance activities. The samples will be collected and homogenized in a stainless steel bowl, removing any vegetative matter and rocks. The sample will be retrieved from the auger bucket, placed into an aluminum pan and homogenized, removing any vegetative matter and rocks. Any metallic debris or frag present will be removed by hand, and notations made on the sample collection sheet. The sample will then be transferred to the appropriate sample bottles for selected laboratory analysis and placed in a cooler on ice. The borehole will be filled in using any residual sampling material.

3.13.2 Surface Water and Sediment Sampling

3.13.2.0.0. Surface water samples will be collected from water bodies downgradient of the landfill cap following installation. Samples will be collected near the shore as migration of MC is being investigated.

3.13.2.0.1. Surface water samples will be collected and analyzed for TAL Metals. The locations to be sampled will be proposed following completion of the MEC clearance activities for Stakeholder concurrence. Surface water sampling locations will be presented to stakeholders in a memorandum report after MEC clearance activities are completed. At each location, a sounding will be made and the water depth recorded on the sample collection log.

3.13.2.0.2. An aliquot of water will be analyzed using the water quality meters and the results documented on the sample collection log. The field parameters analyzed will be turbidity, dissolved oxygen, temperature, specific conductivity and oxygen reduction potential.The remaining sample will be transferred into the appropriate sample bottles for laboratory analysis.

3.13.3 Monitoring Well Installation/Groundwater Sampling

Groundwater samples will be collected from wells located upgradient and downgradient of the landfill cap after it is installed. The number and location of the wells will be presented in a Long-Term Monitoring Plan following completion of the MEC clearance activities. New and existing wells will be utilized. It is assumed that the wells will be analyzed for TAL Metals, but this will be evaluated in the Long-Term Monitoring Plan as well.

3.13.3.1. Drilling Methods and Equipment

3.13.3.1.0.0. Boreholes will be advanced for installation of monitoring wells utilizing HSA drilling methods (ASTM D1452-80). The borehole will be advanced to 10 ft below the water table or until rig refusal, utilizing 8.25-in outside diameter flighted augers for 2-inch polyvinyl chloride (PVC) wells. The boring will be kept plumb and true through leveling of the drill rig prior to drilling and maintaining a drilling speed that is sufficiently low to prevent deviation of the borehole.

3.13.3.1.0.1. Subsurface drilling operations within SEDA will require MEC avoidance to ensure that drilling equipment does not encounter MPPEH. Prior to intrusive activity, a UXO Technician will sweep the sampling location with a Schoenstedt magnetometer, and will adjust the location to avoid magnetic anomalies. After every 2 ft of borehole advancement, the driller will stop, and the hole will be checked for metallic material by lowering a magnetometer to the bottom of the borehole. The driller will continue only if the next 2-ft interval has been cleared by the UXO Technician. This procedure will continue for the first 12 ft. Upon reaching total depth, all cuttings will be removed from the boring. Drill cuttings will be containerized in drums and disposed offsite or placed under the landfill cap if it has not been installed at the date of the well construction.

3.13.3.1 Groundwater Sampling

Groundwater samples will be obtained IAW the Facility-Wide FSP (Parsons, 2006).

3.14 Waste Minimization Plan

This section presents the disposal procedures for waste generated during the MEC Clearance at the OD Grounds.

3.14.1 Waste Stream Disposal Requirements

Waste streams requiring disposal could potentially include soil, waste water, metallic debris and other cultural materials, other hazardous waste (including industrial chemicals, if encountered), PPE/solid waste, and MPPEH; all are considered IDW.

3.14.1.1 Waste Soil

If the excavation uncovers soil that is suspected to have contamination associated with industrial chemicals (based on visual or olfactory evidence), additional laboratory analysis may be required to determine the appropriate disposal method. These analyses may include explosives, metals, VOCs, TCLP Metals, TCLP VOCs, pH, and ignitability.

3.14.1.2 Waste Water

3.14.1.2.0.0. Use of disposable sampling equipment will be performed where possible to minimize the generation of waste water. Should waste water be produced, the dates the

waters are collected will be marked on the side of the container, and notated on an electronic drum log (maintained by the UXOQCS).

3.14.1.2.0.1. Aqueous samples will be collected from the decontamination solution for off-site analysis. One composite sample will be collected for every five drums or 200 gallons of accumulated aqueous investigative waste. The composite sample will be analyzed for disposal characterization and will be collected using either disposable bailers or a powered sampling pump with disposable tubing. If separate phase liquids are encountered in the container, care will be taken to sample each phase to allow for proper disposal characterization. If the waste is found to be characteristically hazardous, the decontamination solution will be disposed off site as hazardous waste. If not characteristically hazardous and no other hazardous constituents are present, the water will be discharged to the ground surface.

3.14.1.3 Metallic Debris and Other Cultural Materials

During intrusive operations, teams may encounter MD, metal cans, drums, and other debris from former activities at the OD Grounds. Debris material (cultural debris) will be staged on site in appropriate containers. Debris material consists of debris that has no visual HTRW contamination and was not located in discolored soil. Metal bins, wood bins, or poly drums will be used to store cultural debris as required. Non-metallic debris will be containerized and stored in a dumpster located in the staging area, or picked up by a local solid waste facility.

3.14.1.4 Other Hazardous Waste Disposal

Shaw will ensure waste minimization efforts are in effect when they collect, secure, store, and arrange for disposal of hazardous waste and decontamination wastes generated as a result of the MEC clearance field activities. Shaw will also retrieve samples for characterization analysis. The provisions of 29 CFR 1910.120, *Hazardous Waste Operations and Emergency Response,* apply.

3.14.1.5 Personal Protective Equipment and other Solid Wastes

Wastes from disposal of PPE will be created daily during intrusive activities. These wastes may include fabric, tape, and plastic sheeting. If there are no detections in soil samples (if collected), the PPE waste can be packaged in plastic bags, labeled as "used, not contaminated" and disposed of as solid waste (trash) in a dumpster or other similar container.

3.14.1.6 Material Potentially Presenting an Explosive Hazard

3.14.1.6.0.0. A detailed account of all MD by weight and MPPEH encountered during the MEC clearance will be maintained. Initially, MD and MPPEH will be reported by the UXO

team leader. Items found to present an explosives hazard will be handled IAW **Section 3.11.4**.

3.14.1.6.0.1. The SUXOS will designate a team leader (UXO Tech III) who will perform a 100 percent reinspection of all recovered items to determine if free of explosives hazards or other dangerous fillers. MD may be stored in the same general area, but will be stored in separate containers. All MD will be stored in locked containers to prevent materials from being added that may not have been through the inspection process.

3.14.1.6.0.2. The UXOQCS will conduct daily audits of the procedures used by the UXO teams and individuals for processing MD, and will perform random sampling (by pieces, volume, or area) of all MD collected from various teams to ensure no items with explosive hazards are identified as MD.

3.14.1.6.0.3. MPPEH inspection, certification, verification and disposition will be performed IAW the procedures outlined in Chapter 14 (Corps of Engineers Contractors MPPEH Inspection, Certification, and Final Disposition Procedures) of EM 1110-1-4009, *Military Munitions Response Actions*. The OESS or UXOQCS and SUXOS will perform an inspection of MD to verify and certify that it is free from explosive material. The inspected debris will be secured in a closed, labeled, and sealed container which will carry a unique ID number (see **Section 3.14.1.6**). The container must be sealed in a manner in which the seal must be broken in order for the container to be opened. The seal number must be recorded and maintained in the site documents as presented in **Section 3.14.1.6**.

3.14.1.6.0.4. A DD Form 1348-1A will be filled out by the SUXOS and used as certification/verification documentation. This form must show the typed or printed names of the SUXOS and OESS, organization, signature, and contractor's home office and field office phone number(s) of the persons certifying and verifying the debris as free of explosive hazards. The form must also clearly state the basic material content, estimated weight, container and seal numbers, site location. The form will also contain the following statement:

"This certifies and verifies that the material listed has been 100 percent inspected and to the best of our knowledge and belief, are inert and/or free of explosives or related materials."

3.14.1.6.0.5. The MDAS will be sent to a recycler who will certify (on company letterhead) that the material has been received, agrees with the provided documentation that the sealed containers contained no explosive hazards when received, and would not be sold, traded, or otherwise given to another party until the contents have been smelted and are only identifiable by their basic content. This documentation as well as a certification of smelting must be returned to the Shaw PM and will be incorporated in the RAR.

3.14.2 Tracking of Waste Containers

3.14.2.0.0. The following tracking system will be used for each waste stream encountered. The tracking system will be administered by the SUXOS (or his designee) and reviewed by the UXOQCS. Every container will be tracked from point of recovery to disposal as follows:

a. Drums – Drums will initially receive a temporary number which will change to a permanent number according to laboratory analysis, etc. This system allows for a more streamlined approach to characterize waste and also for the consolidation of waste into larger containers for disposal. Temporary drum numbers will be designated as "T-001, T-002, etc." and will be tracked via an electronic spreadsheet as well as the container form shown found in **Appendix F**. Once it is deemed necessary that a drum or other container receives a permanent number, the drum will be marked according to the following paragraphs.

b. Container Number – Each container will be given a unique container number that will be marked directly on the top and side of the container. The container number will be an alphanumeric sequence which also identifies the site waste stream, and container number. Waste stream designations for the project consist of the following:

   - HTRW-Contaminated Soil – HTWS
   - Decontamination Water – H2O Decon
   - Personal Protective Equipment/Solid Waste – PPE/SW
   - Cultural Debris – CD
   - Munitions Debris – MD

3.14.2.0.1. An example container number follows: SEDAODG-MD-001. This designation identifies the container as being from SEDA (OD Grounds), containing MD, and identified as container number 1. Containers will be sequentially numbered with no numbers reused, e.g. SEDAODG-MD-001, SEDAODG-CD-002, SEDAODG-HTWS-003, etc. For soils which can be in more than one category (e.g., SW and HTWS), the more hazardous category will take precedence (for this example, HTWS).

3.14.3 Transportation

Upon receipt of analytical data and the waste approval code from the disposal facility, transport of the containers to the appropriate facility will be arranged. An approved disposal contractor will be used as a transporter and the waste will be disposed at an appropriate approved disposal facility. Shipments will be coordinated and scheduled when a sufficient

number of containers have accrued (or when a specific waste stream is exhausted). The scheduling will also take into account any state mandated storage periods.

3.14.4 Disposal Documentation

All disposal documentation will be in full compliance with applicable rules and regulations, including DA Pam 385-61, USEPA requirements, NYSDEC requirements, and Department of Transportation (DOT) Hazardous Material Regulations (49 CFR 100-199). SEDA will be listed as the generator of all waste streams and will provide a person responsible for signing all required paperwork. Copies of all disposal documentation paperwork will be maintained in the site filing system by the SUXOS. Disposal documentation will be included in the RAR.

3.14.5 Waste Profile Sheet

Prior to shipment of waste from the worksite, samples will be forwarded to a commercial laboratory. From this analysis, a Waste Profile Sheet will be produced for each of the waste streams.

3.14.6 Shipping Labels

All containers will be labeled IAW DOT and USEPA regulations and restrictions. Additionally, each outside container will be marked on the top and sides with the following information:

a. Generation date;

b. Waste approval code;

c. USEPA ID number;

d. Hazardous Waste Label or Non Hazardous Waste Label (as appropriate);

e. Unique drum number (for example: SEDAODG-MD-001); and,

f. Waste profile sheet number.

3.14.7 Manifesting

3.4.7.0.0 Shaw, as the shipping agent of hazardous waste, is responsible for manifesting the waste in compliance with existing rules and regulations. Waste will be properly manifested and sent to disposal facilities with a Hazardous Waste Manifest. This form will be provided by the waste shipment and disposal contractor. The manifest will be signed by a representative from SEDA. An EPA ID number specific to this site will need to be obtained through SEDA. It is anticipated that materials requiring a waste manifest would include materials generated from decontamination of the Burn Tray, drill cuttings, purge water, and decontamination water.

3.4.7.0.1 For non hazardous waste, Shaw will properly ship waste using bills of lading, non hazardous manifest and/or Military Forms accurately describing the waste per State/Federal Regulations and/or military guidelines. Forms will be provided by the waste shipment and disposal contractor. Shipping papers will be signed by a representative from SEDA.

3.14.8 Weight Slips

A signed weight slip will be furnished to SEDA and USAESCH indicating the actual weight of the waste that has been shipped to the approved disposal facility.

3.14.9 Notification of Waste Shipped

For hazardous waste, a Notification of Waste Shipped form, required under the Land Ban Disposal restrictions, will be completed by the waste management subcontractor. This form will identify treatment standards required in 40 CFR 268. This form will be prepared as an addendum to the manifest.

3.14.10 Certificate of Disposal/Destruction

A Certificate of Disposal/Destruction indicating acceptance of all materials by the disposal facility will be signed by the disposal facility representative and furnished to SEDA and USAESCH within 90 working days after the disposal action has been completed. The completion of this form will be coordinated by Shaw.

Table 3-1
Data Quality Objectives Process at the OD Grounds

Step	Data Quality Objective
1. State the problem.	There is a potential for MEC and MC at the OD Grounds and Open Burning Tray. The SEDA facility was constructed in 1941, and was operated by the U.S. Army until its closure in July 2000. From 1941 to 1995, the site was used for receipt, storage, maintenance, and supply of military items including munitions and equipment. OD Grounds consists of a large open area approximately 90 acres in size surrounding a large berm that was used to suppress the effects of ordnance demolition activities. A variety of ordnance was destroyed by detonation at this area, including explosives, rockets, and heavy artillery. The blast radius shown on old drawings included in the ASR is 1,800 ft from the center of the demolition berm. This contract covers the 0- to 1,000-ft radius. Based on the source of munitions activities, there may be potential for MEC in the surface and subsurface at the OD Grounds. In addition, there is a potential for MC contamination based on the previous munitions activities. The Open Burning Tray was used to destroy munitions by burning them within an aboveground steel tray mounted atop a concrete pad to minimize the impact of the burning on the environment. The OB area has been remediated with the exception of the burn pan itself and concrete pad. The future land use of the OD Grounds and Open Burning Tray is conservation/recreation. Therefore, human receptors identified at the OD Grounds include: authorized personnel, visitors, recreational users, State of New York conservation employees. Ecological receptors are also present in the OD Grounds. The purpose and scope of this Task Order is to design and complete the installation of an NYS Part 360 landfill cap to inter hazardous contaminated soils at the SEDA in Romulus, New York. Additionally, other activities will be performed in support of the landfill construction to include additional MEC remedial actions and long-term monitoring at the site. Specifically, this Task Order was established to conduct a remedial action within the 0-1000 foot radius area surrounding the former OD area to remove all Material Potentially Presenting an Explosive Hazard (MPPEH) as well as closing the Open Burning Tray. A landfill cap will also be placed at the site following the MEC remedial activities. Elevated metals were identified, primarily surrounding OD Hill, which is located at the center of the OD Grounds. These elevated metals are present within the 0-500 ft radius and were not observed outside this area. Risks to human health and the environment will be addressed by placing a landfill cap over the contaminated soils. The capping activities are being discussed in separate work planning documents, so the hazardous and toxic waste (HTW) contamination is not further discussed in this work plan. The Open Burning Tray is empty of munitions so explosive hazards do not remain. The OB tray may be used for disposal of ordnance during the OD Grounds MEC clearance activities. Following completion of the MEC clearance activities, all left over materials will be removed from the tray. The maximum inventory of hazardous wastes ever present in the burn tray during its active life is estimated at approximately 5,000 lbs of propellant, which was the maximum weight requested in the RCRA Part A and Part B permit application. The propellant would have been present in many of the extremely varied types of munitions stored at SEDA. Residual hazardous wastes (i.e., munitions constituent [MC]) present in the Open Burning Tray could present an unacceptable risk to human health or the environment.
2. Identify the decision	The goal of the project is MEC clearance is to remove MPPEH from within the 0- to 1,000-ft radius, constructing a landfill cap to inter soil with concentrations of COCs in excess of SCLs (to be covered under a separate design document) and close the Open Burning Tray.

Table 3-1 *(continued)*
Data Quality Objectives Process at the SEDA MRSs

Step	Data Quality Objective
3. Identify inputs to the decision	Historical information Surface Sweep DGM survey and intrusive inspection Excavation and sifting of saturated metallic areas Mag and dig survey for heavily wooded areas and areas with steep terrain Closure of Open Burning Tray Chemical analytical results for soil, surface water and groundwater
4. Define the study boundaries	This work plan covers the 0- to 1,000-ft radius of the OD Grounds, excluding the portion remediated for the OB Grounds, and the Open Burning Tray (see Figure 1-2).
5. Develop a decision rule	Shaw will remove all MPPEH from the 0- to 1,000-ft radius, excluding the area remediated under the OB Grounds, as described under "Identify the Decision" above in order to eliminate hazards. Shaw will inter soil with concentrations of COCs in excess of SCLs under a landfill cap. This effort will be described within a future design document. Shaw will close the Open Burning Tray.
6. Specify limits of decision errors	The data will be of the quantity and quality necessary to provide technically sound and defensible assessments of potential risks and hazards to human health and the environment. Specific information on chemical analytical sampling is presented in Appendix E.
7. Optimize the design for obtaining data	Sections 3.6 through 3.11 identifies the technical approach for the MEC clearance. The Open Burning Tray will be closed IAW the approved work plan as discussed in Section 3.12. The data obtained from the MC sampling performed as part of the closure of the Open Burning Tray (described in Section 3.12) will be used to confirm that all contamination was removed from the site.

Table 3-2
Proposed IVS Design

Item	Burial Depth (feet)	Orientation	Number of Items	Easting (feet)	Northing (feet)
Small ISO	0.33-1	V and H (cross line)	2	TBD	TBD

Abbreviations:

H *horizontal*
ISO *industry standard object*
TBD *to be determined*
V *vertical*

Table 3-3
QC Frequency and Acceptance Criteria, OD Grounds

Test	Acceptance Criteria	Frequency of Testing			
		Start of Day	Start and End of Day	First Day of Project Only	Equipment Change
Equipment Warm-up	Equipment Specific - typically 5 minutes and readings have stabilized	X			X
Record Sensor Position	±1 inch			X	X
Personnel Test	+- 2.5 mV of background EM61 MK2		X		X
Cable Shake Test	Data spiking > 3 mV not evident above background EM61 MK2		X		X
Static Background Test	+- 2.5 mV of backgroundEM61 MK2		X		X
Static Spike Test	Within 10 percent of standard response after background correction		X		X
IVS	Amplitudes > 75 percent and position offset < 1.2 ft		X		X

Abbreviations:

mV *millivolts*

QC *quality control*

Table 3-4
Schedule of Daily Operations

1.	Workers and support staff arrive at the CP or other designated meeting point and receive a daily safety briefing by the UXOSO.
2.	All team leaders receive a daily operations schedule.
3.	Work force sets up the equipment and mitigation supplies at the site.
4.	Once the site is ready for the day, the UXOSO will give a short, specific safety briefing to the Down Range Teams. The USAESCH Safety Specialist will be notified, and work will commence, pending approval of the USAESCH Safety Specialist.
5.	Team members will perform all necessary instrument checks
6.	During the workday, there will be some QC checks, as well as operational challenges of the equipment being used on site.
7.	During intrusive operations, an operations log will be kept and appropriate entries will be made on the geophysical dig sheets indicating the findings.
8.	If suspect MEC/HTRW is encountered, operations will be conducted IAW Section 3.11.4 and 3.11.5 of this Work Plan.
9.	The work force will conduct any necessary cleanup or shutdown of the work site before the day's work ends.
10.	The SUXOS may or may not conduct a daily debrief for the day's operations.
11.	IDW drums generated during the day will be labeled and placed in the appropriate temporary storage facility.

Table 3-5
Demolition Notification List

Contact Name/Title	Phone Number
USAESCH Team members will be notified of demolition operations via email	
John S. Nohrstedt USAESCH Project Manager	John.Nohrstedt@usace.army.mil
Kevin Healy USAESCH Technical Manager	Kevin.W.Healy@usace.army.mil
Seneca Army Depot Activity	
Steve Absolom BRAC Environmental Coordinator	Work: (607) 869-1309 Cell: (315) 406-4737
USACE NY District	
Randy Battaglia NY District Project Manager	Work: (607) 869-1523 Cell: (315) 559-0199
Tom Battaglia NY District Project Engineer	Work: (607) 869-1353
Local Authorities	
Seneca County Sheriff	(315) 539-9241
Hillside Children's Center	(315) 585-3015
Shaw Environmental & Infrastructure, Inc. Team members will be notified of demolition operations via email	
Doug Schicho Shaw Project Manager	Douglas.Schicho@shawgrp.com
Gretchen Tabano Shaw Project Engineer	Gretchen.Tabano@Shawgrp.com

Table 3-6
Human Health and Ecological Screening Values (Seneca Army Depot)

Analyte	CAS No.	Human Health Soil Screening Values [a]				SPLP Screening Values	Ecological Screening Values for Soil			Human Health Groundwater Screening Values			
		NYS DEC Soil Clean Up Objectives Commercial	NYS DEC Soil Clean Up Objectives Unrestricted	Residential RSL	Industrial RSL	NYS Ground-water Effluent (GA Waters) [b]	EPA Eco-SSLs [c]	EPA Region 4 ESV [d]	Selected ESV for Soil [e]	Ambient Water Quality Criteria [f]	Tapwater RSL [a]	MCL [g]	
TAL Metals SW-846 3010A/3050B/6010C/7470A/7471B		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(ug/L)	(mg/kg)	(mg/kg)	(mg/kg)	(ug/L)	(ug/L)	(ug/L)	
Aluminum	7429-90-5	NA	NA	7700	99000	2000	pH Dependent	50	pH Dependent	NA	1600	50	l
Antimony	7440-36-0	NA	NA	3.1	41	6	0.27	3.5	0.27	3	0.6	6	
Arsenic	7440-38-2	16	13	0.39	1.6	50	18	10	18	25	0.045	10	
Barium	7440-39-3	400	350	1500	19000	2000	330	165	330	1000	290	2000	
Beryllium	7440-41-7	590	7.2	16	200	NA	21	1.1	21	NA	1.6	4	
Cadmium	7440-43-9	9.3	2.5	7	80	10	0.36	1.6	0.36	5	0.69	5	
Calcium	7440-70-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Chromium	7440-47-3	1500	30	12000	150000	NA	26	0.4	26	50	1600	100	
Cobalt	7440-48-4	NA	NA	2.3	30	NA	13	20	13	NA	0.47	NA	
Copper	7440-50-8	270	50	310	4100	400	28	40	28	200	62	1300	
Iron	7439-89-6	NA	NA	5500	72000	600	pH Dependent	200	pH Dependent	300	1100	300	l
Lead [j]	7439-92-1	1000	63	400	800	50	11	50	11	25	NA	15	
Magnesium	7439-95-4	NA	NA	NA	NA	NA	NA	NA	NA	35000	NA	NA	
Manganese	7439-96-5	10000	1600	180	2300	600	220	100	220	300	32	50	l
Mercury [k]	7439-97-6	2.8	0.18	2.3	31	1.4	NA	0.1	0.1	0.7	0.16	2	
Nickel	7440-02-0	310	30	150	2000	200	38	30	38	100	30	NA	
Potassium	7440-09-7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Selenium	7782-49-2	1500	3.9	39	510	20	0.52	0.81	0.52	10	7.8	50	
Silver	7440-22-4	1500	2	39	510	100	4.2	2	4.2	50	7.1	100	l
Sodium	7440-23-5	NA	NA	NA	NA	NA	NA	NA	NA	20000	NA	NA	
Thallium	7440-28-0	NA	NA	0.078	1	NA	NA	1	1.0	NA	0.016	2	
Vanadium	7440-62-2	NA	NA	39	520	NA	7.8	2	7.8	NA	7.8	NA	
Zinc	7440-66-6	10000	109	2300	31000	5000	46	50	46	NA	4700	5000	l

[a] Screening toxicity values are from the NYS SCOs (unrestricted, Table 375-6.8[a], restricted, Table 375-6.8[b]) and USEPA Regional Screening Level (RSL) Table for November 2011. RSL value based on a cancer risk of 1.0E-06 and a hazard quotient of 0.1.

[b] NYS DEC Section 703.6; Table 3 Groundwater Effluent Limitations (2008).

[c] EPA, 2007, Ecological Soil Screening Level guidance. On-line at: http://www.epa.gov/ecotox/ecossl/index.html

[d] Screening value based on: EPA, 2001, *Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment* , Originally published November 1995, Website version last updated November 30, 2001: http://www.epa.gov/region4/waste/ots/ecolbul.html

[e] Priority for Selection of Soil ESVs: 1) EPA Eco-SSL; 2) EPA Region 4 Ecological Screening Values for Soil. Priority for Selection of Surface Water ESVs: 1) NYS WQS; 2) EPA Region 3 ESV; 3) EPA Region 4 ESV.

[f] Technical and Operational Guidance Series (TOGS), http://www.dec.ny.gov/regs/4590.html

[g] MCL values from the USEPA National Primary Drinking Water Standards (January 2011).

[h] NYS DEC Section 703.5; Table 1 Water Quality Standards for Surface Water and Groundwater (2008).

[i] USEPA Region 3 Freshwater Screening Benchmarks, online.

[j] RSL for lead based on the action level of 15 µg/L (EPA, 1996, Drinking Water Regulations and Health Advisories, Office of Water, Washington, DC, October). Not adjusted using divisor of 10.

[k] RSL for mercuric chloride was used.

[l] Value is Secondary MCL.

[m] Value is for dissolved surface water criterion.

µg/L = micrograms per liter = parts per billion

mg/kg = milligrams per kilogram = parts per million

Note: For surface water ESVs that are hardness dependend, hardness of 100 mg/L assumed.

EPA = U.S. Environmental Protection Agency

ESV = Ecological screening value

NA = Not available

Table 3-6
Human Health and Ecological Screening Values (Seneca Army Depot)

NYS Human Health Surface Water Screening Values (Fish Consumption) [h] - Class C Waters	Analyte	CAS No.	Ecological Screening Values for Surface Water					Minimum Soil Criteria Level	Minimum Groundwater Criteria Level	Minimum Surface Water Criteria Level
			NYS Water Quality Standards [h]		EPA Region 3 ESV [i]	EPA Region 4 ESV [d]	Selected Surface Water ESV [e]			
(ug/L)	**TAL Metals SW-846 3010A/3050B/6010C/7470A/7471B**		(ug/L)			(ug/L)	(ug/L)	(mg/kg)	(ug/L)	(ug/L)
NA	Aluminum	7429-90-5	100		87	87	100	7700	50	100
NA	Antimony	7440-36-0	NA		30	160	30	0.27	0.6	30
NA	Arsenic	7440-38-2	340	m	3.1	190	340	0.39	0.045	340
NA	Barium	7440-39-3	NA		4	NA	4	330	290	4
NA	Beryllium	7440-41-7	1100		0.66	0.53	1100	7.2	1.6	1100
NA	Cadmium	7440-43-9	2.1	m	0.25	0.66	2.1	0.36	0.69	2.1
NA	Calcium	7440-70-2	NA		116000	NA	116000	NA	NA	116000
NA	Chromium	7440-47-3	74	m	85	117	74	26	50	74
NA	Cobalt	7440-48-4	5		23	NA	5	2.3	0.47	5
NA	Copper	7440-50-8	9.0	m	9.0	6.54	9.0	28	62	9
NA	Iron	7439-89-6	NA		300	1000	300	5500	300	300
NA	Lead [j]	7439-92-1	0.69	m	2.5	1.32	0.69	11	15	0.69
NA	Magnesium	7439-95-4	NA		82000	NA	82000	NA	NA	82000
NA	Manganese	7439-96-5	NA		120	NA	120	180	32	120
0.0007	Mercury [k]	7439-97-6	0.0026		0.026	0.012	0.026	0.1	0.16	0.0007
NA	Nickel	7440-02-0	52		52	87.71	52	30	30	52
NA	Potassium	7440-09-7	NA		53000	NA	53000	NA	NA	53000
NA	Selenium	7782-49-2	4.6	m	1	5	4.6	0.52	7.8	4.6
NA	Silver	7440-22-4	0.1		3.2	0.012	0.1	2	7.1	0.1
NA	Sodium	7440-23-5	NA		680000	NA	680000	NA	NA	680000
NA	Thallium	7440-28-0	8		0.8	4	8	0.078	0.016	8
NA	Vanadium	7440-62-2	14		20	NA	14	7.8	7.8	14
NA	Zinc	7440-66-6	83	m	120	58.91	83	46	4700	83

[a] Screening toxicity values are from the NYS SCOs (unrestricted, Table 375-6.8[a]) and USEPA Regional Screening Level (RSL) Table for November 2011. RSL value based on a cancer risk of 1.0E-06 and a hazard quotient of 0.1.

[b] NYS DEC Section 703.6; Table 3 Groundwater Effluent Limitations (2008).

[c] EPA, 2007, Ecological Soil Screening Level guidance. On-line at: http://www.epa.gov/ecotox/ecossl/index.html

[d] Screening value based on: EPA, 2001, *Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment* , Originally published November 1995, Website version last updated November 30, 2001: http://www.epa.gov/region4/waste/ots/ecolbul.html

[e] Priority for Selection of Soil ESVs: 1) EPA Eco-SSL; 2) EPA Region 4 Ecological Screening Values for Soil. Priority for Selection of Surface Water ESVs: 1) NYS WQS; 2) EPA Region 3 ESV; 3) EPA Region 4 ESV.

[f] Technical and Operational Guidance Series (TOGS), http://www.dec.ny.gov/regs/4590.html

[g] MCL values from the USEPA National Primary Drinking Water Standards (January 2011).

[h] NYS DEC Section 703.5; Table 1 Water Quality Standards for Surface Water and Groundwater (2008).

[i] USEPA Region 3 Freshwater Screening Benchmarks, online.

[j] RSL for lead based on the action level of 15 µg/L (EPA, 1996, Drinking Water Regulations and Health Advisories, Office of Water, Washington, DC, October). Not adjusted using divisor of 10.

[k] RSL for mercuric chloride was used.

[l] Value is Secondary MCL.

[m] Value is for dissolved surface water criterion.

µg/L = micrograms per liter = parts per billion

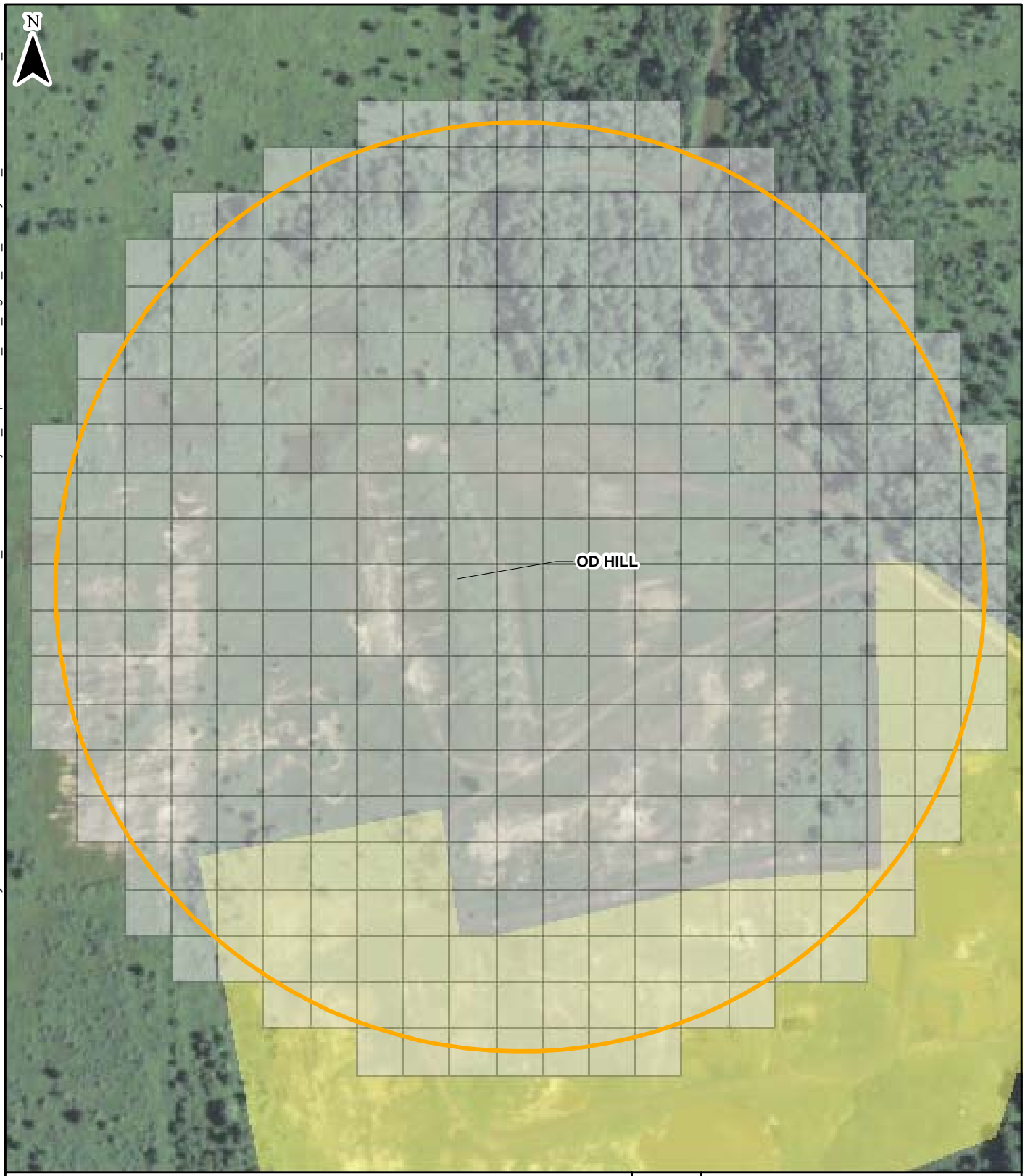
mg/kg = milligrams per kilogram = parts per million

Note: For surface water ESVs that are hardness dependend, hardness of 100 mg/L assumed.

EPA = U.S. Environmental Protection Agency

ESV = Ecological screening value

NA = Not available



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Project Number: 144717

MRS 1,000-Foot Buffer To Be Cleared

OB Grounds (Already Cleared)

Proposed Grid System

0 300 600 Feet

Projection : NAD_1983_StatePlane_New_York_Central_FIPS_3102_Feet

U.S. ARMY ENGINEERING SUPPORT CENTER
HUNTSVILLE

MILITARY MUNITIONS RESPONSE PROGRAM

FIGURE NUMBER 3-1

SURVEY GRID LAYOUT AND SURFACE CLEARANCE AREA SENECA ARMY DEPOT ACTIVITY NEW YORK

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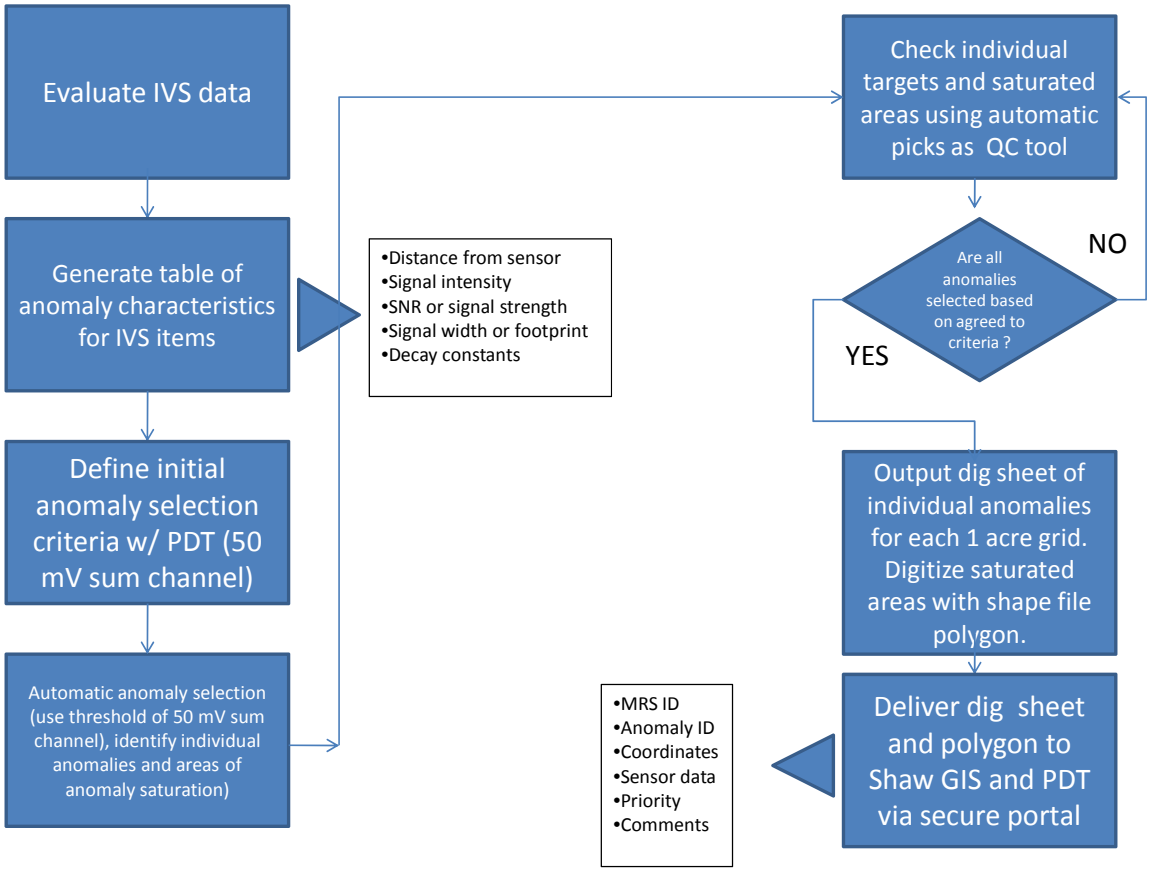
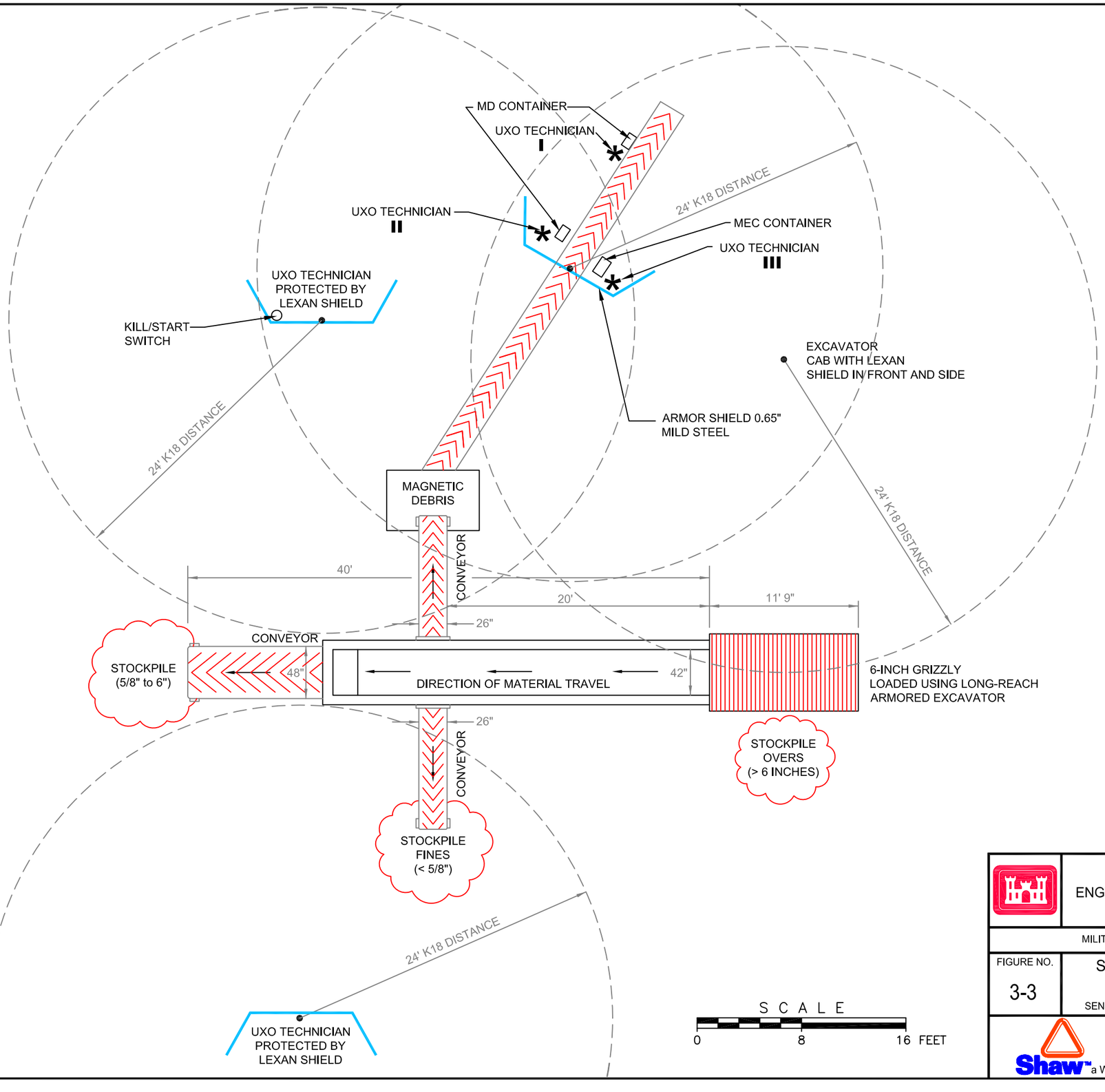
Figure 3-2
EM61 MK2 Anomaly Selection Process





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S. Wiafe 03/15/12	D. Schicho 03/15/12	-- --	Fort-Ord-SO_schematic.dwg

U.S. ARMY
ENGINEERING SUPPORT CENTER
HUNTSVILLE

MILITARY MUNITIONS RESPONSE PROGRAM

FIGURE NO. 3-3

SCREENING OPERATION
SCHEMATIC

SENECA ARMY DEPOT ACTIVITY, NEW YORK

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File: N:\cad\CAD drawings\Sacramanto-ACOE\Fort-Ord-SO_schematic.dwg
Plot Date/Time: Mar 16, 2012 - 11:46am
Plotted By: stephen.Wiafe

4.0 QUALITY CONTROL PLAN

4.0.0.0. This QCP discusses the requirements for monitoring and verifying, and reporting on the quality of work throughout the execution of the tasks required by the PWS. It describes key processes and procedures that apply to all work performed by Shaw and its subcontractors. Specifically, the QCP addresses the following:

a. Daily QC Reports;

b. QC Inspection Process;

c. QC Audits;

d. Nonconformance Identification/Corrective Action Reporting Procedures;

e. Lessons Learned;

f. Submittal Review and Document Change Procedures; and,

g. Qualifications and Training.

4.0.0.1. The objectives of this QCP are to address the specific operating needs of the project and to establish the necessary levels of management and control to ensure the work performed:

a. Meets the technical requirements of the applicable project plans;

b. Conforms to SOPs established in the Work Plan;

c. Conforms to applicable guidance and regulations; and,

d. Meets or exceeds the minimal acceptable quality level established in the USAESCH Quality Assurance Surveillance Plan (QASP) (USAESCH, 2011).

4.0.0.2. The QCP is written in parallel to the USAESCH QASP, which summarizes the performance requirements of the PWS, identifies the performance metrics, establishes the minimum acceptable quality level for each definable feature of work (DFW), and summarizes surveillance methods that the Army will employ in evaluating performance on this Task Order contract.

4.1 Daily QC Report

4.1.0.0. For all field work days, the UXOQCS is responsible for preparing and submitting the DQCR to the USAESCH Safety Specialist and the project file. The DQCR is to provide an overview of QC activities performed each day, including those performed for subcontractor and supplier activities. The DQCR is intended to present an accurate and

complete picture of QC activities. Both conforming and deficient conditions are to be reported. The DQCR should be precise, factual, legible, and objective. Copies of supporting documentation, such as checklists and surveillance reports, are to be attached.

4.1.0.1. The DQCR is to be assigned and tracked by a unique number comprised of the Task Order number followed by the date expressed as DDMMYY. Copies of DQCRs with attachments are to be maintained in the project file. An example DQCR is presented in **Appendix F**.

4.2 QC Inspections

4.2.0.0. The QC Specialist with designated QC staff will be responsible for assisting the Shaw PM in maintaining compliance with this QCP through the implementation of a three-phase inspection process. This section specifies the minimum requirements that must be met and to what extent QC monitoring must be conducted by the QC staff. The inspection system is based on the three-phase system of control to cover the activities. The three-phase inspection system consists of preparatory, initial, and follow-up inspections for applicable DFW. The three-phase inspection system will be performed on all proposed work sequences and documented using standard forms provided in **Appendix F**.

4.2.0.1. A DFW is defined as a major work element that must be performed to execute and complete the project. It consists of an activity or task that is separate and distinct from other activities and requires separate control. The DFWs that have been identified for this project are as follows:

a. Survey Grid Placement;
b. Vegetation Clearance;
c. Surface Clearance;
d. DGM Surveys;
e. Anomaly Reacquisition;
f. Excavation of Anomalies/Intrusive;
g. Soil Excavation/Sifting;
h. Mag and Dig Operations;
i. Closure of Open Burning Tray;
j. MEC Disposal by Detonation;
k. IDW Disposal; and,.

l. MC Sampling and Analysis

4.2.0.2. These DFWs are summarized in **Table 4-1** along with reference to the pertinent work plan section. Inspection criteria for these DFWs will depend on the work tasks being performed. Three-Phase QC Checklists are contained in **Appendix F**. Procedures for executing these DFWs are provided in this work plan, which may include specific QC procedures and tests that are integral to the work, such as equipment calibration and testing. This QCP does not attempt to reiterate these procedures. The QC staff will refer to the applicable portion of this work plan for specific QC requirements to be checked during QC inspections.

4.2.1 Preparatory Phase Inspection

4.2.1.0.0. A preparatory phase inspection will be performed prior to beginning each DFW. The purposes are to review applicable work plans, processes, and specifications and verify that the necessary resources, conditions, and controls are in place and compliant before the start of work activities. The QC staff shall verify that lessons learned during similar previous work have been incorporated as appropriate into the project procedures to prevent recurrence of past problems. The QC staff shall generate and use a Preparatory Phase Inspection Checklist. The generic checklist provided in **Appendix F** may be customized to address the specific DFW, work scope, and MRS conditions. Work plans and operating procedures are to be reviewed by the QC staff to ensure that prequalifying requirements or conditions, equipment and materials, appropriate work sequences, methodology, hold/witness points, and QC provisions are adequately described. The QC staff shall verify, as applicable, the following:

a. The required plans and procedures have been prepared and approved and are available to the field staff;

b. Field equipment and materials meet required specifications;

c. Field equipment is appropriate for intended use, available, functional, and calibrated;

d. Work responsibilities have been assigned and communicated;

e. Field staff possesses the necessary qualifications, knowledge, expertise, and information to perform their jobs;

f. Arrangements for support services (such as on-site testing and off-site test laboratories) have been made; and,

g. Prerequisite site work has been completed.

4.2.1.0.1. Discrepancies between existing conditions and approved plans/procedures are to be resolved. Corrective actions for unsatisfactory and nonconforming conditions

identified during a preparatory inspection are to be verified by the QC staff prior to granting approval to begin work.

4.2.1.0.2. Client notification should be performed at least 48 hours prior to conducting preparatory phase inspections. Results are to be documented in the Preparatory Phase Inspection Checklist and summarized in the DQCR (**see Appendix F**).

4.2.2 Initial Phase Inspection

An initial phase inspection will be performed, as applicable, the first time each DFW is performed. The purposes will be to check preliminary work for compliance with procedures and specifications, to establish the acceptable level of workmanship, and to check for omissions and resolve differences of interpretation. The QC staff shall generate and use an initial inspection checklist. The Initial Phase Inspection Checklist form, provided in **Appendix F**, may be customized to address the specific work scope and MRS conditions. The QC staff will be responsible to ensure that discrepancies between site practices and approved specifications are identified and resolved. The QC staff will oversee, observe, and inspect all applicable DFWs at the MRS and ensure that off-site activities, such as analytical testing, are properly controlled. Discrepancies between MRS practices and approved plans/procedures are to be resolved and corrective actions for unsatisfactory and nonconforming conditions or practices are to be verified by the QC Specialist or designee before granting approval to proceed. Client notification for initial inspections will be required at least 48 hours in advance. Results of initial inspections are to be documented in the initial phase inspection checklist and summarized in the DQCR.

4.2.3 Follow-Up Phase Inspection

4.2.3.0.0. Follow-up phase inspections will be performed periodically while the DFW is performed in order to ensure continuous compliance and level of workmanship. The QC staff will be responsible to monitor on-site practices and operations taking place, verify continued compliance of the specifications and requirements within the contract, MRS work scope, and applicable approved project plans and procedures. Discrepancies between site practices and approved plans/procedures will be resolved, and corrective actions for unsatisfactory and nonconforming conditions or practices must be verified by the QC staff prior to granting approval to continue work. Follow-up inspection results will be summarized in the DQCR.

4.2.3.0.1. Periodic checks of procedures and/or documentation will be made for completeness, accuracy, and consistency. Follow-up inspections of field activity will typically include a review of field data and any calibration logs for all instruments in use.

4.3 Surface Clearance and Mag and Dig Quality Control

4.3.0.0 Upon completion of a surface clearance or mag and dig removal grid by the UXO Team, the UXOQCS shall perform a grid inspection encompassing, at a minimum, 10 percent of the grid surface area. The results of the inspections shall be documented on the Daily QC/Safety Reports. Grid failures (i.e., MEC is found during QC) shall be documented on the Daily QC/Safety Reports and a corrective action request issued. All grids shall be inspected by the UXOQCS prior to notifying the OESS that a grid is complete. The list of completed grids checked by the UXOQCS and ready for quality assurance (QA) inspection shall be updated daily, as required, and forwarded or made available to the OESS.

4.3.0.1 Coverage and blind seed items will be placed within the mag and dig investigation areas by the UXOQCS based on the requirements in DID-004.01. The location of the seed items will not be known to the on-site project personnel. Section 3.11.1 reviews the QC protocol, performance metrics, and quality objectives for the mag and dig investigation.

4.4 Subsurface Investigation Geophysics Quality Control

4.4.0.0. DGM within selected subsurface investigation areas will be performed IAW this work plan. The geophysics QC process will ensure data collection, digital data processing, and anomaly selection criteria are achieving established QC metric criteria. **Table 3-3** lists the QC metrics for the instrument functional checks which will be tracked during the course of the project. Metrics may be further refined following the completion of the IVS. Quality objectives for the DGM program that involve spatial sampling, anomaly selection, blind seeding, and intrusive anomaly verification are documented in Sections 3.7.5, 3.7.6, and 3.7.7.

4.4.1 Seeding Program

Blind seed items will be used by QA/QC personnel to ensure the investigation is meeting the project DQOs. Nails or rebar placed at the grid corners of the DGM full coverage grids will be used as a dynamic positioning quality check.

4.4.1.1 Grid Corners

Grid corners will be used during geophysical data collection to quantify positional accuracy. The grid corners will consist of 6-inch rebar spikes or equivalent inserted vertically at the surveyed grid node intersection for each subsurface investigation grid. The location of these spikes will be recorded during the grid node survey.

Digital anomaly response and position of the grid corners will be identified during data processing and analysis. Each grid corner will be reviewed to quantify positional accuracy

by measuring the anomaly target location to the actual geo-referenced location of the rebar spike recorded during the grid survey. The measured offset will be logged for each dataset in the geophysical processing form. Offset distance between the anomaly target selection and the actual grid corner location shall not exceed 2.4 ft.

4.4.1.2 Blind Seed Items

Blind seed items will be placed within the subsurface investigation areas by the UXOQCS as directed by the Shaw QC Geophysicist. All seeds will be located using a survey-grade GPS or equivalent within removal grids. The location of the seed items will not be known to the on-site project personnel. QA/QC personnel will review the DGM data against the seed locations. The blind seeds shall be detected within 2.4 ft of the seed survey location.

4.4.2 Soil Screening QC

Screened material will be inspected periodically by the UXOQCS to ensure the material is free of MPPEH. The UXOQCS will periodically request that material be re-run through the tromel. A minimum of 10 percent or one excavator or loader bucket every 10 loads will be re-run. If MPPEH is found during the QC, the entire run since the previous QC will be re-run. A log will be maintained and any failures will be reported to the SUXOS immediately.

4.4.3 Feedback Process

Geophysical investigation updates will be provided in the project weekly status reports. The reports will include DGM coverage, processed data, and cumulative target count. For QC purposes, dig results will be compared back to the digital data and response amplitude prior to releasing the results to the Project Team. The size and response of the DGM anomaly shall match the characteristics of the excavated item to ensure all metal is removed. If the anomaly does not match the excavated item characteristics, the target location will be reacquired and checked by the UXOQCS for remaining anomalous signals.

4.4.4 Additional Inspections

Additional inspections may be performed on the same DFW at the discretion of the Army or the designated QC staff with approval by USAESCH. Completion and acceptance inspections will also be performed to verify that project requirements relevant to the DFW are satisfied.

4.5 Quality Audits

Due to the importance of quality in this project, it is anticipated that at least one on-site audit will be conducted by the QC Manager. Quality audits may be conducted at the discretion of the QC Manager. Audits are a formal assessment tool to determine the degree of conformance with project and external requirements. Audits of various project functions will

be performed by the QC Manager and may also be performed by the Army. These functions include, but are not limited to, explosive inventory, MRS documentation, scheduled reports, MEC/MD accountability, MEC clearance, closure of Open Burning Tray, and administrative support activities. Audit reports are typically a rich source of feedback information. The QC Manager will use the Shaw Procedure EI-009 to conduct these audits.

4.6 Corrective/Preventive Action Procedures

Regular inspections should prevent deviations from the work plans and methods being used to perform quality work. However, this is not always the case. When unplanned deviations are detected that may affect the quality of the work performed, a nonconformance will be reported. If a change is discovered prior to beginning work, it will be documented as a variance.

4.6.1 Nonconformance Documentation

4.6.1.0.0. Complex field efforts, including the MEC clearance activities proposed for this task order, are sometimes subject to nonconformance. A nonconformance is defined as an unplanned deviation that occurs during the implementation of a task that cannot usually be corrected until after it has occurred. Nonconformance may include using unapproved methods, not following procedures, or substituting unapproved materials or equipment to perform an activity. All nonconformances must go through a cycle of being identified, documented, assessed, corrected, and will be reported. Each of these steps is critical in handling non-conformances as they are encountered.

4.6.1.0.1. The identification of a nonconformance is the responsibility of every person assigned to support the project. This responsibility is incorporated into each person's understanding of the tasks assigned by the supervisor or task leader and the individual's function on the project. As personnel perform their duties on the project, they must constantly be aware of the scope of the activity and recognize when a deviation from the planned activity has occurred or is occurring. After recognizing deviations, they must take action by informing their supervisors or site leaders and documenting in writing the specifics of what occurred using a NCR. An example nonconformance report form is included in **Appendix F**. When completed, the NCR will be reviewed by a peer or supervisor and presented to the Shaw PM. The PM will assign a lead individual who will work with the person who identified the nonconformance (and other team members as needed) to assess its impact on the project and develop a corrective action plan.

4.6.1.0.2. As warranted by the nonconformance, the USAESCH PM and/or appropriate technical support person will be contacted by the Shaw PM and asked to provide input into the assessment and corrective action process. In all cases, the Shaw PM will be consulted

and the corrective action will be decided upon and recorded on the NCR. Once the corrective action is implemented, the Shaw PM will assign a person to verify that the corrective action is successful in preventing future occurrences of the nonconformance. When this has been verified, the NCR will be completed, and copies will be distributed to all individuals who participated in the identification, assessment, and resolution of the nonconformance. The completed report will be included as a permanent part of the project file. In addition, full documentation will be provided to USAESCH detailing what failed the QA process, why it failed, and how the problem was corrected.

4.6.1.0.3. Nonconformances will also be used by project auditors to help focus audits on the historical project deviations. The auditors will review the corrective action procedures established from the resolution of the nonconformance and determine whether the original nonconformance issues have been permanently resolved. Modified corrective actions may be indicated by the findings of the audit.

4.6.2 Continuous Improvement

4.6.2.0.0. Project staff at all levels are to be encouraged to provide recommendations for improvements in established work processes and techniques. The intent is to identify activities that are compliant but can be performed in a more efficient or cost-effective manner.

4.6.2.0.1. Typical quality improvement recommendations include the identification of an existing practice that should be improved (e.g., a bottleneck in production) and/or recommendations for an alternative practice that provides a benefit without compromising prescribed standards of quality. Project staff members are to bring their recommendations to the attention of project management or QC staff through verbal or written means.

4.6.2.0.2. Deviations from established protocols are not to be implemented without prior written approval of the PM and concurrence of the QC Specialist. Staff-initiated recommendations resulting in tangible benefits to the project should be formally acknowledged by project management personnel.

4.7 Lessons Learned

Lessons learned on the project will be captured and reported on QC documentation forms described in this work plan. Significant lessons learned will be highlighted, as applicable, in the monthly status reports. When identified, lessons learned will be provided to the appropriate field crews by the UXOQCS during the morning briefing.

4.8 Submittal Management

The PM will be responsible for overall management and control of project submittals, including submittal scheduling and tracking. The QC Manager will ensure, through detailed review, that submittals as well as the materials and work these represent, are in full compliance with applicable contract specifications. The QC Manager will also be responsible for ensuring that a project file is established and maintained and that accurate project documents are retained and controlled as prescribed herein.

4.8.1 Submittal Reviews

4.8.1.0.0. Prior to client delivery or use, project submittals are to be reviewed and approved by Shaw per Shaw procedure T-DP-001(b). Knowledgeable members of the project staff and the PM or designated representative will conduct technical reviews for the project planning documents and report(s). Multiple reviewers will be used to evaluate different components of the documents (i.e., technical, editorial, and QC reviews). The reviewers will ensure that the planning documents and report(s) meet the following requirements:

a. The documents satisfy the requirements of the PWS, requirements and DQOs identified, client requirements (including applicable DIDs), and applicable regulatory requirements;

b. Report assumptions are clearly stated, justified, and documented;

c. The reports clearly and accurately present the MEC clearance results;

d. The basis for the recommendations and conclusions presented in the reports are clearly documented;

e. The tables and figures are prepared and checked according to Shaw requirements; and,

f. The documents have been proofread; punctuation, grammar, and spelling are correct.

4.8.1.0.1. Submitted documents may also contain signature locations for PM approval.

4.8.2 Work Plan Changes

The distribution of this work plan will be controlled by the QC Manager in order to ensure that the most recent, accepted version is available at all locations where investigative activities covered by this work plan are performed. Revisions to this work plan will require the same level of approval, control, and distribution as the original. Revisions will be documented in the footer of each page and personnel will be informed of changes.

4.9 Qualifications and Training

Project staff will be qualified to perform their assigned tasks IAW terms outlined by the contract. UXO personnel will meet the minimum qualification standards commensurate with their duties, IAW DDESB TP 18 (DDESB, 2004). The UXOSO will conduct and document all site-specific training and maintain records documenting the required qualifications and training for each site worker. The UXOQCS will monitor expiration dates in order to advise employees of the need for refresher training or other requirements and will maintain training records for personnel and visitors, as required by this work plan. All required records will be maintained on site for audit purposes. Field Activity Daily Logs will be maintained by the UXOQCS to document details of field activities during QC monitoring activities.

Table 4-1
Definable Features of Work

DFW	Description	Work Plan Reference	PWS Reference	WERS DID
1	Survey Grid Placement	Section 3.4.1	3.2	N/A
2	Vegetation Clearance	Section 3.3.6 & 3.4.2	3.2	N/A
3	Surface Clearance	Section 3.4.3	3.2	N/A
4	DGM Surveys	Section 3.5 & 3.6	3.2.1.1, 3.2.1.4	004.01, 007.01
5	Anomaly Reacquisition	Section 3.7.3	3.2.1.5	004.01, 007.01
6	Excavation of Anomalies/ Intrusive Investigation	Section 3.9.6	3.2.1.5	N/A
7	Soil Excavation/Sifting	Section 3.9.7	3.2.1.2	N/A
8	Mag and Dig Operations	Section 3.11	3.2.3	004.01
9	Closure of Open Burning Tray	Section 3.12	3.2.4	N/A
10	MEC Disposal by Detonation	Section 3.11.4	3.2	002.01, 003.01
11	MC Sampling and Analysis	Section 3.13	3.3	009.01
12	IDW Disposal	Section 3.14.1	3.2	N/A

Abbreviations:
N/A not applicable

5.0 EXPLOSIVES MANAGEMENT PLAN

5.1 Purpose

This Explosives Management Plan provides details for the management of explosives during the MEC clearance activities. This work plan was developed IAW DID WERS-002.01 and the following documents:

a. DoD 4145.26-M, Contractor's Safety Manual for Ammunition and Explosives;

b. DoD 6055.9-M, DoD Ammunition and Explosives Safety Standards;

c. Applicable Sections of DOT, 49 CFR Parts 100-199;

d. DA Pam 385-64; Ammunition and Explosive Safety Standards;

e. AR 190-11, Physical Security of Arms, Ammunition, and Explosives;

f. EM 1110-1-4009, Military Munitions Response Actions;

g. EP 1110-1-18, Military Munitions Response Process;

h. Local and state laws and regulations;

i. USACE EM 385-1-97, Explosives Safety and Health Requirements Manual;

j. USACE EM 385-1-1, Safety and Health Requirements Manual; and,

k. ATF P 5400.7 Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF) Federal Explosives Laws and Regulations.

5.2 Acquisition

Shaw maintains a valid Explosive Permittee License (1-VA-510-33-2B-00374) which was issued by the ATF and complies with the appropriate portions of ATF P 5400.7. Federal Explosives Law and Regulations (ATF, 2007). These permits will be filed on site and will be available for local, state, or federal inspection. Shaw will store the demolition material on site in two ATF-approved explosive storage Igloos provided by SEDA. Primary responsibility, accountability, and use of the explosives will remain with the SUXOS unless custody is transferred to the Government or another contractor with a current ATF explosives license.

5.2.1 Description and Estimated Quantities

When required, Shaw will order and stock an initial quantity of not more than 50 lbs NEW of commercial counter charges, initiating explosives, and venting charges for disposal and demilitarization operations. Based on usage and demand, the quantity in stock may increase, but at no time will storage quantities exceed 100 lbs NEW.

5.2.2 Acquisition Source

Shaw will purchase explosives from a local licensed explosives distributor, who will deliver the demolition material to the site. The demolition team leader will be authorized to request and receive explosives from the explosives distributors. The SUXOS may assist if required.

5.2.3 Listing of Proposed Explosives

The type, amount, class, and NEW of the donor explosives anticipated to be acquired at the start of the project are provided in **Table 5-1** and will not exceed 100 lb NEW at any given time. The types of explosives that may be used will be determined.

5.3 Initial Receipt

Shipments of explosives will be by the distributor IAW federal and state transportation requirements. The explosive distributor is responsible for all permits and documentation required by federal, state, and local regulations. The SUXOS and demolition team leader will strictly control access to all explosives. All receipts, issues, turn-ins, and inventories of explosives will be properly documented and verified, through physical count, by the demolition team leader and UXOQCS.

5.3.1 Procedures for Receipt of Explosives

Upon receipt, the type, quantity, packaging, and lot number of each explosive item will be checked against the manifest and recorded on the Magazine Data Card. The original receipt documents and an inventory will be maintained on file by the demolition team leader. The Magazine Data Card will remain in the magazine with the explosive items and be annotated and updated upon each issue, receipt, and inventory. The SUXOS will maintain both the original receipt documents, a duplicate Magazine Data Card (**Appendix F**), and the Explosives Usage Record (**Appendix F**) on file at the site.

5.3.2 Procedures for Reconciling Receipt Documents

The SUXOS and demolition team leader will reconcile the delivery shipping documentation with the requested amounts ordered and received. Any shortages or overages will be reported to the demolition SUXOS, who will contact the explosives distributor and reconcile any differences. In addition, he will notify the Shaw site and project managers and if necessary ATF.

5.4 Storage

When required, explosives will be stored in standard ammunition magazine(s) that exist at SEDA within a fenced area with appropriate signage and emergency notification data.

5.4.1 Storage Magazines

Explosives will be stored at SEDA in the storage magazines that exist as part of the former SEDA ammunition storage facility (A0705 and A0703). These "Double Igloo" type, earthen covered magazines were constructed in 1942 and conform to Department of Defense Explosive Safety Board (DDESB) and Army safety standards for lightning protection and explosives storage.

a. The magazines are approved for 250,000 lbs HC of 1.1 explosives.

b. The explosive storage igloos are located within the SEDA former ammunition area that is surrounded by a chain link fence behind locked gates that effectively prevent unauthorized access. These magazines comply with the criteria and quantity distance requirements established in DoD 6055.9-M, Department of Defense Ammunition and Explosives Safety Standards, DA Pam 385-64, and other DoD and ATF directives.

c. Magazines are used to comply with explosive compatibility requirements (i.e., bulk explosives, initiating explosives).

d. The magazines are bullet-resistant, fire-resistant, weather-resistant, theft-resistant, ventilated, and grounded. In the event of a thunderstorm, no activities are to be conducted in the magazine area. They are built in direct contact with the ground, and the ground around them slopes away for drainage.

e. Hinges and hasps are attached to doors by welding, riveting, or bolting (nuts on inside of door). Hinges and hasps have been installed such that they cannot be removed when the doors are closed and locked. Each door is equipped with two padlocks fastened in separate hasps and staples. Padlocks have at least five tumblers and a casehardened shackle of at least 3/8-inch diameter. Padlocks are protected with not less than 1/4-inch steel hoods constructed to prevent sawing or lever action on the locks, hasps, and staples.

5.4.2 Establishment of Storage Facilities

Shaw will comply with ATF, federal, and local storage and compatibility criteria and procedures when using the existing explosives storage magazines. This entails maintaining the magazine(s) to comply with the magazine criteria and quantity distance requirements established in ATF Regulation ATF P 5400.7 and DoD 6055.09-M, *DoD Ammunition and Explosives Safety Standards.*

5.4.3 Physical Security of Storage Facilities

A chain link fence exists surrounding the entire OB/OD area to include the explosive storage igloos. The magazine storage area will be inspected each workday by the SUXOS and demolition team leader to ensure the integrity of the enclosure.

5.5 Transportation

Explosives will be delivered to the project by a licensed and permitted commercial explosives vendor. When explosives are required at the work site, vendor personnel will transport the explosives to an area designated by Shaw UXO personnel. After receipt, Shaw will transport the explosives to the explosive storage magazine. Transportation of demolition material will comply with all federal, state, and local regulations. Even though permits are not required for the transportation of the small quantities of explosives to be used on site, Shaw will use the most expeditious route when transporting demolition material. No public roads will be used during the transport of explosives during the MEC clearance activities on the SEDA property.

5.5.1 Procedures for Transportation from Storage to Disposal Location

5.5.1.0.0. The driver of any explosive-laden vehicle will ensure that the load is properly braced and that the initiators are carried separately from main-charge explosives. The SUXOS or authorized individual of moving explosives will ensure that the driver and any passengers are not carrying any smoking products or flame-producing devices. Smoking will be strictly forbidden among all personnel involved in the handling or transportation of explosives.

5.5.1.0.1. Transportation of explosives on SEDA will not require travel on public highways. However, should it occur, placarding and inspections will be conducted IAW state and federal requirements. The UXOSO will provide the team with a transportation route plan in the event public roads will be traveled. Every effort will be made to take a route with the least public exposure. For transportation of demolition material, Shaw will comply with the following:

a. Initiating explosives, such as blasting caps, will remain separated from other explosives at all times. Blasting caps and other initialing devices may be transported in the same vehicle as long as they are in a separate container, such as an IME Type 22, or equivalent container designed to transport blasting caps) and secured away from other explosive items.

b. A second IME Type 22 or equivalent container will also be used to transport the primary demolition material such as the booster or perforators. The two containers will be placed in the bed of the vehicle and blocked in using sand bags or other means to keep the containers from shifting. The containers may also be covered with a tarp.

c. Compatibility requirements will be observed.

d. Only the demolition team leader UXO Technicians III may be issued and transport explosive materials. The receiving party shall sign the receipt documents for accountability.

e. Operators transporting explosives will have a valid driver's license.

f. Drivers will comply with posted speed limits but will not exceed a safe and reasonable speed for conditions. Vehicles transporting explosives off-road will not exceed 25 mph.

g. Personnel will not ride in the cargo compartment of a vehicle transporting explosives.

5.5.2 Explosives Transportation Vehicle Requirements

Vehicles transporting explosives on the project site will comply with the following requirements:

a. Vehicles transporting explosives will be placarded when carrying any Class 1 explosives.

b. All vehicles transporting explosives will be equipped with reliable communications, a first-aid kit, and two 10-lb "BC"-type fire extinguishers. One extinguisher will be located in the driver's compartment and the other located in the cargo compartment.

c. Vehicles transporting explosives will be inspected using DD Form 626, and the inspections will be documented on an explosives transportation vehicle safety checklist, which will be kept in the vehicle during transport.

d. The vehicle used to transport the explosives will have a non-sparking bed liner, and all explosive loads will be covered prior to departure.

e. Vehicles used for the transportation of explosive materials shall not be loaded beyond their rated capacity and the explosive materials shall be secured to prevent shifting of load or dislodgement from the vehicle.

f. When explosive materials are transported by a vehicle with an open body, a magazine or closed container shall be securely mounted on the bed to contain the cargo.

g. The driver of any explosive-laden vehicle will ensure that the load is properly braced and that the initiators are carried separately in an authorized portable container.

h. Smoking, matches, open flames, and spark producing devices are only permitted at areas designated by the SEDA Facility Manager and not within 50 ft of the magazine(s).

i. Electromagnetic radiation hazards (e.g., radios and mobile phones) will be observed when carrying electric detonators.

5.6 Receipt Procedures

The SUXOS will strictly control access to all explosives. All receipts, issues, turn-ins, and inventories of explosives will be properly documented and verified, through physical count, by the SUXOS and the demolition team leader.

5.6.1 Records Management and Accountability

All original explosive records will be archived IAW ATF regulations and requirements. Copies of all records will be maintained on site by the site supervisor and will be available for inspection by authorized agencies. Explosive items will be tracked by their respective lot number until the items are expended or transferred to government control and accountability or are returned to the distributor.

5.6.2 Authorized Individuals

The SUXOS is required to provide explosives distributors with documentation of individuals authorized to request and receive explosives. The individuals authorized to receive and issue explosives are either the Tech III demolition team leader or the Shaw SUXOS. The SUXOS will designate in writing the individual(s) authorized to transport and use explosives.

5.6.3 Procedures for Reconciling Receipt Documents and Proposed Intervals

The SUXOS and demolition team leader will reconcile the delivery shipping documentation with the requested amounts ordered and received. Any shortages or overages will be reported to the explosives distributor and reconcile any differences. In addition, he will notify the Shaw site and project managers. If, due to an inability to reconcile the discrepancy and the overages/shortages cannot be clarified, the ATF must be contacted within 24 hours of the finding.

5.6.4 Certification

The demolition team leader and his Technician II performing demolition will sign and date the Explosives Usage Form (**Appendix F**) certifying that the explosives were used for their intended purpose.

5.7 Inventory Procedures

Explosives will be inventoried at least weekly by the demolition team leader and the SUXOS. Complete inventories will also be conducted after any issues/turn-ins of demolition material. The purpose of these inventories is to reconcile the actual quantities stored and used with the quantities annotated on the Magazine Data Card and Explosives Usage Record (**Appendix F**).

5.7.1 Physical Inventory Procedures

5.7.1.0.0. The demolition team leader and SUXOS will strictly control access to all explosives. All issues and turn-ins of explosives will be properly documented and verified, through physical count, by the SUXOS and demolition team leader. On receipt, the type, quantity, container type, and lot number of each explosive item is recorded on the Magazine Data Card (**Appendix F**).

5.7.1.0.1. The SUXOS will review all requests for explosives from the demolition team leader and only sufficient explosives for the day's operations will be issued. Issues of explosives are recorded on Explosives Usage Records entries (**Appendix F**) and deducted from the Magazine Data Card(s) and annotated in the daily journal. This procedure will ensure that the issued explosives are accounted for while they are in the possession of individual users. The demolition team leader shall certify on the Explosives Usage Record that the explosives were used for their intended purpose. Entries made on the Explosives Usage Records and Magazine Data Cards will be verified through physical count by the demolition team leader when drawing or turning in the explosives and verified by the SUXOS.

5.7.1.0.2. At the end of each disposal operation, the SUXOS and the demolition team leader will reconcile the entries on each Explosives Usage Record. The record of ordnance items destroyed with the explosives consumed will be kept in the SUXOS daily log.

5.7.1.0.3. Entries made on the Explosives Usage Records and Magazine Data Cards will be verified through physical count of the amount being drawn by the demolition team leader when drawing or turning in the explosives, and the SUXOS will verify the record. (**Appendix F**).

5.7.2 Procedures for Reconciling Inventory Discrepancies

The SUXOS and demolition team leader will be responsible for performing a documented weekly inventory of the explosives within the magazine. If there is a discrepancy between the inventory and the volume of explosives within the magazine, then they will review the magazine Data Card and Explosives Usage Record to see if the inventory records are current. If the records review does not reconcile the discrepancy, it will be reported to the OESS, contracting officer's representative (COR), and demolition contractor PM for investigation. In addition, the Shaw site and project managers will be notified as well as ATF.

5.8 Inspection of Magazines

The SUXOS and demolition team leader will inspect the magazine(s) daily throughout the work week. This inspection need not be an inventory, but must be sufficient to determine whether there has been unauthorized entry or attempted entry into the magazines, or

unauthorized removal of the contents of the magazines. For the magazine located at the SEDA project site, all applicable local regulations and directives will be followed.

5.9 Reporting Loss or Theft of Explosive Materials

If it is confirmed that ordnance or explosives are missing, then the SUXOS will contact the COR immediately by telephone and in writing within 24 hours. The OESS, and Shaw site and project managers will be notified following the notification of the COR. The SUXOS will notify ATF and immediately begin an investigation. Local authorities will be notified, and a written report will be issued within 24 hours.

5.10 Procedures for Return to Storage of Explosives Not Expended

Explosives that were issued for use but were not expended will be returned daily to the magazines at the completion of disposal operations. The demolition team leader will return the unused explosives to the storage magazine and record the items on the Magazine Data Card and Explosives Use Record (**Appendix F**).

5.11 Disposal of Remaining Explosives

ATF requires an accounting of all explosives purchased and used; therefore, at project completion, all unused explosives will either be disposed of by detonation or a change of custody, and accountability will be transferred to an incoming contractor, a government agency, or returned to the distributor. All returned or transferred items will be recorded on the Magazine Data Card and Explosives Usage Record (**Appendix F**).

5.12 Economic Analysis for Different Alternatives

An economic analysis of alternatives is not required for this project.

Table 5-1
Donor Explosives Quantities

Description	DoD Hazard Class//Division	Quantity	NEW	DoD Storage Compatibility Group
Detonating cord (80 grain/ft)	1.1 D	2000 ft	14.28 pounds (lbs)	D
PETN boosters (1 lb)	1.1D	5 ea	5 lbs	D
Cap, Blasting electric, commercial	1.4B	25 ea	Less than .5 lbs	B
Jet Perforators, 21 gram	1.4S	50 ea	Less than 2.5 lbs	S
Shock Tube	1.4B	2500 ft	1.2 lbs	B
EZ Dets (Instant Detonators)	1.4B	50	Less than .5 lbs	B
Total NEW			23.98 lbs	

Abbreviations:

NEW *Net Explosive Weight*
NONEL *non-electric*
PETN *pentaerythrite tetranitrate*

6.0 ENVIRONMENTAL PROTECTION PLAN

6.1 Introduction

The purpose of this EPP is to describe the approach, methods, and procedures to be employed by Shaw to protect the natural, cultural, and archaeological environments during performance of tasks associated with the MEC clearance. Specifically, this EPP describes the procedures and methods that will be implemented during MRS activities to minimize pollution, protect and conserve natural resources, restore damaged areas, and control noise and dust within reasonable limits. This EPP was prepared IAW DID MR-005-12, Environmental Protection Plan. Issues relating to environmental protection will be coordinated through SEDA.

6.2 Identification of Environmental Resources

6.2.1 Threatened and Endangered Species

There are no known federal threatened or endangered species within the OD Grounds.

6.2.2 Water Resources

6.2.2.0.0. Surface water flow from precipitation events at OD Grounds is controlled by local topography which slopes gently to the east-northeast, as there is little relief on site other than the demolition mound. In general, surface water flows east making its way into a network of drainage swales throughout the site that eventually lead into Reeder Creek, a sustained surface water body. Reeder Creek flows to the north-northwest along the eastern border of the OD Hill.

6.2.2.0.1. The OD Grounds is bounded on the east by Reeder Creek, which is a perennial creek that is generally less than 1 ft deep and eventually flows into Seneca Lake. The quality of surface water in Reeder Creek has been designated by the State of New York as a Class C water body (best usage of fresh water is fishing; the waters shall be suitable for fish propagation and survival). Seneca Lake is located approximately 10,000 ft west of the OD Grounds and is used as a source of drinking water for numerous surrounding communities and SEDA. Surface drainage is generally to the east towards Reeder Creek.

6.3 Proposed Mitigation Measures

6.3.1 Manifesting, Transportation, and Waste Disposal

6.3.1.0.0. Production of hazardous wastes is not anticipated. MPPEH items that require destruction or venting will be destroyed in demolition operations, followed by recovery and off-site disposal of the nonhazardous fragments. When detonation of MPPEH is determined appropriate and the items can be moved, they will be demolished through the use of

consolidated shots conducted at OD Hill. If they cannot be moved, they will be BIP. Items not related to MEC, MPPEH and/or MD will be collected and sent to a scrap dealer for recycling or sent to a commercial or municipal landfill for proper disposal.

6.3.1.0.1. Appropriate on-site housekeeping practices will be maintained during the course of the project. All project wastes will be collected and disposed properly off site. This type of waste will primarily consist of general trash (i.e., office paper, food and beverage containers) and used but uncontaminated protective clothing.

6.3.1.0.2. Any waste material removed from the Burn Tray prior to closure will be handled and disposed of IAW Section 2.3.2 of the Closure Plan for the Open Burn Tray in SWMU - SEAD-23 (Parsons, 2005). The burn pan and concrete pad beneath the burn pan will be sampled for characterization and disposed of IAW Section 2.3.4 of the closure plan.

6.3.1.0.3. IDW produced as a result of soil, surface water, groundwater sampling activities or characterization sampling activities related to the closure of the Burn Pan will be disposed of IAW Section 16.3.12 of the Generic Site-Wide SAP for Seneca Army Depot Activity (Parsons, 2006). IDW may include soil, sediment purge water, drilling water, decontamination water, sampling and decontamination equipment, and PPE.

6.3.2 Burning Activities

No burning for removal of vegetation will be conducted. Burn operations may be conducted in order to achieve thermal certification of recovered small MPPEH and MD. Burning will be conducted within the existing burn pan. This and any other activity that could potentially cause a spark (such as during demolition operations) will be carefully monitored. Fire extinguishers will be present during all burning and demolition operations and an assessment of vegetation conditions will be made prior to each detonation. If the vegetation is dry and may pose a wildfire hazard, precautionary measures will be taken. This may include spraying water on the area or other measures. Fire prevention measures and emergency response plans for fire control are discussed in the APP.

6.3.3 Dust and Emission Control

6.3.3.0.0. Field operations are not anticipated to generate an amount of dust that would require dust control measures. Any dust suppression will consist of water application to exposed surface soils. Water will be applied so as to prevent soil migration to nearby drainage pathways. Water for dust suppression will be obtained from a hydrant located east of the site. All water use will be coordinated with the Seneca County Water District (315) 539-1637. Additional information on dust monitoring and controls is presented in the APP.

6.3.3.0.1. Other emissions sources include automobiles used to travel to and from the site and heavy equipment. All vehicles and heavy equipment will be in good working order and will meet applicable vehicle emissions requirements. Vehicles will not be left idling for extended periods of time.

6.3.3.0.2. An air monitoring plan has been developed to protect the workers involved in the munitions response action. Public health and safety is ensured by monitoring within the work zone and creating an EZ surrounding the investigation area. Perimeter air monitoring will be conducted IAW the New York State Department of Health (NYSDOH) Generic Community Air Monitoring Plan (CAMP) during all intrusive investigation. Based on requirements specified in the NYSDOH CAMP, the perimeter air monitoring program will consist of real-time perimeter measurements for total VOCs and respirable airborne dust particulates (particulate matter less than 10 microns – PM10). The data will be saved in the data loggers attached to the instruments.

6.3.4 Spill Control and Prevention

The following sections describe the type/amount of potential spills that could occur during remedial actions, spill prevention and control measures, spill countermeasures, spill response equipment, and spill notification procedures.

6.3.4.1 Potential Spill Types

6.3.4.1.0.0. Potential spill types that may occur during the remedial action includes waste liquids (decontamination liquids, excavation water, etc.), waste solids (soils, etc.), and materials brought on site for interim measures work that contain hazardous constituents.

6.3.4.1.0.1. The only hazardous liquids that will be brought on site will be small quantities of gasoline and diesel, motor oil, paints, and solvents. Throughout operations, these materials will be stored and transported in approved containers.

6.3.4.2 Spill Prevention

a. Wastes collected from the remedial action will be properly containerized, stored, treated, and disposed IAW applicable federal and state regulations.

b. Equipment fueling and/or lubrication performed by either Shaw or their subcontractors will be performed utilizing drip pans to contain any spills which may occur.

c. Wastes and/or chemicals will be stored in a manner to prevent contact with stormwater including the use of tarpaulins and/or storage under a roofed structure.

d. All storage containers for liquid storage will be certified for aboveground use.

e. The storage drums/containers will be inventoried periodically to determine if leakage is occurring and the exterior of the tanks will be examined.

f. All transport drivers will be trained in DOT and USEPA spill prevention measures.

g. The transport driver will be required to remain on duty and with his truck during filling operations to protect against spills.

h. The volume of waste material will be calculated prior to filling drums or containers.

i. No pump operations are to continue unless attended constantly.

j. Personnel training will be conducted on spill prevention, containment and retrieval methods at the start of interim measures work.

k. Phone numbers will be posted regarding the report of a spill to the response agencies and the state.

6.3.4.3 Spill Countermeasures

a. Any fuel leakage, oil drips, or hydraulic line rupture that may occur during the operation of trucks, heavy equipment, etc., will be immediately cleaned up.

b. Any spill of hazardous materials will be reported through the local spill response system and addressed immediately.

c. Emergency containment action will consist of placing adsorbent materials around the site of the spill.

d. Accidental spills will be cleaned up immediately. The spilled medium (liquid or solid) will be collected and containerized awaiting waste characterization, transportation, and disposal.

6.3.4.4 Spill Mitigation Equipment

6.3.4.4.0.0. The following spill mitigation equipment will be available onsite for use during the removal actions:

a. Drip pans;

b. Shovels; and,

c. 55-Gallon drums (for containerization).

6.3.4.4.0.1. The Site Manager should be immediately notified of any spills. Emergency response plans for spills and leaks are discussed in the APP. Reporting of spills to state agencies will occur only after discussion with the Shaw PM, USAESCH PM, and NY District PM.

6.3.5 Storage Areas and Temporary Facilities

Temporary facilities, such as personnel trailers, placement of temporary magazines, and temporary waste staging areas, if required, will be staged so as to minimize disturbance of native vegetation or interference with investigation areas. Shaw will coordinate the locations of these temporary facilities with SEDA prior to mobilizing them to the field. All temporary storage and facilities will be removed upon completion of the MEC clearance activities.

6.3.6 Access Routes

It is not expected that field operations will require the construction of new access roads. However, in the event that additional access or modification to existing roads is required, Shaw will coordinate these activities with the SEDA prior to initiating vegetation and/or soil disturbance.

6.3.7 Protection and Restoration of Trees and Shrubs

6.3.7.0.0. Widespread vegetation removal is not anticipated for the MEC clearance. Some minor vegetation disturbance (brush cutting, grass mowing and removal of low hanging limbs, removal of trees smaller than 3 inches in diameter) may be required to facilitate completion of geophysical surveys as discussed in **Section 3.6**, but large-scale vegetation removal, clearing, or other activities that would disturb vegetation and create erosion conditions are not anticipated. Some vegetation disturbance may occur near temporary facilities. Clearing activities at any of the MRSs will be minimized to the extent possible to allow for the execution of work. Brush and vegetation will be placed at locations designated by SEAD. Root balls and other organic oversized material will be set aside for later incorporation into the cap.

6.3.7.0.1. To further minimize environmental impacts, the following special protection measures will be implemented:

a. Any vegetation disturbance will be coordinated with SEAD prior to initiating activities.

b. Shaw will consult with the SEDA prior to commencing fieldwork that will disturb any ecological or cultural resources or vegetation clearing.

c. Locations of temporary facilities must be approved and coordinated with SEAD.

d. Minimal vegetation clearance will be performed to reduce the possibility of the influx of nonnative, noxious weeds.

e. Clothing, equipment, tools, and other items brought to the MRSs will be inspected for presence of foreign items that could impact the MRSs (e.g., exotic slugs/snails,

plants, and seeds). Equipment and tools will be cleaned prior to being introduced to the MRSs.

6.3.7.0.2. All disturbed or impacted areas will be restored to their original condition. Grading will be conducted in areas where needed to obtain positive drainage. All disturbed impacted areas where vegetation was removed will be seeded with a seed mix approved by the SEDA.

6.3.8 Control of Water Run-On and Runoff

6.3.8.0.0. Excavation of subsurface MPPEH will be required as discussed in **Section 3.9.6** and excavation of areas exhibiting metallic saturation will be required as discussed in **Section 3.9.7**. Due to the investigative nature of the proposed activities, the exact location(s) where excavation will be conducted is not known at this time. Erosion and sediment controls will be constructed, stabilized, and functional as required before general site disturbance occurs. The construction sequence for the installation and implementation of erosion and sediment controls will generally commence, as follows:

a. Provide erosion control measures such as silt fence to prevent soil erosion on roadways edges and roadside ditches.

b. Dust suppression will consist of water application to exposed surface soils. Water will be applied so as to prevent soil migration to nearby drainage pathways.

c. Construct required diversion channels and berms to direct runoff to control structures.

d. Once control structures are functional, clear and grub upland areas and strip topsoil to stockpile areas. Clear and grub only areas that have downstream control structures established. Remove or dispose of debris IAW project specifications.

e. For stockpiled excavated soil or fill material brought to SEAD, construct berms around the pile and cover with poly sheeting to prevent sediment migration. Stock piles to be on site for an extended period will be vegetated.

f. Seed and stabilize slope and channels to prevent slope and channel erosion.

g. Maintain dewatering processes and erosion control guidelines throughout work period.

h. Once activity has ceased in disturbed areas that are to be seeded or stabilized, prepare and place appropriate seed mix, mulch, etc.

i. After final stabilization has been achieved, remaining temporary erosion and sediment pollution control facilities will be removed.

j. Construction materials and equipment to be stored on site will be protected to minimize exposure to storm water.

6.3.8.0.1. Should any measures contained within this work plan prove incapable of adequately removing sediment from on-site flows prior to discharge or of stabilizing the surfaces involved, additional measures will be immediately implemented to eliminate such problems.

6.3.8.1 Soil Stabilization Requirements

6.3.8.1.0.0. Disturbed portions of each work area where the excavation investigation activities have temporarily ceased shall be stabilized with temporary seed or mulch as presented in **Table 6-1**.

6.3.8.1.0.1. Disturbed portions of each work area where the excavation investigation activities have permanently ceased shall be stabilized with permanent seeding or mulch as presented in **Table 6-2**.

6.3.8.1.0.2. All permanent vegetative cover shall be placed in consideration of SEAD requirements, adaptability to site conditions, aesthetics, and natural resource values and maintenance requirements.

6.3.9 Decontamination and Disposal of Equipment

Waste may be generated as a result of decontamination and disposal of equipment or other material. Any used equipment or components (such as used PPE) that must be disposed will be placed in a suitable storage area pending accumulation of suitable quantities and will be disposed as municipal waste in an appropriate manner.

6.3.10 Minimization of Disturbed Area

To minimize the impacts of vehicles and other equipment within the MRS, vehicles will remain on existing roads to the extent practicable. Holes caused by excavations will be backfilled and the area regraded to maintain positive drainage.

6.4 Post-Activity Cleanup

Following completion of fieldwork activities, all debris created during the project will be removed. The MRS will be restored to the original topography and the surface will be re-vegetated. Temporary facilities, such as office trailers, dumpsters (for office trash and putrescible wastes), portable toilets, and similar facilities will be removed. All areas of soil disturbance will be restored as closely as possible to prior conditions. MRS restoration activities following both MEC clearance and remediation activities will consist of grading detonation areas and other disturbed areas to blend with the surrounding topography. For

erosion control, the areas will be reseeded using the approved native seed mixes established and set forth by the SEDA.

6.5 Air Monitoring Plan

6.5.0.0. There is potential for exposure to on-site personnel through all routes (i.e., dermal contact, inhalation of dust and vapors, and ingestion) as part of the MMRP investigation activities. It is unlikely that established occupational exposure limits for the contaminants identified will be exceeded at any of the MRSs, based upon the dust exposure calculations for each MRS included in the APP.

6.5.0.1. Since the potential for exposure cannot be eliminated, employee inhalation exposures in the breathing zone will be monitored in real-time for total dust using aerosol monitors during excavation activities to verify that exposure limits are not exceeded. Conservative real-time air monitoring action limits have been established and are specified in the APP. If monitoring indicates these limits are being approached, then engineering controls, such as wetting and/or mechanical ventilation will be applied and/or Level C PPE may be required. If the additional engineering controls fail to adequately control dust or vapor levels to specified levels, then PPE will be upgraded to include respiratory protection in order to prevent personnel exposures above occupational exposure limits.

Table 6-1
Temporary Stabilization Requirements

Area Requiring Temporary Stabilization	Timeframe to Apply Erosion Controls
Any disturbed area within 50 ft of a stream and not a final grade	Within 2 days of the most recent disturbance if the area will remain idle for more than 21 days
For all construction activities, any disturbed areas that will be dormant for more than 21 days but less than one year, and not within 50 ft of a stream	Within 7 days of the most recent disturbance within the area
Disturbed areas that will be idle over winter	Prior to the onset of winter weather

Table 6-2
Permanent Stabilization Requirements

Area Requiring Permanent Stabilization	Timeframe to Apply Erosion Controls
Any area that will lie dormant for 1 year or more	Within 7 days of the most recent disturbance
Any areas within 50 ft of a stream and at final grade	Within 2 days of reaching final grade
Any other areas at final grade	Within 7 days of reaching final grade within that area

7.0 PROPERTY MANAGEMENT PLAN

Government furnished property will not be used on this project. Therefore, a Property Management Plan will not be required and this chapter serves as a placeholder only.

8.0 INTERIM HOLDING FACILITY SITING PLAN FOR RECOVERED CHEMICAL WARFARE MATERIEL PROJECTS

This sub-plan is not required by this task order.

9.0 PHYSICAL SECURITY PLAN FOR RECOVERED CHEMICAL WARFARE MATERIEL PROJECT SITES

This sub-plan is not required by this task order.

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Appendix A

Task Order Performance Work Statement

Section C - Descriptions and Specifications

Performance Work Statement
Remedial Action
Seneca Army Depot Activity (SEDA)
Open Detonation Ground
Romulus, New York
22 Nov 2011

1.0 OBJECTIVE: The objective of this task order is to design and complete the installation of a NYS Part 360 landfill cap to inter hazardous soils at the Seneca Army Depot Activity (SEDA) in Romulus, New York. Additionally, the Contractor shall perform other activities in support of the landfill construction to include additional investigation and Long Term Monitoring at the site. All activities shall be performed in compliance with CERCLA and Department of Defense, Army, and USACE Regulations and Guidance to include Interim Guidance and Data Item Descriptions (DID's). The subject site is considered a Munitions Response (MRS) and Hazardous, Toxic and Radiological Waste (HTRW) site.

This task order shall be conducted pursuant to Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and National Oil and Hazardous Substances Contingency Plan (NCP) requirements, with regulatory coordination, as appropriate, of the New York Department of Environmental Conservation (NYSDEC) and the United States Environmental Protection Agency (USEPA) Region II.

2.0 BACKGROUND
2.1 Work under this Performance Work Statement (PWS) falls within the Military Munitions Response Program (MMRP) for the Open Burn/Open Detonation Ground Area of Concern (AOC) at Seneca Army Depot located in Seneca County, NY. The AOC consists of 365 acres and was used to perform open detonation and open burning of munitions.
Of particular concern for this effort is an area of approximately 18 acres with potential ancillary needs over a wider area than the actual landfill cap construction. The contractor will complete all actions necessary to meet CERCLA requirements and achieve acceptance of the required designs and construction so the parcel can be closed out.

This requirement involves a legacy BRAC-funded, Military Munitions Response Program (MMRP) site (Munitions Response Site or MRS). The Department of Defense (DoD) established the MMRP under the Defense Environmental Restoration Program (DERP) to address unexploded ordnance (UXO), discarded military munitions (DMM), and munitions constituents (MC) located on current and former military installations. The Contractor shall perform all work in compliance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Contingency Plan (NCP), 40 CFR Part 300. Any activities involving work in areas potentially containing explosive hazards shall be conducted in full compliance with United States Army Corps of Engineers (USACE), Department of the Army (DA), and Department of Defense (DOD) regulations.

3.0 GENERAL REQUIREMENTS:
3.0.1 Contractor Methods: This is a performance based task order. The performance objectives and standards included herein are the basis of the task order requirements. The technical approach and level of effort expended to achieve task order objectives and standards are solely up to the contractor to select and adjust as necessary through the life of the task order. Government recognizes the contractor's right to change the technical approach and level of effort from that proposed with the understanding that the contractor shall still meet all project objectives and gain government Quality Assurance acceptance in order to receive payment. Given the short time available during the pre-award phase to evaluate the site it is possible that after award and refinement of the conceptual site model and data needs that the contractor will wish to adjust the investigation strategy. If before the field work begins, an adjustment in the quantities or types of field investigations are required to achieve the performance standard or the Government determines that the performance standard must be adjusted the Government at its discretion may choose to modify the contract with the price adjustment based upon the prorated unit prices proposed in the accepted proposal. Once these adjustments are complete the contractor shall be obligated to deliver the required

performance standard making adjustments in the field strategy as may be necessary to achieve the standard without a change in price.

3.0.2 Quality monitoring and measurement: The contractor will be evaluated periodically during performance of this task order to ensure compliance with the proposed and accepted performance goals, regulations, guidance and DIDs, and to document that acceptance criteria (AC), delivery schedule, and the overall completion date are being met. This evaluation will be performed according to a Quality Assurance Surveillance Plan (QASP). A programmatic QASP will be provided by the government as a starting point for the contractor prepared Draft QASP per Task 2. The government will finalize the contractor's Draft QASP. This final QASP will be supplied to the contractor and used by the government to evaluate the contractor's performance. Failure to adequately complete any service or submittal to at least a satisfactory level of quality or timeliness may result in a repeat of the work, or a poor performance evaluation, or both.

3.0.3 Performance Requirements. Performance requirements are addressed in each task and summarized in the Performance Requirements Summary (PRS) provided in Attachment A. Performance metrics are provided in Attachment B. If discrepancies or ambiguity exists between the documents, the order of precedence is 1) the Task; 2) Performance Requirements Summary; 3) Performance Metrics.

3.0.4 Task pricing: A pricing schedule is provided in Attachment D which will be used as a basis for negotiation of price increase or decrease due to government changes in the specified performance objectives.

3.0.5 Variation in Estimated Quantities. If the quantity of a unit-priced item in this contract is an estimated quantity and the actual quantity of the unit-priced item varies more than 15 percent above or below the estimated quantity, an equitable adjustment in the contract price shall be made upon demand of either party. The equitable adjustment shall be based upon any increase or decrease in costs due solely to the variation above 115 percent or below 85 percent of the estimated quantity. If the quantity variation is such as to cause an increase in the time necessary for completion, the Contractor may request, in writing, an extension of time, to be received by the Contracting Officer within 10 days from the beginning of the delay, or within such further period as may be granted by the Contracting Officer before the date of final settlement of the contract. Upon the receipt of a written request for an extension, the Contracting Officer shall ascertain the facts and make an adjustment for extending the completion date as, in the judgment of the Contracting Officer, is justified.

3.1 <u>Task 1, Preparation of Work Plans and Designs</u>. This is a Firm Fixed Price task.
Objective: The Contractor shall prepare, submit and gain acceptance of a WP, munitions constituent munitions constituent (MC) UFP-QAPP and QASP that are detailed and comprehensive plans covering all aspects of the project execution. A UFP-QAPP applies only to environmental sampling. Project involves a cap to inter hazardous soil from the open detonation hill and surrounding area of the site, amongst other ancillary items.

Performance Standard: Prepare the WP in accordance with DID WERS-001 and EM 1110-1-4009, EM 385-1-1 and , EM 385-1-97. Prepare the sampling and analysis plan, field sampling, and UFP-QAPP in accordance with EM 1110-1-4009, DID WERS-009.01, and UFP-QAPP, as appropriate. UFP-QAPP content shall also meet the requirements of DoD Quality Systems Manual for Environmental Laboratories (current version). Draft QASP includes requirements in regulations, guidance, DIDs and the Quality Control Plan in the WP.

AC: Acceptance of WP and UFP-QAPP with two revisions. Draft QASP reflects requirements and QCP with one revision required.

Measurement / Monitoring: Review of WP, UFP-QAPP and QASP per guidance to verify that the minimum acceptable content has been provided and acceptance by the project team and regulatory agencies.

Task specific Incentives/Disincentives: Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.

Specific Task Requirements: The sampling and analysis plan (SAP) shall include the Contractor's phased approach and address contaminants of interest and sample media (soil/groundwater/sediment/surface water). The Contractor shall provide a discussion on data evaluation.

3.2 Task 2, Field Sampling Activities. This is a Firm Fixed Price/Fixed Unit Price task.
Objective: Conduct field activities, remove MEC contamination at the required munitions response site (MRS) meeting the project DQOs. This task shall include all field activities necessary to execute this task except MC sampling. MC sampling requirements are covered under Task 8, Environmental Sampling & Analysis.

3.2.1 Task 2a. Area of 0-1,000 Foot Radius from the Existing OD Hill.
3.2.1.1 Task 2a.1 (Formerly Task 2a.1 and 2a.3). The Contractor shall geophysically map the 0-1000 foot radius area (58.4 acres). The Contractor shall delineate all areas which exhibit metallic saturation, whereby individual anomalies >50mV are not distinguishable. The Contractor's work shall include construction support while this work is on-going.

3.2.1.2 Task 2a.2 (Formerly Task 2a.4). The Contractor shall excavate those areas exhibiting metallic saturation to a depth of 6 inches, pushing or transporting the excavated soils to within the 0-500 foot radius area and regrading these with the existing OD hill material. The regraded material shall be maintained within the 0-500 foot radius area as necessary. The Contractor's work shall include construction support while earth work is on-going. **For the purposes of estimation, the Contractor shall assume that 20 acres of this overall area will exhibit saturation.**

3.2.1.3 Task 2a.3 (Formerly Task 2b.1 and 2b.2). The Contractor shall perform a surface sweep of the existing OD hill material for potential MPPEH. The Contractor shall remove all MPPEH in the regraded OD hill material. For the purposes of estimation, the Contractor shall assume that this will amount to 50 anomalies per acre or 900 anomalies.

3.2.1.4 Task 2a.4 (Formerly Task 2a.5). The Contractor shall geophysically re-map the portions of the 500-1000 foot radius area which were considered saturated and which were excavated to a depth of 6 inches. **For the purposes of estimation, the Contractor shall assume that 20 acres of this overall area will require re-mapping.** The Contractor's work shall include construction support while this work is on-going.

3.2.1.5 Task 2a.5 (Formerly Task 2a.2). The Contractor shall reacquire and prosecute all identified, mapped targets in the area of the 500-100 foot radius which exceed the 50mV threshold (15,240).

3.2.3 Task 2c, Area of 0-1000 foot radius for the existing OD Hill. The Contractor shall mag, flag and prosecute identified targets in wooded or severely overgrown or sloped terrain in this area. For purposes of estimation, the cost for this task shall be based upon 700 anomalies per acre and an FUP cost per additional anomaly given as well. Depending upon the method used to clear this area, consideration shall be given to using DGM for the purposes of mapping the area.

3.2.4 Task 2g, Open Burning Tray. The Contractor shall close the Open Burning Tray IAW the approved work plan.

3.2.5 The following applies to all MRSs:
Performance Standard: Field work, data quantity and quality, and analysis of said data provides the results in the Feasibility Study:

- Demonstrate that the work was performed in accordance with the applicable laws, regulations, and guidance documents;
- Demonstrate that the boundaries of all identified MEC contaminated areas have been delineated to an accuracy of at least +/- half the transect spacing, maximum 250 feet.
- Perform the field sampling activities in accordance with the accepted Work Plans (prepared previously).
- Proper processing and disposition of UXO, DMM and MC encountered in accordance with approved Work

Plan(s).

- All Material Potentially Presenting an Explosive Hazard (MPPEH) and munitions debris processed in accordance with Chapter 14, EM 1110-1-4009 and Errata Sheet No. 2.
- Meet the project DQOs.
- All geophysics shall be IAW the approved Work Plans. For this task order 1 acre of transects equals 14,520 lf

(2.75 miles) of transects 3 feet wide. One acre's worth of grids equals seventeen (17) 2,500 sf grids or four (4) 10,000 sf grids.

AC: Conduct the field sampling activities in accordance with the accepted/approved WP. QC data submitted meets Work Plan requirements. No more than 3 CARs for non-critical violations and/or 1 CAR for critical violations. No unresolved Corrective Action Requests. All final data and QC tests/documentation submitted. Government QA acceptance QC tests/documentation gained. No Class "A" Safety, contractor at fault, violations during execution of work, <1 non-explosive related Class D, accidents, or <2 non-explosive Class C accidents IAW AR 385-40. Major safety violations, 1 non-explosive related safety violation. Minor safety violations, 2 safety violations. Zero letters of reprimand, grievances, or formal complaints.

Measurement / Monitoring: Period inspection/review of field work. Verify compliance with accepted WP and other Plans as required. Quality control tests/documentation submitted per the QASP for government review. Additionally, statistical confidence will be calculated using the Visual Sampling Plan software, UXO Estimator or other approved statistical method. Boundary precision will be determined by evaluation of the sampling footprint as it relates to the reported contaminated/uncontaminated areas in question. Anomaly density profile and other remediation cost driver precision will be verified by QA of methods used.

Task specific Incentives/Disincentives: Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.

Specific Task Requirements:

- Restore all areas to their original condition; all access/excavation/detonation holes shall be backfilled.
- Maintain a detailed accounting of all UXO, DMM, MD and range-related debris encountered. This accounting shall include: amounts of UXO, DMM and MD; nomenclature; location and depth of UXO/DMM; location of MD; and final disposition. The accounting system shall also account for all demolition materials utilized on site. Digital photographs of UXO and DMM and examples of MD found during the investigation are to be taken.
- All UXO, DMM and MC encountered during this effort shall be processed in accordance with the approved work and safety plans.
- **Hazardous, Toxic and Radiological Waste (HTRW) Disposal:** The Contractor shall collect, secure, store,

and arrange for disposal of any HTRW generated as a result of field activities. The HW containers shall be staged, secured, labeled, sampled and analyzed (if required) IAW the approved work plan. The Contractor shall recommend appropriate disposal actions for all waste items. The Contractor shall perform the HW disposal in a timely manner.

3.3 <u>Task 3, Environmental Sampling & Analysis (Optional)</u>: This task is a Firm Fixed Price/Unit Price task
Objective: Collect sufficient data that meets the project DQOs, of known quality and quantity to determine the nature and extent of munitions constituents (MC) and HTRW to support and perform a human health and ecological baseline risk assessment, as may be required.

Performance Standard: Perform field activities in accordance with the Work Plan. MC analyses shall be performed in accordance with the requirements of the Department of Defense (DoD) Quality Assurance Manual (QAM), WERS-009.01 Munitions Constituents Chemical Data Quality Deliverables, and the approved project specific plans.

AC: Sampling field work and data meets established criteria within the accepted Work Plan.

Measurement / Monitoring: Periodic inspection/review of field work, and data. Verify compliance with the accepted WP. Quality control tests/documentation submitted per the QASP for government review.

Incentive/Disincentive: Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.

Task Specific Requirements: This sampling effort will be used in the event additional data is required to support conclusions/recommendations to be presented. The contractor shall propose on two Sample Delivery Groups; one for soils and the second for surface water. The Contractor shall assume that each SDG will be composed of twenty samples, including all required QC. The sampling rationale, and methods that will be utilized will ensure that data generated are of an acceptable quality for its intended use and address contaminants of interest in the recommended sample media (soil/surface water). The contractor shall also propose on the quantity, quality and the methods used to verify adherence to the PARCCS parameters for sample collection, handling, laboratory analysis, verification and validation. Any deviations from the accepted SAP shall be documented in the Daily Quality Control Reports (DQCR) and conveyed to USAESCH personnel immediately. The contractor will provide an independent laboratory to analyze QA samples separate from the contractor's primary laboratory.

3.4 Task 4 – Remedial Action Report. This will be a firm fixed price task.
Objective: The Remedial Action report shall be submitted after completion of the remediation effort. The Remedial Action Report shall certify that all items identified in the WP have been completed.

Performance Standard: Acceptance of the Final Remedial Action Report by the project team with no more than 40 minor comments and no more than 5 major comments.

AC: Acceptance of all report documents (with two revisions) by the Project Team.

Measurement/Monitoring: Review of reports per guidance to verify that the minimum acceptable content has been provided.

Task Specific Incentives/Disincentives: Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.

Specific Task Requirements:
The Remedial Action report shall include:

1. summary of historical background
2. summary of field work activities and results
3. summary of remediation efforts and correlations to meeting remediation objectives;

3.4.1 Report/Document Requirements
3.4.1.1 Electronic Deliverables. All documents are to be delivered in the Adobe PDF format 1.4 (compatible with Acrobat 5.0 or later) with searchable text using the original image. Files printed from scanned documents shall be as legible as the originals. Care shall be taken to optimize the scanning settings to ensure to avoid excessive PDF file size. All scanned documents shall be assembled into the fewest number of individual files as appropriate and grouped according to property/project task. The PDF file generation settings need to be submitted in writing and approved by the Government.

3.4.1.2 PDF Standards. The Contractor shall prepare all documents according to the following specifications.

3.4.1.3 Adobe PDF Version. The PDF file shall be in PDF Version 1.4, or later which is compatible with Acrobat 5.0 or later.

3.4.1.4 PDF Image + Searchable Text Conversion. PDF Image + Searchable Text Conversion contain a bitmapped image of the original, and a hidden layer of searchable text. The conversion process shall involve scanning the hardcopy original, performing OCR (Optical Character Recognition) to capture the text of the

document, and distilling the two layers into a PDF searchable image file. The PDF searchable image files will be as legible as the original. Indexing: The Contractor shall ensure that the PDF/Searchable Image files shall be able to be indexed for full-text retrieval by any search engine capable of indexing PDF files.

3.4.1.5 Bookmarks. The Contractor shall bookmark all section headings, subheadings, appendices, maps/drawings, and table of contents according to the document table of contents to provide quick access to specific areas of the PDF document in order to have retrieval of chapters, sections, appendices, and illustrations one click away.

3.4.1.6 Document Security. Each PDF file will have the following document security settings applied. The Master Password will be "E3200 Characterization".

- Security Method: Adobe Standard Security
- Encryption Level: 128-bit RC4 (Acrobat 5.0 or later)
- User Password: No.
- Master Password: Yes.
- Printing: Fully Allowed.
- Changing the Document: Not Allowed.
- Copying Content or Extraction: Allowed
- Authoring Comments and Form Fields: Not Allowed.
- Form Field Filling or Signing: Not Allowed.
- Content Accessibility Enabled: Allowed.
- Document Assembly: Not Allowed.

3.4.1.7 Document Options.

- Fast Web Viewing. The PDF file will be saved to optimize the file for Fast Web Viewing.
- Background PDF Downloading. The PDF will be created to permit background PDF downloading.

3.4.1.8 Document Open Options

- Initial View: Bookmarks and Page.
- Page Number: 1
- Magnification: Fit in Window
- Window Options: Resize Window to initial page, and Display Title

3.4.9 Scanning Standards.

The Contractor shall scan the all pages according the following:

Document Type	Color Type	Scanning Resolution (dpi)
Black & White Text	Binary	300
Black & White drawing/map	Binary	150
Grayscale photo/drawing/map	Black & White Photo 16 Shades of grey	150
Color Photo/drawing/map	Color Photo 256 colors	150

3.4.10 Image Orientation. All pages will be at the correct orientation, i.e. text will be readable without rotating the pages.

3.4.11 De-skewing. If necessary, pages will be de-skewed to ensure correct page orientation; for those pages skewed due to scanning problems.

3.4.12 Delivery and Media Format. A copy of all files, and all project related submission documents developed under this contract shall be delivered to the Government on electronic digital media with each progress submission. All submittals shall be provided in their native electronic digital format and shall be provided on read-only memory (DVD or CD). The electronic digital media shall be in the format that can be read and processed by the Government's target Intel based computer system. Each DVD shall have an index file created in Microsoft Excel placed in its root directory named "index.xls" that shall contain as a minimum a list of the filenames, their directory location on the DVD, and a brief description of their content. The files shall be copied to the delivery media using standard DOS copy commands, or other methodology approved in writing by the Government, in an orderly directory structure approved by the Government. The external label for each electronic digital media shall contain, as a minimum, the following information:

- The Contract Number (and Task Order Number if applicable) and date.
- The format and version of operating system software.
- The sequence number of the digital media.

Each DVD or CD shall be delivered in a jewel case with a paper index of DVD or CD content.

3.5 <u>Task 5, Installation of An Engineered Cap</u>. This is a Firm Fixed Price task.
Objective: The Contractor shall install an engineered cap as designed and approved by the regulators in Task 1. The Contractor shall supply all of the labor, material and equipment necessary to perform this work.

Performance Standard: Field work, data quantity and quality, and analysis of said data provides the results required to meet approved plans and be acceptable to the regulators.

- Demonstrate that the work was performed in accordance with the applicable laws, regulations, and guidance documents;
- Perform the field sampling activities in accordance with the accepted Work Plans (prepared previously).
- Proper processing and disposition of UXO, DMM and MC encountered in accordance with approved Work Plan(s).
- All Material Potentially Presenting an Explosive Hazard (MPPEH) and munitions debris processed in accordance with Chapter 14, EM 1110-1-4009 and Errata Sheet No. 2.
- Meet the project DQOs.

AC: Conduct the field activities in accordance with the accepted/approved WP. QC data submitted meets Work Plan requirements. No more than 3 CARs for non-critical violations and/or 1 CAR for critical violations. No unresolved Corrective Action Requests. All final data and QC tests/documentation submitted. Government QA acceptance QC tests/documentation gained. No Class "A" Safety, contractor at fault, violations during execution of work, <1 non-explosive related Class D, accidents, or <2 non-explosive Class C accidents IAW AR 385-40. Major safety violations, 1 non-explosive related safety violation. Minor safety violations, 2 safety violations. Zero letters of reprimand, grievances, or formal complaints.

Measurement / Monitoring: Period inspection/review of field work. Verify compliance with accepted WP and other Plans as required. Quality control tests/documentation submitted per the QASP for government review. Boundary precision will be determined by evaluation of the sampling footprint as it relates to the reported contaminated/ uncontaminated areas in question.

Task specific Incentives/Disincentives: Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.

Specific Task Requirements:

- All UXO, DMM and MC encountered during this effort shall be processed in accordance with the approved work and safety plans.

- Hazardous, Toxic and Radiological Waste (HTRW) Disposal: The Contractor shall collect, secure, store,

and arrange for disposal of any HTRW generated as a result of field activities. The HW containers shall be staged, secured, labeled, sampled and analyzed (if required) IAW the approved work plan. The Contractor shall recommend appropriate disposal actions for all waste items. The Contractor shall perform the HW disposal in a timely manner.

3.6 <u>Task 6, Preparation of A Long Term Monitoring Plan</u>. This is a Firm Fixed Price task.
Objective: The Contractor shall prepare, submit and gain acceptance of a Long Term Monitoring (LTM) Plan for the monitoring of groundwater and the management of the installed cap. Groundwater monitoring shall be based upon the six existing wells and the installation of another six wells. The Contractor shall assume an average depth of 15 feet per well.

Performance Standard: Prepare the plan in accordance with DID WERS-001 and EM 1110-1-4009, EM 385-1-1 and EM 385-1-97. Prepare the sampling and analysis plan, field sampling, and UFP-QAPP in accordance with EM 1110-1-4009, DID WERS-009.01, and UFP-QAPP, as appropriate. UFP-QAPP content shall also meet the requirements of DoD Quality Systems Manual for Environmental Laboratories (current version). Draft QASP includes requirements in regulations, guidance, DIDs and the Quality Control Plan in the WP.

AC: Acceptance of LTM Plan and UFP-QAPP with two revisions. Draft QASP reflects requirements and QCP with one revision required.

Measurement / Monitoring: Review of LTM Plan, UFP-QAPP and QASP per guidance to verify that the minimum acceptable content has been provided and acceptance by the project team and regulatory agencies.

Task specific Incentives/Disincentives: Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.

Specific Task Requirements: The sampling and analysis plan (SAP) shall include the Contractor's phased approach and address contaminants of interest and sample media (soil/groundwater/sediment/surface water). The Contractor shall provide a discussion on data evaluation.

3.7 <u>Task 7, Performance of Long Term Monitoring</u>. This is a Firm Fixed Price task.
Objective: Following regulatory approval of the Long Term Monitoring Plan prepared under Task 6, the Contractor shall implement the LTM plan and perform monitoring of the ground water and management of the installed cap. The Contractor shall provide all the labor, material and equipment required to install ground water monitoring wells required in the approved plan. As part of this task, the contractor shall perform one year of Long Term Monitoring on a quarterly basis. The effort will also include submission and approval of Long Term Monitoring reports presenting a description of the effort performed, the results achieved and recommendations for the next period of monitoring.

Performance Standard: Field work, data quantity and quality, and analysis of said data provides the results required to meet approved plans and be acceptable to the regulators.

- Demonstrate that the work was performed in accordance with the applicable laws, regulations, and guidance

documents;

- Perform the field sampling activities in accordance with the accepted Work Plans (prepared previously)/ LTM

Plan.

- Proper processing and disposition of any UXO, DMM and MC encountered in accordance with approved Work
Plan(s).
- Any Material Potentially Presenting an Explosive Hazard (MPPEH) and munitions debris processed in accordance with Chapter 14, EM 1110-1-4009 and Errata Sheet No. 2.
- Meet the project DQOs.

AC: Conduct the field activities in accordance with the accepted/approved LTM Plan. QC data submitted meets LTM Plan requirements. No more than 3 CARs for non-critical violations and/or 1 CAR for critical violations. No unresolved Corrective Action Requests. All final data and QC tests/documentation submitted. Government QA acceptance QC tests/documentation gained. No Class "A" Safety, contractor at fault, violations during execution of work, <1 non-explosive related Class D, accidents, or <2 non-explosive Class C accidents IAW AR 385-40. Major safety violations, 1 non-explosive related safety violation. Minor safety violations, 2 safety violations. Zero letters of reprimand, grievances, or formal complaints.

Measurement / Monitoring: Period inspection/review of field work. Verify compliance with accepted LTM Plan and other Plans as required. Quality control tests/documentation submitted per the QASP for government review. Boundary precision will be determined by evaluation of the sampling footprint as it relates to the reported contaminated/ uncontaminated areas in question.

Task specific Incentives/Disincentives: Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.

Specific Task Requirements:
- Any UXO, DMM and MC encountered during this effort shall be processed in accordance with the approved work and safety plans.
- **Hazardous, Toxic and Radiological Waste (HTRW) Disposal:** The Contractor shall collect, secure, store,
and arrange for disposal of any HTRW generated as a result of field activities. The HW containers shall be staged, secured, labeled, sampled and analyzed (if required) IAW the approved work plan. The Contractor shall recommend appropriate disposal actions for all waste items. The Contractor shall perform the HW disposal in a timely manner.

3.8 <u>Task 8, Performance of Additional Long Term Monitoring (Optional)</u>. These are Firm Fixed Price tasks. **Objective**: If awarded, the Contractor shall provide additional LTM for the site and perform monitoring of the ground water and management of the installed cap. As part of this task, the contractor shall perform Long Term Monitoring on the basis requested as part of the individual options. The effort will also include submission and approval of Long Term Monitoring reports presenting a description of the effort performed, the results achieved and recommendations for the next period of monitoring.

Performance Standard: Field work, data quantity and quality, and analysis of said data provides the results required to meet approved plans and be acceptable to the regulators.
- Demonstrate that the work was performed in accordance with the applicable laws, regulations, and guidance
documents;
- Perform the field sampling activities in accordance with the accepted Work Plans (prepared previously)/ LTM
Plan.
- Proper processing and disposition of any UXO, DMM and MC encountered in accordance with approved Work
Plan(s).
- Any Material Potentially Presenting an Explosive Hazard (MPPEH) and munitions debris processed in accordance with Chapter 14, EM 1110-1-4009 and Errata Sheet No. 2.
- Meet the project DQOs.

AC: Conduct the field activities in accordance with the accepted/approved LTM Plan. QC data submitted meets LTM Plan requirements. No more than 3 CARs for non-critical violations and/or 1 CAR for critical violations. No unresolved Corrective Action Requests. All final data and QC tests/documentation submitted. Government QA acceptance QC tests/documentation gained. No Class "A" Safety, contractor at fault, violations during execution of work, <1 non-explosive related Class D, accidents, or <2 non-explosive Class C accidents IAW AR 385-40. Major safety violations, 1 non-explosive related safety violation. Minor safety violations, 2 safety violations. Zero letters of reprimand, grievances, or formal complaints.

Measurement / Monitoring: Period inspection/review of field work. Verify compliance with accepted LTM Plan and other Plans as required. Quality control tests/documentation submitted per the QASP for government review. Boundary precision will be determined by evaluation of the sampling footprint as it relates to the reported contaminated/ uncontaminated areas in question.

Task specific Incentives/Disincentives: Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.

Specific Task Requirements:

- Any UXO, DMM and MC encountered during this effort shall be processed in accordance with the approved work and safety plans.
- **Hazardous, Toxic and Radiological Waste (HTRW) Disposal:** The Contractor shall collect, secure, store,

and arrange for disposal of any HTRW generated as a result of field activities. The HW containers shall be staged, secured, labeled, sampled and analyzed (if required) IAW the approved work plan. The Contractor shall recommend appropriate disposal actions for all waste items. The Contractor shall perform the HW disposal in a timely manner.

3.8.1 <u>Task 8.1, Performance of An Additional Year of Long Term Monitoring (Optional)</u>. If awarded, the Contractor shall provide LTM for an additional (2^{nd}, overall) year on a quarterly basis.

3.8.2 <u>Task 8.2, Performance of An Additional Year of Long Term Monitoring (Optional)</u>. If awarded, the Contractor shall provide LTM for an additional (3rd overall) year on a quarterly basis.

3.8.3 <u>Task 8.3, Performance of An Additional Year of Long Term Monitoring (Optional)</u>. If awarded, the Contractor shall provide LTM for an additional (4th overall) year on a semi-annual basis.

3.9 <u>Task 9, Performance of the Five Year Review (Optional)</u>. This is a Firm Fixed Price task.

Objective:

- If awarded, the Contractor shall provide an additional (5^{th} overall) year of LTM for the site and perform

monitoring of the ground water and management of the installed cap on a semi-annual basis.

- If awarded, the Contractor shall perform the regulatory-required Five Year Review. This review shall include presentation and analysis of the five years of annual monitoring and maintenance activities and will include meetings, presentations, report preparation/ revision/ response to comments and recommendations for the future of the site.
- The Contractor shall prepare, submit and gain acceptance of the Five Year Review report which shall certify

that all items identified in the Work Plans and the LTM Plan have been completed.

Performance Standard:

- Field work, data quantity and quality, and analysis of said data provides the results required to meet approved plans and be acceptable to the regulators.
- Demonstrate that the work was performed in accordance with the applicable laws, regulations, and guidance

documents;

- Perform the field sampling activities in accordance with the accepted Work Plans (prepared previously)/

LTM Plan.

- Proper processing and disposition of any UXO, DMM and MC encountered in accordance with approved

Work Plan(s).

- Any Material Potentially Presenting an Explosive Hazard (MPPEH) and munitions debris processed in accordance with Chapter 14, EM 1110-1-4009 and Errata Sheet No. 2.
- Meet the project DQOs.
- Prepare report documents in accordance with the DIDS, the WP/LTM Plan and all applicable Federal, State and local regulations.

AC:

- Conduct the field activities in accordance with the accepted/approved LTM Plan. QC data submitted meets

LTM Plan requirements. No more than 3 CARs for non-critical violations and/or 1 CAR for critical violations. No unresolved Corrective Action Requests. All final data and QC tests/documentation submitted. Government QA acceptance QC tests/documentation gained. No Class "A" Safety, contractor at fault, violations during execution of work, <1 non-explosive related Class D, accidents, or <2 non-explosive Class C accidents IAW AR 385-40. Major safety violations, 1 non-explosive related safety violation. Minor safety violations, 2 safety violations. Zero letters of reprimand, grievances, or formal complaints.

- Acceptance of all report documents (with two revisions) by the Project Team and regulators.

Measurement / Monitoring:

- Period inspection/review of field work. Verify compliance with accepted LTM Plan and other Plans as required. Quality control tests/documentation submitted per the QASP for government review. Boundary precision will be determined by evaluation of the sampling footprint as it relates to the reported contaminated/ uncontaminated areas in question.
- Review of reports per guidance to verify that the minimum acceptable content has been provided.

Task specific Incentives/Disincentives: Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.

Specific Task Requirements:

- Any UXO, DMM and MC encountered during this effort shall be processed in accordance with the approved work and safety plans.
- **Hazardous, Toxic and Radiological Waste (HTRW) Disposal:** The Contractor shall collect, secure, store,

and arrange for disposal of any HTRW generated as a result of field activities. The HW containers shall be staged, secured, labeled, sampled and analyzed (if required) IAW the approved work plan. The Contractor shall recommend appropriate disposal actions for all waste items. The Contractor shall perform the HW disposal in a timely manner.

3.10 (<u>Task 10) Project Management</u>. The Contractor shall manage the task order in accordance with the basic contract statement of work. All project management associated with the task order, with the exception of the direct technical oversight of the work described in the preceding tasks, shall be accounted for in this task.

4.0 SUBMITTALS.

Even though draft and draft final submittals are requested, the term "draft" shall not reflect upon the quality of the submittal being provided by the Contractor. Submittals shall include all supporting materials including supporting data whether electronic or hardcopy. Submittals not meeting the requirements of referenced guidance or Data Item Descriptions or missing supporting data may be rejected and revised by the contractor at the contractor's own expense.

4.1 The Contractor shall deliver the specified number of copies shown in Table 4.2 of each report listed in Table 4-1 to the following addressees (addresses to be verified by Contractor):

US Army Engineering & Support Center, Huntsville (KO)
Attn: CEHNC-CT-E (Ms. Janice Jamar)
PO Box 1600
Huntsville, AL 35807-4301
4820 University Square
Huntsville, AL 35816-1822
US Army Engineering & Support Center, Huntsville (PM/COR)
Attn: CEHNC-ED-CS-P (Mr. John S. Nohrstedt)
PO Box 1600
Huntsville, AL 35807-4301
4820 University Square
Huntsville, AL 35816-1822

Commander
U.S. Army of Corps of Engineers, New York District
Attn: Mr. Randy Battaglia, Project Manager
CENAN-PP-E
5786 Route 96
Building 125
Seneca Army Depot
Romulus, New York, 14541

Commander's Representative
Seneca Army Depot Activity
Attn: Mr. Stephen Absolom (BRAC Environmental Coordinator)
5786 Route 96
Building 123
Seneca Army Depot
Romulus, New York, 14541

Commander
US Army Public Health Command
Attn: MCHB-IP-REH (Mr. Hoddinott)
Building E1675, Room 114
Edgewood Area, Aberdeen Proving Ground, 21010

Mr. Julio Vazquez
US Environmental Protection Agency
Emergency and Remedial Response Division
290 Broadway
18th Floor, E-3
New York, New York, 10007-1866

Mr. Kuldeep K. Gupta, PE
New York State Department of Environmental Conservation (NYSDEC)
Division of Environmental remediation
Remedial Bureau A, Section C
625 Broadway,
Albany, New York 12233-7105

Mr. Mark Sergott
Bureau of Environmental Exposure Investigation, Room 300
New York State Department of Health
547 River Street, Flanigan Square

Troy, New York, 12180

4.2 Submittals and Due Dates.
The Contractor shall submit 1 copy of the entire submittal on a CD with each hard copy of a submittal (Reports, Plans, etc) in accordance with DID WERS-007.01. Hardcopies shall be printed on both sides of the paper whenever possible.

Table 4-1 List of Submittals

Submittal	**Due Date (Calendar Days)**
Meeting minutes for Kickoff phone conference	7 days after Kickoff phone conference
Proposed Schedule	7 days after kickoff conference call
AAPP	7 days prior to site visit
Pre-Public Meeting Materials	14 Days prior to public meetings
Final Public Meeting Materials	no later than day of Meeting
Draft Work Plan and Design Plans and Draft QASP	30 days after award
Draft Final Work Plan	14 days after receipt of comments
Final Work Plan	14 days after receipt of comments
Quality Control Documents	**As required by Regulation, guidance, DIDs, QCP, QASP, or agreed to in project schedule, to include the following**:
Daily QC Report for Environmental Sampling	Daily during Sampling Activities
Analytical Data Submittal for QA Evaluation	30-45 days after completion of fieldwork
Electronic Laboratory Data Submittal	45-60 days after completion of fieldwork
Cap Installation	120 days after of acceptance of the Final WP/Design
Draft LTM Plan	30 days after award
Draft Final LTM Plan	14 days after receipt of comments
Final LTM Plan	14 days after receipt of comments
LTM Implementation	TBD

4.3 Submittal Quantities
Provide the number of submittals shown in Table 4-2 to the addressees given in Section 4.2. No draft documents shall be released to the regulatory community until reviewed by the government.

Table 4-2 Submittal Guidance

	Draft Documents	Draft Final/Final Documents
KO/COR	1 each	1 each
CENAN	2	2
SEDA	3	3
EPA	1	1
NYSDEC	1	1
NYSDOH	1	1
CHPPM	1	1

4.4 Period of Performance: The period of performance will be 24 months from NTP or Date of Award.

5.0 MILESTONE PAYMENTS FOR FIRM FIXED PRICE TASKS: Milestones will be considered met or completed when the required QC documentation has been submitted, QA completed and the submittal and/or product is accepted. Any payment vouchers submitted that do not coincide with the final accepted milestones or do not have the appropriate QC documentation will be rejected. All payments will be made utilizing an agreed upon Payment Milestone Schedule. The Contractor shall provide suggested milestones for payment. Milestones for payment shall be shown on the project schedule.

5.1 The following is a list of potential milestones for payment:
- Final Submittals: upon government acceptance, for example: Final WP
- Field Work: for defined units and activities completed and QA review and acceptance.
- Meetings: after completion of meetings with government acceptance of meeting minutes.

6.0 REFERENCES:
6.1 Refer to "Base Contract."

6.2 Previous Phase I and II results

6.3 Previous ESI

7.0 ARMY CONTRACTOR MANPOWER REPORTING
7.1 Implementation.

7.1.1 The Office of the Assistant Secretary of the Army (Manpower & Reserve Affairs) operates and maintains a secure Army data collection site where the contractor will report contractor manpower information (including subcontractor manpower information) required for performance of this contract. The contractor shall submit all the information required in the format specified at the following web address: **https://cmra.army.mil/default.aspx**

7.1.2 The Contractors shall fill in the required information on the website, fields are shown below:
- Contract Number
- Delivery Order Number (if applicable)
- Task Order Number (if applicable)
- Requiring Activity Unit Identification Code (UIC)
- Command
- Contractor Contact Information
- Federal Service Code (FSC)
- Direct Labor Hours
- Direct Labor Dollars
- Location Information (where contractor and subcontractors (if applicable) performed the services

7.1.3 Reporting period will be the period of performance not to exceed 12 months ending September 30 of each government fiscal year and must be reported by 15 October of each calendar year.

7.1.4 If your particular contract crosses fiscal years, 2 entries must be made to capture the data for the contract period; for example if the contract start date is 1 January 2007 and ends 31 December 2007, the data for the period from 1 January 2007 through 30 September 2007 shall be entered not later than 15 October 2007 and the period 1 October 2007 through 31 December 2007 shall be entered not later than 15 January 2008.

Attachment A
Performance Requirements Summary:

A.1 The Contractor shall meet the following performance requirements. Performance requirements are addressed in each task and summarized in the following Performance Requirements Summary. If discrepancies or ambiguity exists between the documents, the order of precedence is 1) the Task; 2) Performance Requirements Summary; 3) Performance Metrics

Table A-1 Performance Requirements Summary

Task Application	Objective	Performance Standard	Minimum Acceptable Criteria	Measurement / Monitoring	Incentive/ Disincentive
1	The Contractor shall prepare, submit and gain acceptance of a WP, munitions constituent munitions constituent (MC) UFP-QAPP and QASP that are detailed and comprehensive plans covering all aspects of the project execution. A UFP-QAPP applies only to environmental sampling. Project involves a cap to inter hazardous soil from the open detonation hill and surrounding area of the site, amongst other ancillary items.	Prepare the WP in accordance with DID WERS-001 and EM 1110-1-4009, EM 385-1-1 and , EM 385-1-97. Prepare the sampling and analysis plan, field sampling, and UFP-QAPP in accordance with EM 1110-1-4009, DID WERS-009.01, and UFP-QAPP, as appropriate. UFP-QAPP content shall also meet the requirements of DoD Quality Systems Manual for Environmental Laboratories (current version). Draft QASP includes requirements in regulations, guidance, DIDs and the Quality Control Plan in the WP.	Acceptance of WP and UFP-QAPP with two revisions. Draft QASP reflects requirements and QCP with one revision required.	Review of WP, UFP-QAPP and QASP per guidance to verify that the minimum acceptable content has been provided and acceptance by the project team and regulatory agencies.	Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.
2	Conduct field activities, remove MEC contamination at the required munitions response site (MRS) meeting the project DQOs. This task shall	Field work, data quantity and quality, and analysis of said data provides the results detailed in Paragraph 3.2.5, above;	Conduct the field sampling activities in accordance with the accepted/approved WP. QC data submitted meets Work Plan requirements. No more than 3 CARs	Period inspection/review of field work. Verify compliance with accepted WP and other Plans as required. Quality control tests/documentatio	Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.

	include all field activities necessary to execute this task except MC sampling. MC sampling requirements are covered under Task 8, Environmental Sampling & Analysis.		for non-critical violations and/or 1 CAR for critical violations. No unresolved Corrective Action Requests. All final data and QC tests/documentation submitted. Government QA acceptance QC tests/documentation gained. No Class "A" Safety, contractor at fault, violations during execution of work, <1 non-explosive related Class D, accidents, or <2 non-explosive Class C accidents IAW AR 385-40. Major safety violations, 1 non-explosive related safety violation. Minor safety violations, 2 safety violations. Zero letters of reprimand, grievances, or formal complaints.	n submitted per the QASP for government review. Additionally, statistical confidence will be calculated using the Visual Sampling Plan software, UXO Estimator or other approved statistical method. Boundary precision will be determined by evaluation of the sampling footprint as it relates to the reported contaminated/uncontaminated areas in question. Anomaly density profile and other remediation cost driver precision will be verified by QA of methods used.	
3 (Optional)	Collect sufficient data that meets the project DQOs, of known quality and quantity to determine the nature and extent of munitions constituents (MC) and HTRW to support and perform a human health and ecological baseline risk assessment, as may be required.	Perform field activities in accordance with the Work Plan. MC analyses shall be performed in accordance with the requirements of the Department of Defense (DoD) Quality Assurance Manual (QAM), WERS-009.01 Munitions Constituents Chemical Data Quality Deliverables, and the approved project specific plans.	Sampling field work and data meets established criteria within the accepted Work Plan.	Periodic inspection/review of field work, and data. Verify compliance with the accepted WP. Quality control tests/documentation submitted per the QASP for government review.	Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.

4	Prepare, submit and gain acceptance of Remedial Action Report	Prepare all report documents in accordance with the DIDS and all applicable Federal, State and local regulations.	Acceptance of all report documents with two revisions.	Review of report documents per guidance to verify that the minimum acceptable content has been provided.	Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.
5	The Contractor shall install an engineered cap as designed and approved by the regulators in Task 1. The Contractor shall supply all of the labor, material and equipment necessary to perform this work.	Field work, data quantity and quality, and analysis of said data provides the results required to meet approved plans and be acceptable to the regulators and as further defined in the PWS text.	Conduct the field activities in accordance with the accepted/approved WP. QC data submitted meets Work Plan requirements. No more than 3 CARs for non-critical violations and/or 1 CAR for critical violations. No unresolved Corrective Action Requests. All final data and QC tests/documentation submitted. Government QA acceptance QC tests/documentation gained. No Class "A" Safety, contractor at fault, violations during execution of work, <1 non-explosive related Class D, accidents, or <2 non-explosive Class C accidents IAW AR 385-40. Major safety violations, 1 non-explosive related safety violation. Minor safety violations, 2 safety violations. Zero letters of reprimand, grievances, or formal complaints.	Period inspection/review of field work. Verify compliance with accepted WP and other Plans as required. Quality control tests/documentation submitted per the QASP for government review. Boundary precision will be determined by evaluation of the sampling footprint as it relates to the reported contaminated/ uncontaminated areas in question.	Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.
6	The Contractor	Prepare the plan in	Acceptance of LTM	Review of LTM	Satisfactory or

	shall prepare, submit and gain acceptance of a Long Term Monitoring (LTM) Plan for the monitoring of groundwater and the management of the installed cap.	accordance with DID WERS-001 and EM 1110-1-4009, EM 385-1-1 and EM 385-1-97. Prepare the sampling and analysis plan, field sampling, and UFP-QAPP in accordance with EM 1110-1-4009, DID WERS-009.01, and UFP-QAPP, as appropriate. UFP-QAPP content shall also meet the requirements of DoD Quality Systems Manual for Environmental Laboratories (current version). Draft QASP includes requirements in regulations, guidance, DIDs and the Quality Control Plan in the WP.	Plan and UFP-QAPP with two revisions. Draft QASP reflects requirements and QCP with one revision required.	Plan, UFP-QAPP and QASP per guidance to verify that the minimum acceptable content has been provided and acceptance by the project team and regulatory agencies.	greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.
7	Following regulatory approval of the Long Term Monitoring Plan prepared under Task 5, the Contractor shall implement the Long Term Management (LTM) plan and perform monitoring of the ground water and management of the installed cap. The Contractor shall provide all the labor, material and equipment required to install ground water monitoring	Field work, data quantity and quality, and analysis of said data provides the results required to meet approved plans and be acceptable to the regulators and as further defined in the PWS text.	Conduct the field activities in accordance with the accepted/approved LTM Plan. QC data submitted meets LTM Plan requirements. No more than 3 CARs for non-critical violations and/or 1 CAR for critical violations. No unresolved Corrective Action Requests. All final data and QC tests/documentation submitted. Government QA acceptance QC tests/documentation	Period inspection/review of field work. Verify compliance with accepted LTM Plan and other Plans as required. Quality control tests/documentation submitted per the QASP for government review. Boundary precision will be determined by evaluation of the sampling footprint as it relates to the reported contaminated/ uncontaminated	Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.

	wells required in the approved plan. As part of this task, the contractor shall perform one year of Long Term Monitoring on a quarterly basis. The effort will also include submission and approval of Long Term Monitoring reports presenting a description of the effort performed, the results achieved and recommendations for the next period of monitoring.		gained. No Class "A" Safety, contractor at fault, violations during execution of work, <1 non-explosive related Class D, accidents, or <2 non-explosive Class C accidents IAW AR 385-40. Major safety violations, 1 non-explosive related safety violation. Minor safety violations, 2 safety violations. Zero letters of reprimand, grievances, or formal complaints.	areas in question.	
8 (Optional)	If awarded, the Contractor shall provide additional LTM for the site and perform monitoring of the ground water and management of the installed cap. As part of this task, the contractor shall perform Long Term Monitoring on the basis requested as part of the individual options. The effort will also include submission and approval of Long Term Monitoring reports presenting a description of the effort performed, the results achieved and recommendations for the next period of monitoring.	Field work, data quantity and quality, and analysis of said data provides the results required to meet approved plans and be acceptable to the regulators and as further defined in the PWS text.	Conduct the field activities in accordance with the accepted/approved LTM Plan. QC data submitted meets LTM Plan requirements. No more than 3 CARs for non-critical violations and/or 1 CAR for critical violations. No unresolved Corrective Action Requests. All final data and QC tests/documentation submitted. Government QA acceptance QC tests/documentation gained. No Class "A" Safety, contractor at fault, violations during execution of work, <1 non-explosive related Class D, accidents, or <2 non-explosive Class C accidents IAW AR 385-40. Major safety violations, 1 non-	Period inspection/review of field work. Verify compliance with accepted LTM Plan and other Plans as required. Quality control tests/ documentation submitted per the QASP for government review. Boundary precision will be determined by evaluation of the sampling footprint as it relates to the reported contaminated/ uncontaminated areas in question. Review of reports per guidance to verify that the minimum acceptable content has been provided.	Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.

			explosive related safety violation. Minor safety violations, 2 safety violations. Zero letters of reprimand, grievances, or formal complaints. Acceptance of all report documents (with two revisions) by the Project Team and regulators.		
9 (Optional)	If awarded, the Contractor shall provide an additional (5th overall) year of LTM for the site and perform monitoring of the ground water and management of the installed cap, complete the Five Year Review/report and complete other actions as defined in the PWS text.	As defined in the text.	As defined in the text.	Period inspection/review of field work. Verify compliance with accepted LTM Plan and other Plans as required. Quality control tests/documentation submitted per the QASP for government review. Boundary precision will be determined by evaluation of the sampling footprint as it relates to the reported contaminated/ uncontaminated areas in question. Review of reports per guidance to verify that the minimum acceptable content has been provided.	Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.
10	The Contractor shall manage the task order in accordance with the basic contract statement of work. All project management associated with the task order, with the				

	exception of the direct technical oversight of the work described in the preceding tasks, shall be accounted for in this task.				

Attachment B
PERFORMANCE METRICS

B.1 Performance Metrics for Performance Assessment Record (PAR)

	Exceptional	Very Good	Satisfactory	Marginal	Unsatisfactory
PAR Category: Quality of Product or Service					
Performance indicator: Document reviews					
Draft Plans, Reports, and documents [Plans, documents and reports are considered draft until accepted as final by the Government]	All contract-milestone documents accepted as submitted	No substantive comments (i.e. limited to grammar, spelling, terminology) to any of the documents, but a few exceptions were noted and corrected	Contractor met Acceptance Criteria	One or more documents required revisions to be resubmitted for approval prior to proceeding. Two backchecks were required on one or more documents before original comments were resolved satisfactorily.	One or more documents did not comply with contract requirements, or one or more documents required more than two backchecks before original comments were resolved satisfactorily, or more than one document was rejected.
Performance indicator: Project Execution					
Process Compliance	Zero Corrective Action Requests (CAR) or 948s	{2} CARs for non-critical violations to WP requirements	Contractor met Acceptance Criteria	{6} CARs for non-critical violations and/or {2} CARs for critical violations	{>6} CARS for non-critical violations and/or {>2} CARs/948s for critical violations, or any unresolved CARs
Project Execution	Zero letters of reprimand, grievances, or formal complaints AND one or more unsolicited letters of commendation		Contractor met Acceptance Criteria	{One} letter of reprimand, grievance or formal complaint that was resolved through negotiation	More than {one} letter of reprimand, grievance or formal complaint that were resolved through negotiation
Task Completion			Contractor met Acceptance Criteria		Final data and QC documentation submitted but not accepted
PAR Category: Schedule					
Performance indicator: Timely completion of tasks					
Final Plans and Reports, project milestones, T.O. invoices	All document submittals and task order milestones and	Project closed out/final invoice accepted ahead	Project closed out/final invoice accepted on	Project closed out/final invoice accepted within 30 calendar days	Project closed out/final invoice accepted more

	Exceptional	**Very Good**	**Satisfactory**	**Marginal**	**Unsatisfactory**
	invoices complete and accepted by T.O date, project closed out/final invoice approved ahead of schedule	of schedule	T.O. date	after T.O. date.	than 30 calendar days after T.O. date.
Project status reports accurate			Yes		No
Performance indicator: Impacts to schedule					
Impacts caused by Contractor or other causes identified, in writing to HNC CO/ PM, in a timely manner to apply acceptable corrective actions.			Yes		No
PAR Category: Cost Control (Not Applicable for Firm Fixed Price)					
Performance indicator: No unauthorized cost overruns					
Unauthorized cost overruns			No		Yes
Total Project Costs	Total contract invoices less than 98% of T.O. authorized amount	Total contract invoices greater than 98% but less than 99.99%of T.O. authorized amount	Total contract invoices between 99.99% and 100% of T.O. authorized amount	Total contract invoices greater than 100% but less than 105% of T.O. authorized amount	Total contract invoices greater than or equal to 105% of T.O. authorized amount
Performance indicator: Monthly cost report					
Monthly cost reports accurate			Yes		No
Performance indicator: Impacts to cost					
Impacts caused by Contractor or other causes identified, in writing to HNC CO/PM, in a timely manner to apply acceptable corrective actions.			Yes		No
PAR Category: Business Relations					
Performance indicator: Met contractual obligations					
Corrective Actions taken were timely and effective (Refer to CARs issued to Contractor)			Yes		No
Performance indicator: Professional and Ethical Conduct					

	Exceptional	Very Good	Satisfactory	Marginal	Unsatisfactory
Meetings and correspondences with Public, project delivery team and other stakeholders	Zero letters of reprimand, grievances, or formal complaints AND one or more unsolicited letters of commendation		Contractor met Acceptance Criteria	One letter of reprimand, grievance or formal complaint that was resolved through negotiation	More than one letter of reprimand, grievance or formal complaint that were resolved through negotiation OR removal of one or more project personnel as a results of a letter of reprimand, grievance or formal complaint.
Performance indicator: Customer has overall satisfaction with work performed					
Customer survey results for rating period	4.0-5.0	3.0-3.9	2.0-2.9	1.0-1.9	<1.0
Performance indicator: Personnel responsive and cooperative					
Key personnel responsive, and cooperative	Always		Most Times		Almost Never
PAR Category: Management of Key Personnel and Resources					
Performance indicator: Personnel knowledgeable and effective in their areas of responsibility					
Personnel assigned to tasks	All personnel proposed by Contractor were assigned to project, some personnel were substituted by higher qualified individuals.		All personnel proposed by Contractor were assigned to project, some personnel were substituted by equally qualified individuals.	All personnel proposed by Contractor were assigned to project, some personnel were substituted by equally qualified individuals, Letter of reprimand received for personnel conduct from HNC.	All personnel proposed by Contractor were assigned to project, some personnel were substituted by lesser qualified individuals or HNC requested, in writing, removal of assigned personnel for poor performance.
Performance indicator: Personnel able to manage resources efficiently					
Instances when resource management had negative impact on project execution	0	1-2	3-4	5-6	>6
PAR Category: Safety					
Performance indicator: Accidents and Violations					
*No Class A Accidents,	0 No class A	No class A accidents IAW	Contractor met Acceptance	{<2} non-explosive related	{1} Any Class A

	Exceptional	Very Good	Satisfactory	Marginal	Unsatisfactory
Contractor at fault	accidents IAW AR 385-10	AR 385-10	Criteria	Class C accidents, or {1} non-explosive Class B accident, IAW AR 385-10	accident IAW AR-385-10, or Any explosive related accident.
*Major safety violations	0 accidents/injuries No safety violations	0 accidents/injuries No safety violations		{2} non-explosive safety violations.	{>1} any violation of procedures for handling, storage, transportation, or use of explosives IAW the WP, and all Federal, State and local laws/ordinances
*Minor safety violations	No safety violations	1 safety violation		{3} safety violations	{>3} safety violations

Classes of Accidents:

- **Class A:** Fatality or permanent total disability (Government Civilian, Military Personnel, and/or Contractor), or >$2,000,000 property damage.

- **Class B:** Permanent partial disability or impatient hospitalization of 3 or more persons (Government Civilian, Military Personnel, and/or Contractor), $500,000< $2,000,000 property damage.

- **Class C:** Lost Workday (Contractor) or Lost Time (Government Civilians), $50,000< $500,000 property damage.

- **Class D:** $2000 < $50,000 property damage.

* From Section C of Solicitation Number W912DY-08-R-0016, Amendment 0007 (may be included but are not limited to these).

The following guidelines are provided for issuing ratings that are subjective in nature, these ratings will be supported by the weight of evidence documented during the government's surveillance efforts:

Exceptional: Performance *meets* contractual requirements and *exceeds many* to the Government's benefit. The contractual performance of the element or sub-element being assessed was accomplished with *few minor problems* for which corrective actions taken by the Contractor were *highly effective*.

Very Good: Performance *meets* contractual requirements and *exceeds some* to the Government's benefit. The contractual performance of the element or sub-element being assessed was accomplished with *some minor problems* for which corrective actions taken by the Contractor were *effective*.

Satisfactory: Performance *meets* contractual requirements. The contractual performance of the element or sub-element contains *some minor problems* for which corrective actions taken by the Contractor *appear or were satisfactory*.

Marginal: Performance *does not meet all* contractual requirements. The contractual performance of the element or sub-element being assessed reflects a *serious problem* for which the Contractor has *not yet identified corrective actions.* The Contractor's proposed actions appear only *marginally effective or were not fully implemented.*

Unsatisfactory: Performance *does not meet most* contractual requirements and *recovery is not likely* in a timely manner. The contractual performance of the element or sub-element contains *serious problems* for which the Contractor's corrective actions *appear or were ineffective*

Attachment C

Price Spreadsheet

Firm Fixed Price Lump Sum Prices offered and accepted are the sole basis of this contract. Unit Prices included herein have no bearing on the task order price and are proposed only to provide a basis for determining a fair and reasonable price if the Government in its sole discretion chooses to modify the performance requirements of this task order. This is a performance based task order and the inclusion of unit prices in the proposal shall in no way be construed as the Government procuring a specified number of units of any given service. The contract is for the provision of services that ultimately meet the performance requirements of each task.

Seneca ADA OB/OD Grounds Remedial Action				
Task, Title, Type	Qty	Unit	Price	Total
BASIC TASKS				
Task 1. Preparation of Work Plans and Designs (FFP)	1.0	LS		
Task 2. Field Sampling Activities (FFP/FUP).				
Task 2a.1 (Formerly Task 2a.1 and 2a.3). The Contractor shall geophysically map the 0-1000 foot radius area (58.4 acres). The Contractor shall delineate all areas which exhibit metallic saturation, whereby individual anomalies >50mV are not distinguishable. The Contractor's work shall include construction support while this work is on-going.	58.4	Acres		
Task 2a.2 (Formerly Task 2a.4). The Contractor shall excavate those areas exhibiting metallic saturation to a depth of 6 inches, pushing or transporting the excavated soils to within the 0-500 foot radius area and regrading these with the existing OD hill material. The regraded material shall be maintained within the 0-500 foot radius area as necessary. The Contractor's work shall include construction support while earth work is on-going. **For the purposes of estimation, the Contractor shall assume that 20 acres of this overall area will exhibit saturation.**	20	Acres		Plus FUP per additional acre.
Task 2a.3 (Formerly Task 2b.1 and 2b.2). The Contractor shall perform a surface sweep of the existing OD hill material for potential MPPEH. The Contractor shall remove all MPPEH in the regraded OD hill material. For the purposes of estimation, the Contractor shall assume that this will amount to 50 anomalies per acre or 900 anomalies.	900	Anomalies		Plus FUP per additional anomaly.
Task 2a.4 (Formerly Task 2a.5). The Contractor shall geophysically re-map the portions of the 500-1000 foot radius area which were considered saturated and which were excavated to a depth of 6 inches. **For the purposes of estimation, the Contractor shall assume that 20 acres of this overall area will require re-mapping.** The Contractor's work shall include construction support while this work is on-going.	20	Acres		Plus FUP per additional acre.
Task 2a.5 (Formerly Task 2a.2). The Contractor shall reacquire and prosecute all identified, mapped targets in the area of the 500-1000 foot radius which exceed the 50mV threshold (15,240).	15,240	Anomalies		Plus FUP per additional anomaly.
Task 2c, Area of 0-1000 foot radius for the existing OD Hill. The Contractor shall mag, flag and prosecute identified targets in wooded or severely overgrown or sloped terrain in this area. For purposes of estimation, the cost for this task shall be based upon 700 anomalies per acre and an FUP cost per additional anomaly given as well	9,800	Anomalies		Plus FUP per additional anomaly.
Task 2g, Open Burning Tray. The Contractor shall close the Open Burning Tray IAW the approved work plan	1.0	LS		

Seneca ADA OB/OD Grounds Remedial Action				
Task, Title, Type	Qty	Unit	Price	Total
Task 3, Environmental Sampling & Analysis (Optional): (FFP/FUP)	2	EA/SDG		
Task 4, Remedial Action Report (FFP)	1.0	LS		
Task 5, Installation of an Engineered Cap (FFP)	1.0	LS		
Task 6, Preparation of a Long Term Monitoring Plan	1.0	LS		
Task 7, Performance of Long Term Monitoring	1.0	LS		
Task 10, Project Management	1.0	LS		
			Basic Tasks Total	
OPTIONAL TASKS				
Task 8. Performance of Additional Long Term Monitoring (Optional)				
Task 8.1, Performance of An Additional Year of Long Term Monitoring (Optional). If awarded, the Contractor shall provide LTM for an additional (2nd overall) year on a quarterly basis.	1.0	LS		
Task 8.2, Performance of An Additional Year of Long Term Monitoring (Optional). If awarded, the Contractor shall provide LTM for an additional (3rd overall) year on a quarterly basis.	1.0	LS		
Task 8.3, Performance of An Additional Year of Long Term Monitoring (Optional). If awarded, the Contractor shall provide LTM for an additional (4th overall) year on a semi-annual basis.	1.0	LS		
Task 9, Performance of Five Year Review (Optional).	1.0	LS		
			Optional Tasks Total	
			Overall Total	

Attachment E

Available Reference Documents

Title	Author	Date
Federal Facility Agreement	US Army	1993
Expanded Site Investigation for Seven High Priority SWMU SEAD 1,16,17,24, 25,26,45	Engineering Science Inc.	Dec 1995
SWMU Classification Report Seneca Army Depot Activity	Engineering Science Inc	Sep 1994
Generic Site Wide Sampling and Analysis Plan for Seneca Army Depot Activity Revised Final	Parson	Jan2006
Ordnance and Explosive Engineering Evaluation/Cost Analysis	Parsons	Feb 2005
Final Site Specific Project report SEAD 45/115 Open Detonation Grounds Ordnance and Explosives Removal Phase I Geophysical Survey and Cost Estimate	Weston Solutions	Mar 2005
Additional Munitions Response Site Investigation Report	Parsons	May 2010
Final Closure Plan Open Burn Tray in Solid Waste Management Unit SEAD 23	Parsons	October 2005
Final Long Term Monitoring Plan for the Open Burning (OB) Grounds	Parsons	Jan 2007
Explosive Safety Submission SEAD 45/115 including Amendments 1-3	Seneca Army Depot	May2010

Attachment F

List Of Acronyms

AEDB-R	Army Environmental Database - Restoration Module
APP	Accident Prevention Plan
AR	Administrative Record
ARAR	Applicable or Relevant and Appropriate Requirement
BEC	Base Realignment and Closure Environmental Coordinator
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLIN	Contract Line Item Number
CONUS	Continental United States
COR	Contracting Officer's Representative
CPAR	Contractor Performance Assessment Report
CRP	Community Relations Plan
CWM	Chemical Warfare Materiel
DA	Department of the Army
DDESB	Defense Explosives Safety Board
DERP	Defense Environmental Restoration Program
DID	Data Item Description
DMM	Discarded Military Munitions
DoD	Department of Defense
EM	Engineer Manual
EMS	Environmental Management System
EOD	Explosive Ordnance Disposal
ERIS	Environmental Restoration Information System
ESP	Explosives Site Plan
ESS	Explosives Safety Submission
FAR	Federal Acquisition Regulation
FFA	Federal Facility Agreement
FFPR	Firm-Fixed Price Remediation

FGDC	Federal Geographic Data Committee
FS	Feasibility Study
FSC	Financial Size Category
GIS	Geographic Information System
HRR	Historical Records Review
IAP	Installation Action Plan
IRP	Installation Restoration Program
IRIS	Integrated Risk Information System
KO	Contracting Officer
LTM	Long-Term Management
LUC	Land Use Controls
MC	Munitions Constituents
MCL	Maximum Contaminant Level
MD	Munitions Debris
MEC	Munitions and Explosives of Concern
MM	Military Munitions
MMRP	Military Munitions Response Program
MPPEH	Material Potentially Presenting an Explosive Hazard
MR	Munitions Response
MRS	Munitions Response Site
MRSPP	Munitions Response Site Prioritization Protocol
NCP	National Oil and Hazardous Substances Contingency Plan
NELAP	National Environmental Laboratory Accreditation Program
NYSDEC	New York State Department of Environmental Conservation
NPL	National Priorities List
NTP	Notice to Proceed
OSHA	Occupational Safety and Health Administration
PBA	Performance Based Acquisition
P/C	Pollutants and/or Contaminants
PMP	Project Management Plan
POP	Period of Performance
PPE	Personal Protective Equipment
PWS	Performance Work Statement
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QASP	Quality Assurance Surveillance Plan
RAB	Restoration Advisory Board
RC	Response Complete
RCRA	Resource Conservation and Recovery Act
RCWM	Recovered Chemical Warfare Materiel

RDX	Cyclotrimethylenetrinitramine
RfD	Reference Dose
RI	Remedial Investigation
RIP	Remedy In Place
ROD	Record of Decision
ROE	Rights of Entry
RPO	Real Property Officer
SARA	Superfund Amendments and Reauthorization Act
SC	Site Closeout
SI	Site Inspection
SME	Subject Matter Expert
SSHP	Site Safety and Health Plan
TNT	Trinitrotoluene
USACE	U.S. Army Corps of Engineers
USAEC	U.S. Army Environmental Command
USEPA	U.S. Environmental Protection Agency
U.S.C.	United States Code
UXO	Unexploded Ordnance
VOC	Volatile Organic Compound

Attachment G

Definitions

Activity-Based Schedule: Activities and milestones defined at the detail level and logically sequenced to support, and manage completion of the performance objectives.

Contractor's Project Costs: Costs incurred by the Contractor (including costs covered by insurance and the PMP) in executing the work required to achieve the performance objectives identified in the PWS for all sites identified in this contract/task order.

Chemical Warfare Materiel (CWM): An item configured as a munitions containing a chemical substance that is intended to kill, seriously injure, or incapacitate a person through its physiological effects. CWM also includes V- and G- services nerve agent, H-series blister agent, and lewisite in other than munitions configurations. Due to their hazards, prevalence, and military-unique application, Chemical Agent Identification Sets (CAIS) are also considered CWM. CWM does not include riot control agency, chemical herbicides, smoke and flame producing items, or soil, water, debris, or other media contaminated with chemical agent.

Deliverables: Documentation or data that support the completion of milestones or achievement of the performance objectives identified in this PWS.

Discarded Military Munitions (DMM) – Military munitions that have been abandoned without proper disposal or removed from storage in a military magazine or other storage area for the purpose of disposal. The term does not include unexploded ordnance, military munitions that are being held for future use or planned disposal, or military munitions that have been properly disposed of consistent with applicable environmental laws and regulations.

Explosive Ordnance Disposal (EOD) – The detection, identification, on-site evaluation, rendering safe, recovery, and final disposal of unexploded explosive ordnance. It may also include explosive ordnance that has become hazardous by damage or deterioration.

Long-Term Management (LTM): The remedial phase including maintenance, monitoring, record keeping, remedy reviews, etc. initiated after response (removal or remedial) objectives have been met (i.e., after Response Complete). LTM includes development and implementation of an exit or ramp-down strategy for LTM activities at each site.

Milestones: Significant events or activities that occur in the course of the Contractor achieving the performance objectives identified in this PWS.

Military Munitions (MM) – All ammunition products and components produced or used by or for the DoD or the U.S. Armed Services for national defense and security, including MM under the control of the DoD, the U.S. Coast Guard, the U.S. Department of Energy, and National Guard personnel. The term military munitions includes: confined gaseous, liquid, and solid propellants, explosives, pyrotechnics, chemical and riot control agents, smokes, and incendiaries used by DoD components, including bulk explosives and chemical warfare agents, chemical munitions, rockets, guided and ballistic missiles, bombs, warheads, mortar rounds, artillery ammunition, small arms ammunition, grenades, mines, torpedoes, depth charges, cluster munitions and dispensers, demolition charges, and devices and components thereof. MM do not include wholly inert items, improvised explosive devices, and nuclear weapons, nuclear devices, and nuclear components thereof. However, the term does include non-nuclear

components of nuclear devices, managed under DOE's nuclear weapons program, after all required sanitization operations under the Atomic Energy Act of 1954, as amended, have been completed.

Munitions Constituents (MC): Any materials originating from unexploded ordnance, DMM, or other military munitions, including explosive and non-explosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions.

Munitions Debris (MD) – Remnants of munitions (e.g., fragments, penetrators, projectiles, shell casings, links, fins) remaining after munitions use, demilitarization, or disposal.

Munitions and Explosives of Concern (MEC): This term, which distinguishes specific categories of military munitions that may pose unique explosives safety risks, means UXO, as defined in 10 .SC 101(e)(5)(A) through (C); DMM, as defined in 10 USC 2710(e)(2); or MC (e.g., TNT, RDX), as defined in 10 USC 2710(e)(3), present in high enough concentrations to pose an explosive hazard.

Munitions response – A response action, including investigation, removal actions, and remedial actions, to address the explosives safety, human health, and/or environmental risks presented by munitions and explosives of concern (MEC) and/or MC.

PMP Documents: The original PMP (including project schedule), revisions, and status reports.

Project Documents (CERCLA): Documentation and data required by CERCLA remediation and RA(O) and/or LTM activities. These documents include the additional site plans referenced in Section 5.0 of this PWS.

Project Price: The approved proposed price for achieving completion of remediation services in accordance with the PWS, the payment of which will be tied to one or more project milestones. The Project Price does not include the cost of the PMP, insurance premiums or surplus line taxes, if applicable.

Project-related information: All previous environmental restoration documentation of a technical nature developed by the Army and previous Army contractors and subcontractors during their work at the sites specified in this PWS, and all the documentation developed by the Contractor in order to achieve the performance objectives specified in this PWS.

Site Close-Out: Site Close-Out signifies when the Army has completed active management and monitoring at an environmental cleanup site, no additional environmental cleanup funds will be expended at the site and the Army has obtained regulator concurrence. For practical purposes, Site Close-Out occurs when cleanup goals have been achieved that allow unrestricted use of the property (i.e., no further LTM, including institutional controls, is required). Site Close-Out may include, but not be limited to, the dismantling, removal, recycling, reclamation and/or disposal of all remedial activity systems and ancillary equipment above and underground to return the site to its natural state.

Unexploded ordnance (UXO): Military munitions that have been primed, fuzed, armed, or otherwise prepared for action; have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installations, personnel, or material; and remain unexploded either by malfunction, design, or any other cause.

Appendix B

Site Maps

(This appendix is a placeholder only. All site maps are contained in the body of the report)

Appendix C

Points of Contacts

Appendix C Points of Contact for OD Grounds Seneca Army Depot Activity

Name of	Organization	Telephone Number	Fax Number
Janice Jamar Janice.A.Jamar@usace.army.mil	US Army Engineering & Support Center, Huntsville (KO) Attn: CEHNC-CT-E (Ms. Janice Jamar) PO Box 1600 Huntsville, AL 35807-4301 4820 University Square Huntsville, AL 35816-1822	(256) 895-1343	
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Steve Absolom Stephen.M.Absolom@us.army.mil	Commander's Representative Seneca Army Depot Activity Attn: Mr. Stephen Absolom (BRAC Environmental Coordinator) 5786 Route 96 Building 123 Seneca Army Depot Romulus, New York 14541	(607) 869-1309	(607) 869-1309
Mr. Keith Hoddinott	US Army Public Health Command (Environmental Health Risk Assessor)	(410) 436-5209	(410) 436-5237

Name of	Organization	Telephone Number	Fax Number
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Mark Sergott Mss04@health.state.ny.us	Mr. Mark Sergott Bureau of Environmental Exposure Investigation, Room 300 New York State Department of Health 547 River Street, Flanigan Square Troy, New York 12180	(518) 402-7860	NA
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Appendix D

Accident Prevention Plan

Draft
Accident Prevention Plan for MEC Clearance at Open Detonation (OD) Grounds Seneca Army Depot Activity, New York

Prepared for U.S. Army Engineering and Support Center
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Contract No. W912DY-10-D-0014, Task Order No. 0005
Shaw Project No. 144717
Rev 0
June 2012

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Acronyms and Abbreviations

°C	degrees Celsius
°F	degrees Fahrenheit
AHA	Activity Hazard Analysis
APP	Accident Prevention Plan
CAMP	Community Air Monitoring Plan
CERCLA	Comprehensive Environmental, Response, Compensation, and Liability Act of 1980 (aka Superfund)
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
COR	Contracting Officer's Representative
CPR	cardiopulmonary resuscitation
CWM	chemical warfare materiel
DAF	Disciplinary Action Form
DoD	U.S. Department of Defense
DUI/DWI	driving under the influence/driving while intoxicated
EAP	Employee Assistance Program
EH&S	environmental, health, and safety
EM	engineering manual
ENG	Engineer
EOD	explosives ordnance disposal
ESS	Explosives Safety Submission
EZ	exclusion zone
ft	foot or feet
H&S	health and safety
HARP	hazard assessment resolution process
HAZWOPER	hazardous waste operations and emergency response
HIPPA	Health Insurance Portability and Accountability Act
HSM	Health and Safety Manager
HTRW	Hazardous, Toxic, and Radioactive Waste
JSA	Job Safety Analysis
KO	Contracting Officer
LWD	lost workday
MC	munitions constituents
MD	munitions debris
MEC	munitions and explosives of concern
MMRP	Military Munitions Response Program

Acronyms and Abbreviations *(continued)*

MPPEH	material potentially presenting an explosive hazard
MRS	munitions response site
MSDS	Material Safety Data Sheet
mV	millivolts
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OB	open burning
OD	open detonation
OESS	Ordnance and Explosives Safety Specialist
OSHA	Occupational Safety and Health Administration
OTI	Outreach Training Institute
PM	Project Manager
PPE	personal protective equipment
PVC	polyvinyl chloride
PWS	performance work statement
RI/FS	Remedial Investigation/Feasibility Study
SEAD	Seneca Army Depot
Shaw	Shaw Environmental & Infrastructure, Inc.
SOP	standard operating procedure
SSHO	Site Safety and Health Officer
SSHP	Site Safety and Health Plan
SSO	Site Safety Officer
SUXOS	Senior Unexploded Ordnance Supervisor
TP	technical publication
USACE	U.S. Army Corps of Engineers
USAESCH	U.S. Army Engineering and Support Center, Huntsville
UXO	unexploded ordnance
UXOSO	Unexploded Ordnance Safety Officer
VOC	volatile organic compound
WBGT	wet bulb globe temperatures
WERS	Worldwide Environmental Remediation Services

Accident Prevention Plan (APP) Acknowledgement

WORKER ACKNOWLEDGEMENT OF THE APP AND SITE SAFETY ORIENTATION

I have read or been trained on the contents of this APP and I understand and agree to abide by its requirements. I also have been properly trained and medically-monitored as required in this APP for the work that I am to perform at Seneca Army Depot. I understand that failure to comply with the provisions of this plan can lead to disciplinary action and possible termination from the project or Shaw. I have read or been instructed as to hazard controls specified in the activity hazard analysis and understand the Shaw requirements to perform daily job safety task analysis evaluation. Documentation of worker acknowledgment will be placed in the Project Records.

Printed Name	Signature	Date

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1.0 BACKGROUND INFORMATION

1.0.0.0. This Accident Prevention Plan (APP) describes the health and safety (H&S) guidelines and considerations developed to protect on-site personnel, visitors, and the public from potential hazards while performing a Munitions and Explosives of Concern (MEC) Clearance at Open Detonation (OD) Grounds at Seneca Army Depot (SEAD), Romulus, New York. This Task Order was established to conduct a remedial action within the 0- to 1,000-foot (ft) radius area surrounding the former OD Area to remove material potentially presenting an explosive hazard (MPPEH) as well as closing the Open Burning Tray. A landfill cap will also be placed at the site following the MEC remedial activities. Long-term groundwater monitoring will occur following installation of the cap, as well. These field activities are anticipated to take place in 2013. The construction of the landfill cap and long term monitoring activities will be addressed in separate planning documents which will be drafted after the completion of the MEC remedial action. Therefore this APP will be amended to include those activities at that time. This will also allow an opportunity to update the APP prior to implementing field activities in 2013.

1.0.0.1. Shaw Environmental & Infrastructure, Inc. (Shaw) will perform this work for the U.S. Army Engineering Support Center, Huntsville (USAESCH) under the Worldwide Environmental Remediation Services (WERS) Contract W912DY-10-D-0014, Task Order No. 0005. This document shall be used in conjunction with the Shaw Environmental & Infrastructure, Inc. H&S policies and procedures, a Site Safety and Health Plan (SSHP), Federal, State and local regulations and established U.S. Army Corps of Engineers (USACE) technical and administrative procedures. The SSHP cited herein is included as **Attachment D-5** to this APP.

1.0.0.2. The procedures and guidelines contained herein were based upon the best available information at the time of the plan's preparation. Specific requirements may be revised if new information is received or conditions change. Written amendments will document any changes made to the plan and will be included as an addendum to the SSHP. Pursuant to WERS Data Item Description 005.01, *Accident Prevention Plan (APP) for Conventional Ordnance and Explosives Projects,* this APP has been prepared in accordance with engineering manual (EM) 385-1-1, Appendix A, Section 28, Hazardous Waste Operations and Emergency Response (HAZWOPER), and EM 385-1-97. In addition, this remedial action is being performed in accordance with the Explosives Safety Submission (ESS) that is being utilized for this scope of work.

1.1 Site Location and Project Objective

1.1.0.0. The SEAD facility is located in Seneca County, Romulus, New York. It is a former U.S. Army site that at one time occupied approximately 10,587 acres. SEAD was owned by the U.S. Government and Operated by the Department of the Army from 1941 until 2000. In 2000, the Army assumed a caretaker role at the SEAD, and since this time more than 8,500 acres have been transferred to other parties. It is bounded to the west by State Route 96A and to the east by State Route 96. Geneva and Rochester are located to the northwest (14 and 50 miles, respectively), Syracuse is 50 miles to the northeast, and Ithaca is 31 miles to the south. The surrounding area outside the SEAD property is used mainly for agriculture. A site vicinity map is provided on **Figure 1-1**.

Figure 1-1 Site Vicinity Map

1.1.0.1. The OD Grounds is located in the northwestern corner of SEAD and is designated SEAD-45. The OD Grounds, together with the Open Burning (OB) Grounds, comprise the 365-acre demolition area at SEAD. The OB Grounds were previously closed with the exception of one burn tray. One burn tray was left operational so it could be used for MEC demolition, if needed as part of the remediation of the OD Grounds. The remainder of the OB Grounds has been closed and is therefore not part of this scope of work. This

scope of work includes a circular area formed by a 1,000-ft radius (approximately 72 acres) from the center of the OD Hill and closure of the Open Burning Tray.

1.1.0.2. The Open Burning Tray is located within the OB Grounds (SEAD-23) in the northwestern portion of SEAD, approximately 3.5 miles northwest of SEAD's main entry gate off New York State Highway Route 96. The Open Burning Tray falls within the 1,000-ft radius covered within this scope of work.

1.2 Phases of Work and Hazardous Activities

1.2.0.0. The major stages of the MEC/munitions debris (MD)/MPPEH clearance include site preparation and brush clearing, mag and dig, digital geophysical mapping, and excavation of anomalies. If MEC is encountered during the surface debris removal, surface clearance, excavation of anomalies, etc., the protocol for identifying, handling, and disposing of the item will be implemented in accordance with the accepted Work Plan. The primary phases of work and potentially hazardous MEC clearance activities include the following:

a. Geophysically map the 0- to 1,000-ft radius area with the exception of those areas that are wooded or severely overgrown or have sloped terrain. Delineate all areas which exhibit metallic saturation, whereby individual targets exhibiting a signal >50 millivolts (mV) are not distinguishable. A surface sweep will be performed prior to conducting the geophysical survey to remove MPPEH and other metal that may impede the geophysical survey. The surface sweep will focus on clearing MPPEH and metal of a sufficient size to interfere with the geophysical survey.

b. Excavate those areas exhibiting metallic saturation to a depth of 6 inches, sifting the soils to remove any MPPEH that might be present, ultimately transporting the excavated soils to within the anticipated cap footprint and regrading the excavated soils with the existing OD hill material. Areas exhibiting metallic saturation are defined as areas within which individual targets with signals over 50 mV cannot be discriminated. The regraded material will be maintained within the anticipated capping footprint area until it can be interred beneath the cap. Construction support will be performed while earth work is ongoing.

c. Geophysically remap the portions of the 0- to 1,000-ft radius area which were considered saturated and which were excavated to a depth of 6 inches. Repeat steps a and b until targets in all portions of the 0- to 1,000-ft radius can be mapped.

d. Reacquire and prosecute all identified, mapped targets in the area of the 0- to 1,000-ft radius which exceed the 50 mV threshold.

e. In the area of 0- to 1,000-ft radius for the existing OD Hill, identified targets in wooded or severely overgrown or sloped terrain will be located using magnetometers and prosecuted (i.e., mag and dig).

f. Close the Open Burning Tray in accordance with the approved *Closure Plan for the Open Burning Tray in Solid Waste Management Unit – SEAD-23* (Parsons, 2005).

1.2.0.1. Activity Hazard Analyses (AHAs) have been prepared for each of the anticipated work activities and are included in Appendix 1 of the SSHP (**Attachment D-5**). AHAs for the following activities have been prepared:

a. Site Mobilization/Preparation;

b. Vehicle Operations;

c. Analog Aided Visual Site Inspection;

d. Vegetation Removal;

e. Geophysical Survey Operations;

f. Fueling Operations;

g. Excavation of MEC;

h. Operation of Earth Moving Machinery and Material Handling Equipment;

i. MEC Demolition Operations; and,

j. Ash Handling.

1.3 Shaw Accident Experience

Table 1-1 below provides the Shaw experience modification rate and U.S. Occupational Safety and Health Administration (OSHA) recordable incident rate for 2009-2011. Shaw's Experience Modification Rate is more than half of the industry standard for companies performing similar services based on the North American Industry Classification System.

Table 1-1
Shaw Accident Experience

Year	Experience Modification Rate Interstate	OSHA Recordable Incident Rate
2011	0.44	0.71
2010	0.48	0.82
2009	0.51	1.10

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2.0 STATEMENT OF SAFETY AND HEALTH POLICY

2.0.0.0. It is the policy of Shaw to provide a safe and healthful workplace for all employees, subcontractors, clients and consultants in compliance with governmental requirements. Additionally, the requirements of our clients shall take precedence, provided that their requirements exceed those of Shaw and governmental regulations.

2.0.0.1. We believe in two fundamental principles of safety: (1) all accidents, injuries, and occupational illnesses are preventable; and (2) if an operation cannot be done safely, we will not do it. To put these principles into practice, every associate will receive the appropriate training, equipment, and other resources necessary to complete assigned tasks in a safe and efficient manner.

2.0.0.2. Safety, industrial hygiene, and accident prevention are the direct responsibility of all members of management, who must create an environment in which everyone shares a concern for their own safety and the safety of their associates. Safety shall take precedence over expediency or shortcuts. It is a condition of employment that all employees work safely and follow established safety rules and procedures. No individual(s) may pose a direct threat to the H&S of other individuals in the workplace.

2.0.0.3. Managers must conduct their businesses in compliance with governmental safety regulations and company procedures. All Shaw H&S standard operating procedures (SOPs) shall be implemented for all Shaw employees on all projects where Shaw is the prime contractor, subcontractor or a joint venture partner. When Shaw is the prime contractor, Shaw procedures shall be applied to all subcontractor personnel.

2.0.0.4. The implementation of effective safety and health practices is a key measure of managerial performance. Management, with the assistance of the internal H&S professional staff, will conduct audits to assess the effectiveness of the safety program(s) in place, and to identify areas for improvement. All deficiencies shall be corrected promptly.

2.0.0.5. All injuries, occupational illnesses, vehicle accidents, and incidents with potential for injury or loss will be investigated. Appropriate corrective measures will be taken to prevent recurrence, and to continually improve the safety of our workplace.

2.1 Safety Program Goals, Objectives, and Accident Experience Goals

2.1.0.0. Shaw considers safety the highest objective and has established a goal of **zero incidents, injuries and environmental harm** for all projects. This is also referred to as the Targeting Zero program. The remediation at SEAD shall be conducted in a manner that

minimizes the probability of near misses, equipment/property damage and injury. Shaw will establish programs to recognize people and projects that demonstrate excellence in safety performance. Shaw will use safety observation programs to identify and correct unsafe acts and conditions. Safety awareness programs will be used to provide continuous training and development of good safe work practices. Shaw site supervision will investigate all incidents to determine root causes and institute corrective actions to prevent recurrence. Shaw will provide and enforce safety rules to protect employees, subcontractors, clients, and the public.

2.1.0.1. Specific goals for safety performance and incident prevention have been established through the Shaw Federal Business Line Safety Council as follows:

a. Lost workday (LWD) case incident rate: 0

b. Total recordable incident rate: 0.88

c. Chargeable vehicle accident rate: 0.11

2.1.0.2. The accident experience goal for this contract is **zero accidents**.

2.2 Shaw Employee Safety Responsibility Requirements

Each employee is responsible for personal safety as well as the safety of others in the area and is expected to participate fully in the Safety Improvement Process, particularly the Safety Observation Program. Employees will use all equipment provided in a safe and responsible manner as directed by the Senior Unexploded Ordnance Supervisor (SUXOS) or the Unexploded Ordnance Safety Officer (UXOSO). All Shaw personnel will follow the policies set forth in the Shaw H&S Procedures EIG-HS-001-999 (available on site on compact disc or through a secure intranet). Site personnel concerned with any aspect of H&S shall bring it to the attention of the SUXOS or the Project Manager (PM). If not satisfied, they should contact the Shaw Health and Safety Manager (HSM). All project personnel have the authority to stop work if, in their judgment, serious injury or environmental harm could result from continued activity. The SUXOS or the PM shall be notified immediately if this becomes necessary. When a stop work is issued, the HSM and USAESCH Ordnance and Explosives Safety Specialist (OESS) will be notified within 1 hour. To protect the H&S of all personnel, employees that knowingly disregard safety policies or procedures could be subject to disciplinary actions up to and including termination. Shaw Employee Safety Responsibility is fully detailed in Shaw SOP EIG-HS-010, Employee Safety and Health Work Rules. Disciplinary action will follow SEI-GUIDE-004, Guidelines for Standard Safety Disciplinary Actions.

2.3 Managers and Supervisors Safety Accountability

2.3.0.0. It is the duty of the first-line supervisor to motivate employees to adhere to Shaw's safety policy in each work situation. A first-line supervisor for these purposes is defined as that person designated to give immediate on-site supervision to personnel involved in a task. For the MEC clearance at SEAD, this person is the SUXOS or Site Manager.

2.3.0.1. All Field Team Leaders shall have complete knowledge of the safe procedure for all jobs and tasks under their supervision, or when in doubt, shall seek assistance prior to initiating a task. This is the only acceptable manner in which to perform the task. If the task cannot be accomplished safely, it will not be attempted. The SUXOS or his designee shall:

a. Explain the safety procedure involved with a task to each employee and check frequently to see that the employee understands and works as instructed.

b. Allocate sufficient time for the training and coaching of all employees to ensure that everyone knows the correct procedure for safely accomplishing required tasks.

c. Prevent new employees from performing any tasks until required training is completed.

d. Immediately correct unsafe conditions that involve site employees or contractors.

e. Ensure that the employees are outfitted with and wear personal protective equipment (PPE) as specified by the SSHP and other Shaw procedures or as directed by the HSM or UXOSO.

f. Set a good safety example.

g. Obtain the cooperation of employees and contractors.

h. Provide a safe work environment for employees and contractors.

i. Confirm contractor safety performance records have been verified prior to contract award and monitor contractor performance during operations.

j. Report all accidents, near misses and property damage in accordance with Shaw SOP EIG-HS-020, Accident Prevention Program: Reporting, Investigation, and Review (**Attachment D-2**).

k. Establish a safety culture, using the elements of the Shaw Safety Improvement process, which promotes awareness, encourages participation, and recognizes excellence.

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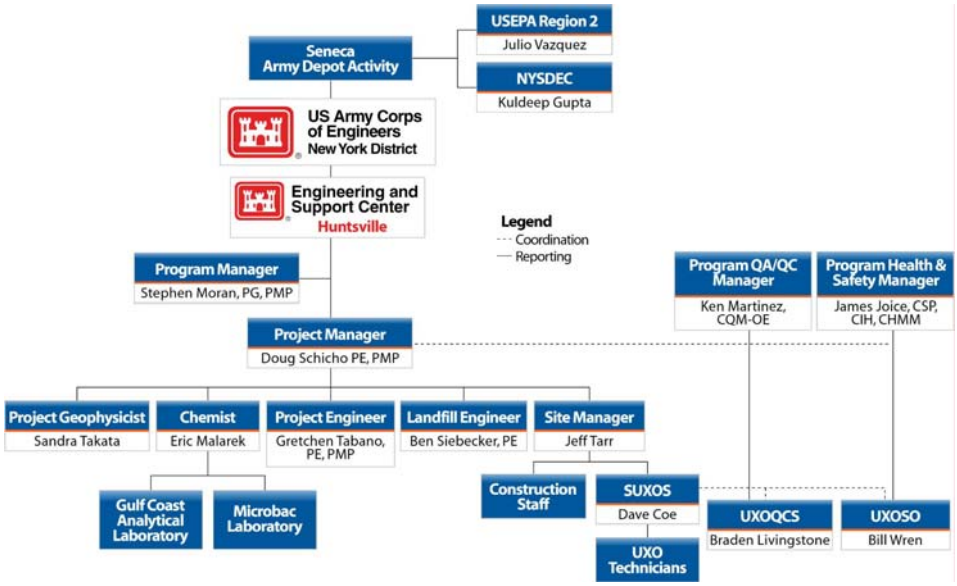
3.0 RESPONSIBILITIES AND LINES OF AUTHORITY

3.0.0.0. Shaw is committed to employee H&S as an integral part of business conduct. Shaw considers employee safety a priority moral obligation while maintaining compliance with Federal, State and Army regulations, particularly Public Law 91-596 the OSHA Act of 1970. As defined by the Act, an employer is any "person engaged in a business affecting commerce that has employees, but does not include the United States or any State or political subdivision of a State." It is the policy and responsibility of Shaw to provide a safe and healthy work environment for all employees and subcontractors. The President and CEO for Shaw, Jim Bernhard, has ultimate responsibility for the H&S of employees and has granted all employees stop work authorization, without fear of reprimand or retaliation-to immediately stop work activity that presents a danger to you, your co-worker, our clients, partners, or the public. Andrew Johnson is the Director of Safety for Shaw and monitors the overall effectiveness of the H&S program. It is every employee's responsibility to question and correct any situation that is not in compliance with our Environmental, Health, and Safety (EH&S) policies. Employees are to report any condition or activities that involve violation of Shaw's policies. If an employee does not feel the issue is addressed adequately, they have the responsibility to raise the issue to a higher level.

3.0.0.1. The overall project organization and reporting structure is presented in the Site-Specific Work Plan, Section 2.0, Technical Management Plan and the following section of this APP. H&S personnel, organization, qualifications, and responsibilities are addressed in more detail in this section. No work shall be performed on site unless a Shaw designated competent person is supervising these activities. The UXOSO William Wren is the Shaw designated competent person to perform as Site Safety and Health Officer (SSHO) for all MEC operations, is a UXO Technician III, and has completed OSHA 30-hour Construction Industry training. The 30-hour training included OSHA required topics presented by qualified Outreach Training Institute (OTI) instructors. Shaw's qualified OTI instructors follow course curriculum areas as required by OSHA and EM 385-1-1 Appendix A (4)(b), 1 through 9. Mr. Wren has more than 10 years experience in HAZWOPER and Explosives Ordnance Disposal (EOD) operations and will report directly to the Program HSM, James Joice, for matters related to safety and health. The HSM reports directly to David Mummert, Certified Industrial Hygienist (CIH) and Director for Shaw's ERC Business Line H&S program. The SUXOS, David Coe, also has required EOD and HAZWOPER training prerequisites in accordance with Technical Publication (TP)-18, EM 385-1-97, and is a designated competent person for site operations.

3.0.0.2. The following organizational chart identifies key personnel for safety at the project level and the lines of authority.



3.0.0.3. **Attachment D-1** of this APP contains resumes for key on-site project personnel. In addition, HAZWOPER Medical Clearances have been provided in **Attachment D-3**.

3.0.0.4. H&S representatives must continually observe activities and correct unsafe acts/conditions as soon as reasonably possible. They are also required to review each Project Safety Inspection Report completed at their location to ensure that corrective actions are implemented. Once this review is complete, they will forward the reports to the appropriate business line HSM.

3.1 Health and Safety Manager

The HSM, James Joice, is responsible for the development, implementation, and oversight of the APP. The HSM reports directly to the business line CIH, and in coordination with the UXOSO, is responsible for the development, implementation, and oversight of the APP. The HSM has completed OSHA 500 and 510 Construction Training and has more than 27 years comprehensive experience in HAZWOPER operations, safety, and industrial hygiene. The HSM shall be available for emergencies and on-site consultation.

3.2 Unexploded Ordnance Safety Officer

3.2.0.0. The UXOSO, William Wren is the competent person identified to perform SSHO duties as well as to oversee MEC safety operations. He is responsible for implementation of this APP during all site activities, as well as making recommendations and revisions for the HSM, PM and SUXOS approval. The UXOSO will conduct daily inspections to determine if operations are being conducted in accordance with this APP, USAESCH requirements, and OSHA regulations. The UXOSO reports directly to the HSM

for matters pertaining to worker safety and health. An open dialogue is kept between the UXOSO, SUXOS, HSM, and PM to ensure that safety issues are quickly addressed and corrective actions taken. The UXOSO has the authority to take immediate steps to correct unsafe or unhealthful conditions, including the stoppage of fieldwork when deemed necessary.

3.2.0.1. The UXOSO will implement the requirements of all Shaw, DoD, Federal, State, and local statutes and codes; analyze MEC, explosives operational risks, hazards, and safety requirements; establish and ensure compliance with all site-specific safety requirements for MEC; enforce personnel limits and safety exclusion zones (EZs) for MEC operations; conduct safety inspections to ensure compliance with munitions safety codes; and operate and maintain conventional air monitoring equipment.

3.3 Senior Unexploded Ordnance Supervisor

The SUXOS, David Coe, is the senior Unexploded Ordnance (UXO) Technician on site and is a competent person to supervise MEC operations. The SUXOS directly controls the operations of all field personnel performing MEC activities and will monitor performance of UXO project personnel to help achieve maximum operational safety and efficiency. The SUXOS reports directly to the Site Manager and will implement the approved plans in the field and must review and approve any changes to the approved UXO plans. The SUXOS will supervise all UXO Teams on the project. Additionally, the SUXOS has the authority to temporarily stop work to correct an unsafe condition or procedure.

3.4 UXO Technician Qualifications

3.4.0.0. As promulgated by the Department of Defense Explosives Safety Board TP-18, all UXO personnel will be graduates of either the U.S. Army Bomb Disposal School Aberdeen Proving Ground, Maryland; the U.S. Naval EOD School, Indian Head, Maryland; the U.S. Naval EOD, Eglin Air Force Base, Florida; the EOD Assistants Course, Redstone Arsenal, Alabama; the EOD Assistant Course at Eglin Air Force Base, Florida; or other DoD certified equivalent course.

3.4.0.1. All personnel working in the field during MEC removal actions are responsible for complying with this SSHP and all other required safety and health guidelines.

3.5 Visitors

3.5.0.0. Site access by personnel making deliveries or performing equipment maintenance, public or government officials, visitors, or base personnel will be limited to support areas only. Support zone access will be limited to designated work, delivery, or observation areas to minimize any potential exposure to MEC operations. Authorization for

limited site access will be determined on a case-by-case basis by the UXOSO in consultation with the HSM, SUXOS, and PM. Site access for such personnel will be limited to areas with no potential for MEC exposure during routine operations. These personnel will be escorted on site and will be strictly prohibited from entering the EZ.

3.5.0.1. Visitors to the project site will be briefed on the hazards present at that location by the UXOSO. Visitors will be responsible for compliance with the requirements specified in this APP.

3.6 Stop Work Authority

3.6.0.0. All personnel have the right and duty to stop work when conditions are unsafe, and to assist in correcting these conditions. If the UXOSO determines that workplace conditions present an immediate uncontrolled risk of injury or illness, immediate resolution with the SUXOS shall be sought. If the SUXOS is unable to correct the unsafe conditions, the UXOSO will consult with the USAESCH OESS and will be authorized and required to issue a Stop Work Order, which shall be immediately binding on all affected Shaw employees and operations.

3.6.0.1. Upon issuing the Stop Work Order, the UXOSO shall contact the SUXOS and HSM and request assistance in implementing corrective action so that operations may be safely resumed. If the SUXOS, UXOSO, and HSM are unable to agree on the necessary corrective actions, or the appropriateness of the Stop Work Order, the issue shall be referred to the PM. Resumption of safe operations is the primary objective; however, operations shall not resume until the UXOSO and HSM have given approval that workplace conditions now meet acceptable safety standards.

3.7 Activity Hazard Analysis

Section 1.2 lists phases of work and hazardous activities requiring AHAs based on the current performance work statement (PWS). No phase of work shall be performed until a thorough pre-task safety and health analysis is performed and AHA is completed and approved. In addition to the AHA, the SUXOS and UXOSO shall complete daily or as often as necessary to ensure employee safety, the Shaw pre-task Job Safety Analysis (JSA) checklist in accordance with Shaw procedure EIG-HS-045 Job Safety Analysis (**Attachment D-2**). The JSA is an effective management technique for identifying hazardous conditions and unsafe acts in the workplace. A JSA is intended to analyze the individual steps or activities, which together create a job or specific work duty, and to detect an actual or potential hazard that may be present. This process can identify less obvious potential hazards that go undetected during routine management observations or audits. A new JSA must be completed every day, before commencement of any work activity and updated in the

event of changing conditions. It should be understood that changing conditions that a work crew encounters during a work period (inclement weather, another contractor began work in the area, etc.) requires that the JSA be modified to address the new hazard. The JSA should be changed to reflect new conditions in the task being performed or new hazards not identified previously in the AHA. All personnel involved in the specific task shall participate in the development and sign-off on the JSA form.

3.8 Disciplinary Action for Violations of Safety Requirements

3.8.0.0. If employees fail to comply with established safety and occupational health requirements, they are subject to disciplinary actions up to termination. The SEI-GUIDE-004, SEI Guidelines for Standard Safety Disciplinary Actions, will be utilized as a consistent approach to disciplinary action when safety violations occur.

3.8.0.1. Safety violations are typically categorized as minor, moderate, or serious. Additionally, concerning second or repeat violations, it should be understood that a violation should not be compounded or considered repeat / second violation if the previous violation occurred more than 3 years prior. The following provides the disciplinary procedures to be used for the specific class of violation.

3.8.0.2. For a **Minor** safety violation (see examples below), the employee's direct site supervisor or functional manager will meet with the employee(s) and discuss the nature of the safety violation. The recommended corrective action should be selected to prevent future violations.

3.8.0.3. Should a second, minor safety violation occur to the same employee, the direct site supervisor and functional manager will meet with the employee and issue a written warning to the employee. The direct supervisor must use the Disciplinary Action Form (DAF). A copy of the DAF must be submitted to the employee's designated Human Resources representative for review prior to issuing the written warning. A further minor violation either being of the same safety issue by the same employee or a different offense may result in another written warning, suspension from work without pay (non-exempt) for a reasonable period of time, or the direct supervisor may recommend a Discharge Termination. These further violations provide for indicators of continued unacceptable behavior and should be accounted for when determining a disciplinary action. The designated Human Resources representative must be consulted prior to suspension or termination.

3.8.0.4. Note: Under the Fair Labor Standards Act, an exempt employee can only be suspended for disciplinary reasons with a reduction in salary, for a violation of a serious safety rule. Exempt employees can be reassigned or instructed not to report to work pending

the supervisor's decision whether to recommend termination. However, they must continue to be paid their regular salary.

3.8.0.5. A **Moderate** safety violation will require the direct supervisor and functional manager to document a verbal or prepare a written warning (using the DAF) for the safety violation. A copy of the DAF must be submitted to the Human Resources representative for review prior to issuing the written warning.

3.8.0.6. In event of a repeat Moderate safety violation by the same employee(s), another written warning may be issued to the employee(s) and the designated Human Resources representative should be contacted to determine if suspension or termination is warranted.

3.8.0.7. If a **Serious** safety violation occurs, it will require that, in most cases, the direct supervisor or person observing the violation had to immediately intervene and/or stop the activity. The employee's direct supervisor and functional manager will complete the DAF for the safety violation that was observed. The designated Human Resources representative shall then be contacted to determine the next course of action, such as suspension or termination (as warranted).

3.8.0.8. If a **Terminable** safety violation occurs, it will require that, in most cases, the direct supervisor or person observing the violation had to immediately intervene and/or stop the activity. The employee's direct supervisor and functional manager will complete the DAF for the safety violation that was observed. The designated Human Resources representative shall then be contacted to determine the appropriate course of action in accordance with requirements set forth in the Human Resources termination process.

3.8.0.9. The following provides typical examples for each class of safety violation. The employee's direct supervisor is responsible for recommending the classification of the violation to the Human Resources representative. The Human Resources representative shall make the final classification of the violation, after consultation with an HSM.

3.8.0.10. **Minor** Safety Violation

a. Failure to wear specified PPE, e.g., safety glasses, gloves, safety shoes/boots, etc.;

b. Failure to perform daily heavy equipment or vehicle inspections;

c. Performing unsafe work practices;

d. Horseplay, which doesn't result in an accident or injury;

e. Failure to attend a scheduled safety meeting; and,

f. Improperly dismounting heavy equipment.

3.8.0.11. **Moderate** Safety Violation

a. Repeat of Minor safety violation;

b. Failure to report a minor first aid injury within a day of the incident (e.g., small cut on finger requiring a band-aid, bee sting, dust particle in eye);

c. Failure to immediately report an accident or injury, including any equipment or property damage;

d. Failure to wear specialty PPE, e.g. face shield, respiratory protection, etc.;

e. Performing unsafe work practices after being corrected;

f. Horseplay, which didn't but could have resulted in an accident or injury;

g. Abuse of safety equipment;

h. Violation of company 60-pound lifting limit or lifting limit of less than 60 pounds designated by a medical professional;

i. Failure to follow restricted activity guidelines directed by a medical professional; and,

j. Neglect in care of company or client vehicles.

3.8.0.12. **Serious** Safety Violation

a. Repeat of Moderate violation;

b. Knowingly performing unsafe work practices that could have or did result in serious injury to the employee or other personnel;

c. Possession/use of drugs (without a prescription) or alcohol on company projects/premises;

d. Positive drug or alcohol test;

e. Unauthorized use of company or client vehicles;

f. Citation for reckless driving or open alcohol container while on company business;

g. Leaving the scene of an automobile accident without contacting the police, regardless of fault;

h. Not immediately reporting a work related auto accident, regardless of fault;

i. Not immediately reporting a work related driving under the influence citation;

j. Not immediately reporting a work related open alcohol container citation;

k. Not immediately reporting a work related hit and run citation;

l. Horseplay that results in employee injury;

m. Destroying or damaging company, client or another employee's property;

n. Tampering with safety equipment;

o. Direct refusal to wear the designated PPE for a task; and,

p. Direct refusal to follow established company H&S Policy.

3.8.0.13. **Terminable** Safety Violation

a. Failure to wear fall protection or not being tied to an anchor point when required;

b. Disregard for a required lockout/tag out; and,

c. Upon conviction or upon pleading no contest to a DUI/DWI while driving on company business.

3.9 Safety Incentive Program

The Shaw PM will develop a site-specific program for approval by the HSM and the MMRP Operations Manager. Shaw SOP EIG-HS-023, Accident Prevention Program: Employee Safety Incentives and Team Safety Award Program, covers all project sites (**Attachment D-2**). This program has been designed to recognize group safety performance and reward the individual only when the project/location team has achieved its established goals. It is intended to encourage all employees to be concerned not only for their own safety, but for the safety of co-workers as well. Key elements of this program include:

a. Eligibility;

b. Program development;

c. Award value;

d. Program funding;

e. Minimum goals (no recordable, lost time or at-fault vehicle/equipment incidents);

f. Award request; and,

g. Goal verification.

3.10 Management Accountability for Safety

The implementation of effective H&S practices is a key measure of managerial performance. Annual performance evaluations are adversely impacted for supervisors and managers who are deficient in these responsibilities. Supervisors and managers who are willfully negligent in complying with safety policies and procedures are subject to disciplinary action, up to and including termination. All managers and supervisors are accountable for upholding Shaw's policies and procedures as outlined in Shaw's Environmental Safety & Health Program Manual and Corporate Code of Conduct. Managers are subject to the same disciplinary action when safety violations occur as referenced above in SEI-GUIDE-004. Accident review boards performed in accordance with Shaw policy EIG-HS-020, Accident Prevention Program: Reporting, Investigation, and Review (**Attachment D-2**) may impose more stringent disciplinary action based on extenuating circumstances surrounding a specific incident and the root cause analysis determined by the board. Managers could also be liable for any legal action stemming from failure to maintain a safe work environment. Management, with the assistance of the internal H&S professional staff, will conduct audits to assess the effectiveness of the safety program(s) in place, and to identify areas for improvement. Each project will maintain a Safety Improvement Log. The Safety Improvement Log is the central repository for all observations for safety improvements identified through any type of safety inspection. The PM will verify that corrective actions listed in the Safety Improvement Log are completed in a timely manner and validate that the corrective action(s) taken is effective in preventing accidents. The SSHO must continually observe activities and correct unsafe acts/conditions as soon as reasonably possible. They are also required to review each Safety Inspection Report completed on site to ensure that corrective actions are implemented. Once this review is complete, they will forward the reports to the HSM.

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4.0 SUBCONTRACTORS AND SUPPLIERS

Each subcontractor working on the project site will be required to adhere to the APP/SSHP and the requirements presented below. Subcontractors performing limited site work may include:

a. Sanitation services;

b. Land survey services;

c. Explosives procurement and delivery services;

d. Demolition services;

e. Equipment and material suppliers; and,

f. Off-site laboratory analytical services.

4.1 Subcontractor/Supplier Coordination and Control

All subcontractors performing work on site will be prequalified and screened for safety performance and compliance with Federal alcohol and substance abuse requirements prior to being issued any contract for site work. Shaw will utilize our procurement procedure EIG-PS-104, Qualification of Sources, to provide a consistent approach to subcontractor procurement including review of their internal safety programs, plans, experience modification rates, OSHA 300 logs, and procedures. Subcontractors will comply with the requirements for site safety as outlined in Shaw's SOP EIG-HS-011, Contractor Safety and Health Rules (**Attachment D-2**). The SUXOS will be responsible for the conduct and control of Shaw subcontractors.

4.2 Subcontractor/Supplier Safety Responsibilities

4.2.0.0. All subcontractor employees are subject to the same training and medical surveillance requirements as Shaw personnel which is dependent upon their specific job activity. All activities involving the potential for worker exposure to hazardous materials will require medical and training certification as mandated by 29 Code of Federal Regulations (CFR) 1910.120, General Industry Regulations HAZWOPER; 29 CFR 1926.65, Construction Industry Regulations HAZWOPER; 29 CFR 1910.1200, Hazard Communication; EM 385-1-1, USACE Safety and Health Requirements Manual, Federal, State and local regulations.

4.2.0.1. All subcontractor personnel will be required to sign-in daily and to attend a daily meeting discussing operations and safety issues. Subcontractors will submit AHAs for their definable features of work activities to the SUXOS or Site Manager ahead of time (at

the Preparatory Inspection) for review and subsequent USAESCH review and approval. All incidents involving subcontractor employees shall be reported immediately to the PM and HSM and a copy of the subcontractor's injury/illness report shall be submitted to the UXOSO within 24 hours.

4.2.0.2. Subcontractors are required to read and sign the APP and comply with all requirements of this APP. Contractors not in compliance will be immediately dismissed from the site.

4.2.0.3. Suppliers delivering various materials to the project site or providing equipment and/or equipment maintenance will comply with all Shaw rules and regulations. Supplier personnel will not be permitted into restricted areas unless training and medical surveillance is in accordance with 29 CFR 1910.120/1926.65. They will follow Shaw-specific and SEAD hot work rules if spark or flame producing work is required. Trucks will be loaded and unloaded in a safe and effective manner, and materials will be stored safely in designated locations only. Associated packaging will be properly disposed and litter will not be permitted to be scattered or blown from truck beds. Operators of mobile equipment on site must observe all traffic rules such as speed limits and right-of-ways of pedestrians. Any subcontractor operating a Shaw vehicle will have to meet the same driving safety training requirements as a Shaw employee. Defensive Driver safety retraining is required every 2 years.

4.2.0.4. The management organization of each subcontractor is responsible for the compliance of their personnel with Shaw's APP, as well as their own H&S program. The Shaw Site Manager, SUXOS and UXOSO will ensure subcontractor compliance with this APP. Since subcontractors are hired for their specific expertise, they must assume primary responsibility for the safety and health of their personnel. However, Shaw is still responsible for the actions of the subcontractors, which is why subcontractors must abide by Shaw's APP. Shaw may elect to allow subcontractors to follow their own H&S plan procedures as long as they are more protective of Shaw's or EM 385-1-1 requirements following review and approval by the PM, HSM and USAESCH. Subcontractor plans when applicable will be included as an addendum to the SSHP. The subcontractor's field supervisor or crew leader will be responsible for performing daily safety inspections of their operations, including:

a. Compliance with OSHA regulations 29 CFR 1910 and 1926 and USACE EM 385-1-1;

b. Performance of all work in accordance with accepted work plans and specifications;

c. Providing and complying with PPE as prescribed in the APP;

d. Reporting immediately any unsafe conditions, faulty equipment, incidents, and near misses to the Site Manager or UXOSO; and,

e. Providing awareness level training to affected Shaw or other subcontract personnel regarding any material, equipment, or operation that may pose a hazard.

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5.0 TRAINING

5.1 Safety Indoctrination Training

All Shaw or subcontractor employees performing work at SEAD shall receive initial safety indoctrination training prior to commencement of actual fieldwork. This training will be performed by the qualified SUXOS or UXOSO. At a minimum, this initial training shall include, but not be limited to:

a. SEAD facility specific H&S training;

b. Site location and description, including emergency routes, first aid kit locations, occupational medical clinic and hospital locations;

c. Statement of Shaw H&S policy;

d. Project organization, key personnel, and responsibilities;

e. Chemical, physical, and biological hazards;

f. MEC avoidance and anomaly investigation;

g. AHA;

h. JSA (EIG-HS-045);

i. Hazard control program;

j. Heat/cold stress;

k. Hearing conservation;

l. Control of hazardous energy;

m. Sanitation;

n. Buddy system requirements;

o. Fire prevention and protection/hot work;

p. Excavation safety;

q. PPE;

r. Site control measures;

s. Exposure monitoring;

t. Medical surveillance;

u. Emergency Response and Contingency Plan;

v. Recordkeeping and data management;

w. Accident and near miss reporting and investigation; and,

x. Site-specific hazard communication.

5.2 Mandatory Training and Certifications

In accordance with CFR 1910.120(e) HAZWOPER, EM 385-1-1, Safety and Health Requirements Manual, Section 28, HAZWOPER, EM 385-1-97 and Shaw H&S SOP EIG-HS-050, Training Requirements, mandatory training and certifications applicable to this project for UXO personnel include at a minimum:

a. APP/SSHP training;

b. HAZWOPER 40-hour training;

c. 24-hour supervisor training;

d. Hazardous Waste Site Supervisor training (for HAZWOPER supervisors);

e. 30-hour OSHA Construction Safety training (for UXOSO or SSHO);

f. 8-hour HAZWOPER refresher training;

g. Shaw defensive driver training;

h. Hazard communication training;

i. Cardiopulmonary resuscitation (CPR) and first aid training;

j. UXO personnel shall be graduates of military EOD schools or a DoD certified equivalent course;

k. Re-certification or refresher training for the cited mandatory training shall follow the following schedule:

   – 8-hour refresher training shall be performed annually for employees who completed the initial 40-hour course.

   – Shaw defensive driver training shall be performed every 2 years.

   – Hazard communication training at a minimum shall be performed annually and is required on a site-specific project basis.

l. Shaw employees who are designated first aid and CPR responders shall also have completed blood-borne pathogen training and adhere to the Shaw SOP EIG-HS-512, Handling of Blood or Other Potentially Infectious Material (**Attachment D-2**).

5.3 Emergency Response Training

There are no tasks in the scope of work that require specific emergency response training beyond what is required in **Sections 5.1 and 5.2** above. All Shaw personnel who have

completed the Shaw 40-hour HAZWOPER Training are qualified as emergency first responder operations level per 29 CFR 1910.120/1926.65 (q)(6)(ii). Site-specific emergency response procedures will be reviewed with all site personnel as a part of site indoctrination. If unanticipated hazardous material other than MEC is identified during the clearance operations, Shaw will leave the location and notify the PM, HSM and OESS. The Emergency Response Plan is provided in **Section 10.2** of this APP. Shaw does not anticipate any materials involved with our scope of work that would initiate a spill emergency response.

5.4 Supervisory and Employee Safety Meetings

5.4.0.0. The Site Manager and SUXOS will conduct daily tailgate safety meetings at the start of each work shift for all on-site personnel and will require any subcontractors to follow equivalent meeting procedures and participate in the Shaw daily safety meetings. The tailgate meeting is a short training or informative session that provides safety guidelines for the planned work activities for the day. The daily tailgate form includes project name and number, date and time, client, work activities, hospital name, address and phone number, ambulance, chemical hazards, physical hazards, PPE, new equipment introduced on site and other safety topics. All attendees shall sign off on the tailgate safety form as well as the competent person(s) conducting the meeting. The UXOSO will also provide assistance with delivery of safety topics relevant to the day's activity. **Attachment D-2** contains the tailgate safety meeting form. Additionally, Field Team Leaders shall employ the use of daily JSA in accordance with Shaw SOP EIG-HS-045 (**Attachment D-2**).

5.4.0.1. Supervisors and PMs shall participate in regional leadership safety councils chaired by senior management. Safety council participation is mandatory and tracked by the HSM, Secretary for the safety council.

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6.0 SAFETY AND HEALTH INSPECTIONS

6.1 Inspections

6.1.0.0. The Site Manager and UXOSO will conduct daily inspections of site operations and assure activities are being performed in accordance with Shaw, Army, and Federal OSHA requirements. The Site Manager and UXOSO have completed 50 hours of Shaw's formal Site Safety Officer (SSO) training and are qualified by Shaw for assessment of workplace safety and health hazards. The 50-hour SSO course entails the following elements and is presented by corporate trainers and CIH:

a. Chemical properties and fundamentals of industrial hygiene;

b. Selection and use of respirators and personal protective clothing;

c. Air monitoring instrumentation – selection, use, and calibration;

d. Theory of safety management, accident investigation, and reporting;

e. Development of site safety plans, AHAs, JSAs, and Hazard Assessment Resolution Process (HARP);

f. Construction Safety – Cranes, Trenching/Shoring, Underground Storage Tank Removal, Hot Work, Electrical Safety;

g. H&S administration and paperwork responsibilities;

h. Emergency planning for on-site and off-site events; and,

i. Use of Shaw SOPs and other reference material.

6.1.0.1. The Shaw PM or HSM will conduct site visits and perform Site Safety Assessments as required by Shaw. These reports are kept on file at the Regional offices and are tracked by the HSM for the project, including the number of action items noted during the visit and written confirmation of the corrective actions for each item. These responses are compiled and provided to program management for review. Deficiencies shall also be documented on the project H&S assessment summary/deficiency tracking log. A list of all corrective action items is required to be maintained showing the corrective action, responsible person, and the date action is to be completed. Follow-up inspections are conducted by H&S personnel to ensure that corrective actions or measures were implemented. This log shall be posted on the H&S bulletin board on site. At a minimum, the PM shall perform monthly project safety inspections. The inspections shall be documented on Shaw form EIG-HS-021c.01, Project Safety Inspection Report in Shaw SOP EIG-HS-021c (**Attachment D-2**).

6.1.0.2. H&S representatives will present workshops and/or conduct joint inspections to help managers and supervisors develop additional inspection skills. The UXOSO/SSHO will have the authority to implement immediate corrective action for any deficiencies observed and have stop work authority. **Attachment D-1** contains documentation of inspectors training and qualifications.

6.2 External Inspections/Certifications

Shaw does not anticipate, but may consider, the use of outside sources to provide safety inspections, as necessary. Shaw will fully comply and assist with workplace inspections performed by SEAD, USAESCH, and Federal and State authorities. Shaw expects the USAESCH on-site representative will provide collaborative assistance as a Teaming Partner for external inspections.

7.0 ACCIDENT REPORTING

7.1 Exposure Data (man-hours worked)

Shaw's HSM tracks and maintains incident records for Federal reporting requirements. Incident rates are reported monthly by corporate to the HSM. Incident rates and workers compensation losses are tracked for each business line. Injury/Illness/Exposure summaries will be submitted by the PM to the Contracting Officer's Representative (COR) monthly via email. The data must be submitted to arrive at USAESCH not later than 10 calendar days after the end of each month. The information cut-off date will be the last day of each month. The monthly submission must include the title of the report (i.e., Accident Exposure Data Report), contract number, task order number, project site, month and year for which the report is made, a point of contact listing both email address and telephone number, and number of LWD accidents to include total days lost. If no hours are worked on the project/task, a report showing "zero (0)" is required.

7.2 Accident Investigations, Reports, and Logs

7.2.0.0. The Site Manager, SUXOS, UXOSO, and PM shall conduct accident/incident investigations in consultation with the HSM. Accident reports are completed by the Site Manager and must be submitted within 24 hours to the HSM and Shaw Corporate Safety Department in Baton Rouge, Louisiana. All incident reporting forms are provided in Shaw procedure EIG-HS-020, Accident Prevention Program: Reporting, Investigation, and Review (**Attachment D-2**). The PM shall report all accidents to the COR as soon as possible but not more than 24 hours after the incident/accident.

7.2.0.1. Engineer (ENG) Form 3394 is required to be prepared and submitted in reporting LWD cases, accidents where three or more persons are admitted to a hospital, a fatality, permanent totally disabling injury, permanent partial disabling injury, or property damage greater than $200,000. ENG Form 3394 must be submitted to the Contracting Officer (KO) or authorized representative following the accident in accordance with EM 385-1-1 as soon as possible but no more than 5 days following the accident.

7.2.0.2. Minor incidents, such as near-misses or on-site first aid injuries, shall be included in the daily field quality control reports. These incidents shall also be reported immediately to the HSM.

7.3 Immediate Notification of Major Accidents

Immediate notification and investigation of accidents is an important component of Shaw's accident prevention program. A full report will be provided to the HSM within 24 hours.

Accidents involving the following categories shall immediately be reported to the Government Designated Authority or authorized representative, HSM, and Shaw EH&S Hotline:

a. A fatal injury or illness;

b. A permanent total disability injury/illness;

c. A permanent partial disabling injury/illness;

d. Hospitalization of 3 or more people as inpatients resulting from a single occurrence;

e. Property damage of $200,000 or more or damage in an amount specified by USACE in current accident reporting regulations;

f. Arc flash incident/accident;

g. USACE aircraft destroyed or missing; or,

h. Three or more individuals become ill or have a medical condition which is suspected to be related to a site condition, or a hazardous or toxic agent on the site.

7.4 Accident Response

The nearest workers will immediately assist a person who shows signs of medical distress or who is involved in an accident as long as the accident scene is safe. The Site Manager, SUXOS and UXOSO will be immediately summoned if not already aware of the situation to begin immediate first aid. The SUXOS will immediately make contact with other field personnel to alert them of a medical emergency situation and recommended action if required. The SUXOS will advise the following information:

a. Location of the victim at the work site;

b. Nature of the emergency;

c. Whether the victim is conscious; and,

d. Specific conditions contributing to the injury, if known.

8.0 MEDICAL SUPPORT

8.0.0.0. The SUXOS and UXOSO are designated as the first responders for medical emergencies or minor injuries and have current first aid/CPR training and will be available on site to respond to injury cases. Medical support will also be augmented by off-site medical response services associated with Geneva General Hospital. At least two first aid and CPR qualified employees are required at all times to be on site during site work. The following table lists the names and dates of training for Shaw's SUXOS and UXOSO.

Name	First Aid Training Completed	CPR Training Completed
David Coe	August 2011	August 2011
William Wren	August 2010	August 2010

8.0.0.1. In the event of severe physical injury, the local emergency response personnel shall be summoned for emergency medical treatment and ambulance service. Their response time is estimated to be less than 25 minutes upon initial notification. The emergency medical responders will be utilized to provide care to severely injured personnel. Once an initial assessment is made by the emergency medical technicians, the decision on using ground or air transportation for the injured will be made. Minor injuries will be treated on site by qualified first aid/CPR providers and if additional non-life threatening treatment beyond first aid is required, personnel will be transported by the Site Manager or UXOSO to a CORE network occupational health clinic, **Life Care Medical Associates 1991 Balsley Road (315) 539-5229, located in Seneca Falls NY**. Major emergency treatment can be provided by **Geneva General Hospital, 196 North Street, (315) 787-4000 or 911, located in Geneva NY.** The Hospital ERs can provide 24-hour emergency medical care along with the services of a critical care center.

8.0.0.2. Transportation routes and maps shall be placed in each site vehicle prior to the initiation of on-site activities. Copies of Shaw EIG-HS-020 reports shall also be provided in each site vehicle. A copy of the maps and directions to the Life Care Medical Associates occupational clinic and Geneva General Hospital is provided as **Attachment D-6**.

8.0.0.3. Additional emergency response and contingency plan procedures are provided in **Section 10.2**.

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9.0 PERSONAL PROTECTIVE EQUIPMENT

9.0.0.0. The SUXOS and UXOSO will perform daily hazard assessments of the work areas and immediately correct any situation where PPE is not being used in accordance with this APP or EM 385-1-1, whichever is most protective. The daily assessments will entail compliance with the AHA provided in the SSHP as well as Shaw JSAs, which are the primary forms of hazard evaluation to determine PPE. AHAs and JSAs are further discussed in **Section 3.7** and **Section 11**.

9.0.0.1. All Shaw personnel on site will have had completed 40-hour HAZWOPER training and annual refresher courses. This training includes when and what type PPE is most protective, how to don, doff, inspect and wear appropriate PPE, limitations, care, testing, maintenance, useful life, storage, and proper disposal of PPE. The written certification of training for SUXOS David Coe and UXOSO William Wren is provided in **Attachment D-1**.

9.0.0.2. If Shaw as the employer or supervisor suspects or is made aware that an employee may not have the proper understanding and skill required of the training, that employee shall be retrained by internal training programs or on site as a daily safety topic associated with pre-shift tailgate safety meetings and documented as to who received the training and the subjects taught. When new PPE is procured, if previous training was not encompassing specific to the equipment, on-site training will be implemented by competent persons.

9.0.0.3. Shaw SOP EIG-HS-600, Personal Protective Equipment, provided in **Attachment D-2**, outlines minimum PPE requirements as well as PPE that is reimbursable by Shaw. This procedure, coupled with H&S management experience, training in proper selection use and maintenance of PPE, site-specific conditions, potential environmental contaminants, and physical hazards, and Department of Army guidance documents and AHA will dictate site-specific requirements. Initial protection levels provided in the SSHP have been established for the site work activities based on the anticipated levels of site contaminants, physical hazards, and the scope of work. The SSHP, AHAs, in conjunction with EIG-HS-600, shall serve as the written certification for use of PPE. All selected PPE shall be used and maintained in accordance with manufacturer's recommendations and best management practices. Once on site, visual inspection of the work activities by the SUXOS, UXOSO or Site Manager may indicate the need for changes in PPE level(s). Any significant change in the PPE level will be approved by the program HSM. If a new task should arise not covered by this APP, the new task shall be evaluated by the UXOSO, Site Manager, HSM, and PM to assure appropriate H&S controls are implemented.

9.0.0.4. Level D PPE will be the minimum level of protection on site for operations. A description of Level D PPE:

a. Street clothes or coveralls;
b. Safety-toed work boots (steel-toed boots not required of personnel performing analog or digital geophysical sweeps when foot impact protection is not a concern);
c. Safety glasses;
d. Hard hats (except UXO personnel performing investigation over an item);
e. Hearing protection (if necessary);
f. Splash shield (if necessary);
g. Leather gloves; and,
h. Face shield over safety glasses and safety chaps (chain saw or brush trimmer use).

9.0.0.5. If additional skin protection from poisonous plants is required, the above Level D PPE ensemble will be upgraded to a modified Level D PPE to include:

a. Permeable Tyvek™ coveralls with elastic wrists and ankles; and,
b. Nitrile gloves (inner).

9.0.0.6. No respiratory protection is required for anticipated Level D operations. If an activity occurs where inhalation is a potential issue, engineering controls shall be utilized to mitigate inhalation hazards.

9.0.0.7. Modified Level D PPE will be the minimum level of protection on site for personnel handling ash from the burn pan cleaning.

a. Street clothes or coveralls;
b. Impermeable Tyvek taped at boots and gloves;
c. Nitrile outer gloves over Nitrile exam gloves;
d. Leather or cut resistant gloves when handling sharp MD;
e. Safety glasses;
f. Hard hats (except UXO personnel performing investigation over an item);
g. Hearing protection (if necessary);
h. Splash shield (if necessary); and,
i. Vinyl, neoprene, or PVC chemical resistant over boots.

Additional information on PPE is provided in Section D5 of the SSHP.

10.0 PLANS REQUIRED BY EM 385-1-1, 15 SEPTEMBER 2008

10.0.0.0. Shaw will provide personnel with the necessary training and experience to safely execute this project and PWS. As the employer, Shaw will determine which employees will be competent in the respective areas of site work for which they will be involved. In addition to this APP, Shaw has prepared the SSHP (**Attachment D-5**) to meet the major requirements of EM 385-1-1, USACE Safety and Health Requirements Manual, 15 September 2008. The level of detail provided in the SSHP has been tailored to be site-specific to the type of work, complexity of operations, and hazards anticipated. For all locations, chemical, physical, and biological occupational exposure prevention shall be addressed as well as MEC safety requirements.

10.0.0.1. Public safety will be achieved by the means of site control zones and access to the work area by authorized personnel only. Site control measures are described in the SSHP and the ESS.

10.1 Layout Plans

Layout plans are not anticipated for this scope of work since temporary facilities construction will not occur on site. All access routes will be by local roads. Shaw will park vehicles adjacent to the MRS where work is being performed. Mobile office trailers will be positioned and anchored on site at a location to be determined at a later date after coordinating with SEAD.

10.2 Emergency Response Plans

Site personnel must be prepared to respond and act quickly in the event of an emergency or accidental release. Emergency preparedness and response procedures will aid in protecting site workers and the surrounding environment. All personnel working on site shall be familiar with the emergency response procedures including.

a. Pre-emergency planning;

b. Personnel roles, lines of authority, training, and communications;

c. Posted instructions and emergency contacts;

d. Emergency recognition and prevention;

e. Criteria and procedures for site evacuation;

f. Procedures for decontamination and medical treatment;

g. Evacuation routes and procedures;

h. Emergency alerting and response procedure; and,

i. Critique of emergency responses and follow-up.

10.2.1 Procedures and Tests

10.2.1.0.0. **Pre-Emergency Planning.** Potential H&S hazards associated with the conduct of site activities are identified by competent persons and identified in AHAs provided in the SSHP. These hazards were assessed to determine the risk that these hazards could result in an emergency situation. Contingency plans for responding to potential emergency situations have been developed as needed and are included in this section. Phone numbers for the local and site emergency response authorities have been collected and are provided in **Section 10.2.2**.

10.2.1.0.1. **Testing.** Shaw will implement a test of the emergency response plan at least once during field work. This will be performed by simulating an emergency situation, i.e., spill, medical emergency, fire, etc., and testing the effectiveness of the air horn alarm system, medical response and first aid supplies, employee accountability at the designated assembly area, communication methods, established hospital routes and required notifications. The Fire Department should be offered to assist in the emergency drill and become oriented to the site layout. Subcontractors if available should also participate in the drill.

10.2.1.0.2. **Personnel Roles.** For fire or severe medical events, the responding Fire Department or EMTs will evaluate the emergency situation and will implement the necessary response. Shaw personnel will provide support as needed. The responsibilities of specific project individuals are as follows:

a. Site Supervisor and SUXOS. At all times during scheduled work activities, the Site Supervisor or SUXOS will be present. These individuals will be responsible for implementing emergency procedures and determining appropriate response actions until the off- site responders arrive. Depending on the circumstances and time permitting, the Site Supervisor or SUXOS will review proposed response actions with the UXOSO and the OESS. Specific responsibilities for the Site Supervisor or SUXOS include:

   – Evaluating and assessing emergency incidents or situations;

   – Assigning personnel and coordinating response activities on site;

   – Assuring that field personnel are aware of the potential hazards associated with the site;

   – Summoning a Fire Department or EMT emergency response team;

- Notifying the PM and HSM of an emergency situation;
- Coordinating response to an incident with the OESS;
- Assuring that all Shaw emergency equipment is routinely inspected and functional;
- Working with the UXOSO regarding the correction of any work practices or conditions that may result in injury to personnel or exposure to hazardous substances;
- Assuring that appropriate emergency response agencies are aware of the provisions made herein;
- Evaluating the safety of site personnel in the event of emergency and providing evacuation coordination if necessary; and,
- Maintaining site facilities and assisting site personnel in accessing those facilities.

b. UXOSO. The UXOSO will assist the Site Supervisor and SUXOS in evaluating H&S concerns with respect to MEC emergency response issues and has authority to take action for providing a safe work place to employees and subcontractors during such events.

c. Site Manager. The PM will provide support to emergency responders and dedicate appropriate project resources to the response effort. If required, the PM will mobilize additional personnel and equipment to the site. The PM will notify and provide the KO/COR with recommendations concerning any additional action(s) to be taken.

10.2.1.0.3. **Emergency Equipment.** Fire extinguishers and first aid kits will be provided in each Shaw support vehicle. One support vehicle shall remain available on site at all times work is being performed and designated as an emergency vehicle. All emergency equipment will be maintained in proper working order and inspected by the UXOSO to ensure completeness and proper working order. The results of the inspection will be documented in the safety log. In the event that any of the disposable items are used, the UXOSO will ensure they are replaced immediately.

10.2.1.0.4. **Critique and Follow-Up Procedures.** The Site Manager, SUXOS, UXOSO, and PM will investigate the cause of the incident to prevent its reoccurrence. The investigation should begin as soon as practical after the incident is under control but not later than the first work day after the incident. Investigations will follow the procedures described below:

a. Interview witnesses and participants as soon as possible or practical;

b. Determine the chronological sequence of events (opinions as to cause should not be solicited at this time);

c. Note the location, movement, displacement, sounds, noises, or other sensory perceptions experienced by the participants or witnesses;

d. Evaluate weather data; and,

e. Verify the condition of all safeguards.

10.2.1.0.5. After the facts have been collected, causal factors should be identified. Two types of causal factors typically exist: apparent and contributing. Apparent factors are those that are self-evident or readily deduced. Contributing factors usually become apparent by questioning why the apparent causal factor was allowed to exist.

10.2.2 Emergency Notification, Reporting, and Posting of Emergency Phone Numbers

10.2.2.0.0. The Site Manager, SUXOS, UXOSO, OESS, and HSM will be notified immediately in the event of an emergency. The Site Manager, SUXOS and UXOSO will immediately evaluate the incident and, if necessary, notify Fire Department or emergency medical assistance (911) support services. If not previously notified, the PM will be advised of the situation.

10.2.2.0.1. Emergency telephone numbers are listed in **Table 10-1**. This list will be maintained with current contacts, and telephone numbers will be posted in a conspicuous area along with other emergency phone numbers. Since most workers will be at various site locations, a copy will be kept in each vehicle.

Table 10-1
Emergency Telephone Numbers

1. MEDICAL FACILITY: Geneva General Hospital	(315) 787-4000 or 911
2. AMBULANCE OFF POST OFF POST EMERGENCY	911
3. OCCUPATIONAL CLINIC: Life Care Medical Associates	(315) 539-5229
4. ROMULUS FIRE DEPARTMENT ON POST EMERGENCY OFF POST EMERGENCY	(607) 869-9611 or 911
5. INTERLAKEN POLICE DEPARTMENT EMERGENCY OFF POST EMERGENCY	(607) 532-4466 or 911 911
6. Seneca County Sheriff	(315) 539-9241
6. POISON CONTROL CENTER	(800) 222-1222
7. USAESCH PROJECT MANAGER: John S. Nohrstedt	(256) 895-1639 (office)
8. USACE NY DISTRICT: Randy Battagila Tom Battagila	(607) 869-1523 (607) 869-1353
9. MMRP PROGRAM MANAGER: Steven Moran	(865) 690-3211 (office) (865) 607-9148 (cell)
10. PROJECT MANAGER: Douglas Schicho	(973) 770-5306 (office) (973)508.7468 (cell)
11. H&S MANAGER: James Joice	(419) 424-4960 (office) (419) 306-3637 (cell)
12. ALTERNATE H&S MANAGER: Doug Russell	(865) 692-3584 (office) (865) 414-9545 (cell)
13. SUXOS: David Coe	(352) 428-9610 (cell)
14. UXOSO: William Wren	(207) 798-0334 (cell)
15. SITE MANAGER: Jeff Tarr	(865) 690-3211 (office) (256) 310-4376 (cell)
16. CORE Health Services	(877) EHS-SHAW
17. Shaw EH&S Hotline	(866) 299-3445
18. SEAD POC: Steve Absolom	(607) 869- 1309

10.2.2.0.2. The Shaw internal Incident Notification, Reporting, and Management Procedure provided in Appendix A of the SSHP will be followed in the event of Shaw reportable incidents. Reporting shall be by phone call initially with a follow-up email. The information provided during notification should include:

a. Name and telephone number of the individual reporting the incident;

b. Location and type of incident;

c. Nature of the incident (fire, explosion, spill, or release) and substances involved;

d. Number and nature of medical injuries;

e. Movement or direction of spill/vapor/smoke;

f. Response actions currently in progress;

g. Estimate of quantity of any released materials;

h. Status of incident; and,

i. Other pertinent information.

10.2.2.0.3. A complete incident report shall be completed by the Site Manager and provided to the OESS once the urgency of the emergency incident has been resolved. The OESS shall be verbally notified immediately and receive a written notification using USACE ENG Form 3394 within 5 days of all reportable accidents (**Attachment D-2**). The report shall include such items:

a. Name, organization, telephone number, and location of the Contractor;

b. Name and title of the person(s) reporting;

c. Date and time of accident/incident;

d. Location of accident/incident (i.e., site location and facility name);

e. Brief summary of accident/incident, including pertinent details such as the type of operation ongoing at time of accident;

f. Cause of accident/incident, if known;

g. Casualties (fatalities and disabling injuries);

h. Details of any existing chemical hazard or contamination;

i. Estimated property damage, if applicable;

j. Nature of damage and effect on contract schedule;

k. Action taken by Contractor to ensure safety and security; and,

l. Other damage or injuries sustained (public or private).

10.2.3 Spill Emergency Plan

There are no hazardous materials anticipated to be stored by Shaw at SEAD during clearance activities that could spill or leak. However, Shaw provides the following spill prevention and control section to set forth the procedures for the coordination of and response to potential spills/discharges of hazardous materials or wastes.

10.2.3.1 Pre-Emptive Measures

The following measures shall be taken to minimize the possibility of spills/discharges:

a. Site controls are to be maintained so that only authorized personnel have access to work areas.

b. Site personnel will be advised of appropriate spill/discharge control measures.

c. Appropriate secondary containment structures will be used for storage of hazardous materials and wastes on site.

d. Storage containment as applicable shall be examined daily.

10.2.3.2 Spill Response

10.2.3.2.0.0. If a material such as a fuel spill is observed at the site, the Site Manager, UXOSO and SUXOS will be immediately notified. An assessment will be made of the magnitude and potential impact of the release. If it is safe to do so, site personnel will attempt to locate the source of the release, prevent further release, and contain the spilled and/or affected materials as follows:

a. The spill or release area will be approached from upwind.

b. Hazards will be identified based on available information from witnesses or material identification documents (i.e., placards, MSDSs, and logbooks). The potential hazards will be evaluated to determine the proper personal protection levels, methods, and equipment necessary for response.

c. If necessary, the release area will be evacuated, isolated, and secured.

d. Work zones shall be set up.

e. If possible, spill containment will initially be made without entering the immediate hazard area.

f. Entry to the release area will be made by personnel with the PPE, training, methods, and equipment necessary to perform the work. Hazardous spill containment and collection will be performed as follows:

- Contain the spill with absorbent socks, booms, granules, or construction of temporary dikes.
- Control the spill at the source by plugging leaks, up-righting containers, over packing containers, or transferring contents of a leaking container.
- Collect the spilled material with shovels, pumps, or heavy equipment as necessary.
- Store the spilled material for treatment or disposal. Treatment and/or disposal options of the material will depend on the amount and type of material.

10.2.3.2.0.1. If site personnel cannot safely respond to an environmental release, evacuation of the area may be warranted. In the event that a spill cannot be controlled or represents a potential impact to human health and/or the environment, Shaw will contact SEAD personnel which will notify the off-site response teams. Upon their arrival at the site, the UXOSO will brief emergency responders of the status and any potential hazards.

10.2.4 Fire Emergency Plan

10.2.4.0.0. **Training.** Site employees will be informed of any potential fire hazards and the requirements and procedures of this plan during indoctrination training and in daily tailgate meetings. This training will be documented.

10.2.4.0.1. **Testing.** Shaw will implement a test of this emergency action plan at least once during field work. This will be performed by simulating a fire emergency and testing the effectiveness of the medical response, first aid supplies, employee accountability at the designated assembly area, communication methods, established hospital routes and required notifications. The Fire Department should be offered to assist in the emergency drill and become oriented to the site layout. Subcontractors should also participate in the drill.

10.2.4.0.2. **Notification.** In the event of a fire or potential fire/explosives related emergency, all activities shall halt, and the SUXOS, UXOSO, and Fire Department (911) shall be notified immediately. Be sure to state you are located on SEAD when calling 911 for on base assistance. If it is safe to do so, site personnel may use fire-fighting equipment available on site to remove and isolate flammable or other materials that may contribute to the fire.

10.2.4.0.3. **Escape Procedures and Routes.** The SUXOS or UXOSO will order personnel to evacuate the area if warranted. In the event that site evacuation is required, a continuous, uninterrupted air horn will be sounded for approximately 10 seconds. Radio or cell phone communication may also be used to alert site workers and provide special instructions as long as these devices do not compromise MEC safety. Evacuations may or

may not be limited to the specific EZ or site area. The safe evacuation distance will be determined by the UXOSO and the SUXOS in consultation with the OESS.

10.2.4.0.4. Upon evacuation notification, personnel will immediately report to the designated upwind assembly or rally point for a "head count" and further instructions. The Site Manager, SUXOS and UXOSO will remain in contact to ensure that evacuation procedures are properly executed. If the designated assembly or rally point is inaccessible, personnel shall evacuate to an upwind location as determined by the SUXOS or UXOSO and perform a "head count." The SUXOS will utilize the Site Entry/Exit Log to ensure all personnel are present or accounted for at the assembly point(s).

10.2.4.0.5. When evacuating:

a. Close, but do not lock any gates;

b. Use communications devices to alert personnel to stay clear of the site; and,

c. Use vehicles to block access routes to the site, but ensure they can be moved rapidly if emergency vehicles must use the access route.

10.2.4.0.6. **Rescue and Medical Duties.** If medical attention is necessary, personnel will follow the medical support procedures provided in **Section 10.2.6**. Upon arrival of emergency responders, the SUXOS and/or UXOSO will advise the lead representative of the location, nature, and identification of any hazardous materials on site, as well as any other specific hazards inherent to the site such as MEC. The emergency responders will coordinate large area evacuation as necessary.

10.2.4.0.7. **Emergency Contacts and Reporting.** Emergency telephone numbers are listed in **Table 10-1**. This list will be posted in a conspicuous area and maintained in each vehicle. Fires will be reported in accordance with **Section 10.2.2**.

10.2.5 Marine Emergency Plan

There are no activities to be performed over open water, so marine emergency procedures are not required.

10.2.6 Medical Support

10.2.6.0.0. **Injuries Requiring On-site Emergency Medical Response.** In the event of severe physical injury, the local emergency response personnel will be summoned for emergency medical treatment and ambulance service. Their response time is estimated to be less than 20 minutes upon initial notification. The emergency medical responders will be utilized to provide care to severely injured personnel. Once an initial assessment is made by

the emergency medical technicians, the decision on using ground or air transportation for the victims will be made.

10.2.6.0.1. **Major Injuries.** Major emergency treatment can be provided by Geneva General Hospital. The Hospital ERs can provide 24-hour emergency medical care along with the services of a critical care center. Transportation routes and maps will be posted in each site vehicle prior to the initiation of on-site activities and are provided as Figures 1 and 2 in **Attachment D-6** of this APP.

10.2.6.0.2. **Minor Injuries.** Minor injuries will be treated on site by qualified first aid/CPR providers and if additional non-life threatening treatment beyond first aid is required, personnel will be transported by the Site Manager, SUXOS or UXOSO to the CORE network occupational health clinic, Life Care Medical Associates, located in Seneca Falls, NY.

10.3 Alcohol and Drug Abuse Prevention Plan

Shaw substance abuse procedures are outlined in Shaw EIG-HS-101, Drug and Alcohol Testing, provided in **Attachment D-2**. Shaw is committed to a drug- and alcohol-free work place. Pre-employment, reasonable cause, and client-specific drug and alcohol testing is part of the overall substance abuse program. Post-accident drug and alcohol testing is a requirement of Shaw when not prohibited by State or Local law. EIG-HS-101 and Shaw's Employee Assistance Program (EAP) provide employees the ability to seek assistance with substance abuse through self-referral programs that maintain complete confidentiality and compliance with Health Insurance Portability and Accountability Act (HIPPA) regulations. Shaw contracts with a third party medical review officer within CORE Health Services and maintains a corporate substance abuse manager. CORE has a network of facilities throughout the U.S. to provide counseling, education, rehabilitation, random testing and coordination with additional resources pertaining to our substance abuse programs. Shaw continues to provide supervisory training on recognition of substance abuse situations and how to report those situations through the HSM and Human Resources. All Shaw employees have access to the EAP as well as Shaw drug and alcohol procedures.

10.4 Site Sanitation Plan

10.4.0.0. Activities for the SEAD clearance and remediation will include working in remote locations where access to a building with bathroom is not available. At least one portable toilet will be stationed at a convenient location to the work site. One is the minimum number of toilets necessary for work crews of 20 or less per EM-385-1-1. This toilet will be moved periodically as work crews change location. The toilet will be routinely serviced and cleaned in accordance with Federal, State, and local health regulations.

10.4.0.1. Portable toilets will be constructed so that the occupants are protected against weather and falling objects; all cracks are sealed, and the door is tight-fitting, self-closing, and capable of being latched. It will have adequate ventilation and all windows and vents screened. It will be constructed so that natural light can enter. Seat boxes will be vented to the outside (minimum vent size 4-inch [10.1 cm]) with vent intake located 1-inch (2.5 cm) below the seat.

10.4.0.2. Since it is not practical to provide running water, hand sanitizers will be used as a substitute for running water. Potable drinking water will be provided at each individual work location. One-serving size individual bottle of water or disposable sanitary cups will be provided along with receptacles for their disposal. In the unlikely event there is a need for an outlet dispensing non-potable water (under Shaw control), it will be posted with non-potable warning signs.

10.5 Access and Haul Road Plan

An access and haul road plan is not required based on the current PWS and existing site conditions. Current access roads shall be used.

10.6 Respiratory Protection Plan

Shaw will employ engineering controls to mitigate the need for respiratory protection to the extent practical. Engineering controls anticipated include wetting techniques for soil excavation using a water truck and wetting ash handling activities associated with burn pan remediation. Shaw procedure EIG-HS-601, Respiratory Protection will serve as the project respiratory protection plan.

10.7 Health Hazard Control Program

The UXOSO shall inspect all equipment and materials before use to determine if they may present a hazardous environment or contain hazardous materials that could be released to the environment during the course of work. If equipment is found to present a hazard (i.e., leaking hydraulic line, oil or fuel leaks, etc.), the equipment shall not be placed in service until appropriate repairs have been made. The AHAs presented in the SSHP address the hazard evaluation for proposed site activities. The AHA will serve as the initial certification of hazard assessment and has been prepared by the Shaw HSM. The AHA is an ongoing process from initiation of the SSHP to implementation and completion of fieldwork. The second phase consists of further analysis in the field by completing a daily JSA. Shaw procedure EIG-HS-045, Job Safety Analysis, will be used to document second-phase hazard control. The Site Manager or SUXOS will complete the JSA in accordance with the requirements contained in EIG-HS-045 (**Attachment D-2**) and when site conditions or

potential hazards change. The JSA will serve as an amendment to the initial AHA and shall be reviewed with all site employees during the daily tailgate safety meeting.

10.8 Hazard Communication Program

10.8.0.0. Material Safety Data Sheets (MSDS) for hazardous chemicals that may be required during site operations will be provided on site to all affected employees. The UXOSO will manage the MSDS file and chemical inventory. Shaw H&S EIG-HS-060, Hazard Communication Program, will be implemented on site (**Attachment D-2**). Employee hazard communication training occurs on an annual basis as a component of the 8-hour HAZWOPER refresher course and site-specific training is a component of initial safety orientation training.

10.8.0.1. Small quantities of gasoline or diesel fuel may be used but hazardous materials other than explosives are not anticipated to be procured, stored or used on site in the execution of this PWS. Shaw will maintain MSDSs in a binder on site for reference.

10.8.0.2. The exact explosives used will be determined when an item requiring detonation is found and a specific disposal plan is developed. MSDS will accompany the explosives delivery. The SUXOS will conduct a pre-detonation meeting where JHAs will be completed and MSDSs will be reviewed with all personnel handling explosives.

10.9 Process Safety Management Plan

Process Safety Management requirements are not anticipated based on the current PWS.

10.10 Lead Abatement Plan

A lead abatement plan is not required based on the current PWS.

10.11 Asbestos Abatement Plan

An asbestos abatement plan is not required based on the current PWS.

10.12 Radiation Safety Program

Radiological hazards are not anticipated at the OD site.

10.13 Abrasive Blasting Plan

An abrasive blasting plan is not required based on the current PWS.

10.14 Heat/Cold Stress Monitoring Plan

10.14.0.0. Shaw SOP EIG-HS-400, Heat Stress, and EIG-HS-401, Cold Stress, shall be utilized. Heat stress is caused by a number of interacting factors, including environmental

conditions, clothing, workload, and the individual characteristics of the worker. Extremely hot weather can cause physical discomfort, loss of efficiency, or personal injury. Because heat stress is probably one of the most common illnesses at a site, regular preventive measures are vital. Individuals vary in their susceptibility to heat stress.

10.14.0.1. Personnel (including subcontractor employees) potentially exposed to heat stress conditions will be made aware of the sources of heat stress, how the body handles heat, heat-related illnesses, preventive/corrective measures, and first aid procedures.

10.14.1 Signs and Symptoms of Heat Stress

10.14.1.0.0. If the body's physiological processes fail to maintain a normal body temperature because of excessive heat, a number of physical reactions can occur ranging from mild to fatal.

10.14.1.0.1. Heat related problems include:

a. **Heat Rash.** Caused by continuous exposure to heat and humidity and aggravated by chafing clothes. Heat rash decreases the body's ability to tolerate heat as well as being a nuisance.

b. **Heat Cramps.** Caused by profuse perspiration with inadequate electrolytic fluid replacement. Heat cramps cause painful muscle spasms and pain in the extremities and abdomen.

c. **Heat Exhaustion.** Caused by increased stress on various organs to meet increased demand to cool the body. Heat exhaustion causes shallow breathing; pale, cool, moist skin; profuse sweating; and dizziness. Heat exhaustion can be alleviated by promptly moving the affected individual to a cool place to lie down and by providing cool fluids to drink.

d. **Heat Stroke.** The most severe form of heat stress. Heat stroke symptoms include hot, dry skin; no perspiration; nausea; dizziness; confusion; strong, rapid pulse; and coma. The body must be cooled immediately to prevent severe injury or death.

10.14.2 Heat Stress Prevention

10.14.2.0.0. One or more of such practices will help reduce the probability of succumbing to heat stress:

a. Acclimate workers to heat conditions when field operations are conducted during hot weather.

b. Provide plenty of liquids to replace the body fluids lost by perspiration. Fluid intake must be forced because, under conditions of heat stress, the normal thirst mechanism is not adequate to bring about a voluntary replacement of lost fluids.

c. If possible, install mobile showers or hose-down facilities to reduce body temperature and cool protective clothing.

d. If possible, conduct strenuous field operations in the early morning.

e. Train personnel to recognize the signs and symptoms of heat stress and its treatment.

f. Rotate personnel to various job duties if possible.

g. Provide shade or shelter to relieve personnel of exposure to the sun during rest periods.

10.14.2.0.1. Individuals succumbing to the symptoms of heat-stress will notify the UXOSO immediately. The onset of heat stress will preempt any of the aforementioned, halt activities, and initiate treatment. Early detection and treatment of heat stress will prevent further serious illness or injury and lost work time. Proper and effective heat stress treatment can prevent the onset of more serious heat stroke or exhaustion conditions. Individuals that have succumbed to any heat-related illness become more sensitive and predisposed to additional heat stress situations.

10.14.3 Heat Stress

10.14.3.0.0. The combination of warm ambient temperature and protective clothing increases the potential for heat stress. Heat stress disorders include:

a. **Heat Rash** is caused by a hot, humid environment and plugged sweat glands.

   – **Symptoms.** It is a bumpy red rash which itches severely. It is not life-threatening.

   – **Treatment.** Dry clothes that help sweat evaporate will reduce the chance of heat rash. Washing regularly and keeping the skin clean and dry will help prevent heat rash.

b. **Heat Cramps** are caused by a loss of body salt through excessive sweating.

   – **Symptoms.** Painful muscle cramps.

   – **Treatment.** To help prevent heat cramps, drink plenty of non-alcoholic, caffeine-free fluids while working in a hot environment. Check with your doctor about the use of salt tablets. They may be recommended in some cases. Anyone suffering from heat cramps should be watched carefully for signs of more serious heat

stress. If the cramps persist or other symptoms develop, seek medical attention immediately.

c. **Heat Exhaustion** results from inadequate salt and water intake and signals that the body's cooling system is not working properly.

   – **Symptoms.** The victim will sweat heavily, their skin will be cool and moist, their pulse weak, and they will seem tired, confused, clumsy, irritable or upset, they may breathe rapidly--even pant--and their vision may be blurred. The victim may strongly argue that they are okay even with these obvious symptoms. If you suspect heat exhaustion, don't let the victim talk you out of seeking immediate medical attention. The heat exhaustion will affect their ability to exercise good judgment.

   – **Treatment.** Until medical help arrives, try to cool the victim and offer sips of cool water as long as the victim is conscious. Immediate medical attention is required. Heat exhaustion can quickly lead to heat stroke.

d. **Heat Stroke** is the deadliest of all heat stress conditions. It occurs when the body's cooling mechanism has shut down after extreme loss of salt and fluids.

   – **Symptoms.** The body temperature will rise, the victim's skin is hot, red, and dry, their pulse fast, and they may complain of headache or dizziness. They will probably be weak, confused, and upset. Later stages of heat stroke cause a loss of consciousness and may lead to convulsions.

   – **Treatment.** In the event of heat stroke, seek immediate medical attention. Until help arrives, try to cool the victim and offer sips of cool water if the victim is conscious.

10.14.3.0.1. Heat stress prevention is outlined in Shaw H&S SOP EIG-HS-400, Working in Hot Environments (**Attachment D-2**). This procedure will be available on site, and this information will be reviewed during safety meetings. Workers are encouraged to increase consumption of water and electrolyte-containing beverages; e.g., Gatorade. In addition, workers are encouraged to take rests and report symptoms whenever they feel any adverse effects that may be heat-related. The frequency of breaks may need to be increased based on worker recommendation to the UXOSO.

10.14.3.0.2. Heat stress can be prevented by assuring an adequate work/rest schedule. Guidelines are presented in **Table 10-2** and should be used in conjunction with EIG-HS-400. The number of hours before a work/rest period is based on experience with similar work. The time periods should be considered maximum. This table is based on wet bulb globe temperatures (WBGT), and therefore should be used accordingly. When no WBGT

instrument is available, Shaw will utilize physiological monitoring techniques as described below and in EIG-HS-400 in order to determine each individual's unique response to environmental heat stress factors.

Table 10-2
Guidelines for Work-Rest Periods

Temperature	Number of Hours Before Rest Period Level D Protection Level
90+°F*	2.0
87.5°F	2.5
82.5°F	3.0
77.5°F	3.5
72.5°F	4.0

Notes:

**Work above 100°F will be reviewed with the Project HSM to determine specific requirements.*

10.14.3.0.3. Physiological monitoring will be implemented to develop a work/rest schedule. Each individual will count his/her radial (wrist) pulse as early as possible during each rest period. If the heart rate exceeds 110 beats per minute at the beginning of the rest period, then the work cycle will be decreased by one-third. The rest period will remain the same. If the heart rate still exceeds 100 beats per minute at the next rest period, increase the following rest period by one-third. The initial rest period should be at least 5 minutes.

10.14.3.0.4. Body temperature, measured orally or through the ear canal, may also be monitored to assess heat stress. Workers should not be permitted to continue work when their body temperature exceeds 100.4°F (degrees Fahrenheit) or 38°C (degrees Celsius). Monitoring should be conducted at the beginning of each break period as noted above.

10.14.3.0.5. Monitoring for heat stress will begin when the ambient temperature reaches or exceeds 80°F for site activities performed with no chemical protective clothing (Level D). Monitoring will include pulse rate, oral/or ear canal temperature, signs and symptoms of heat stress and fluid intake.

10.14.4 Cold Stress

10.14.4.0.0. As with high temperatures, outdoor work in low temperatures can result in risks to the health of employees exposed without adequate preparation. The combined temperature/wind chill affect is shown in **Table 10-3**. To minimize impacts from cold stress, the information and precautions given below shall be observed. If cooler conditions than

expected are encountered (e.g., 45°F) during work hours, the requirements established in SOP EIG-HS-401 will be followed.

10.14.4.0.1. Cold-related worker fatalities have resulted from failure to escape low environmental air temperatures, or from immersion in low temperature water. Most hypothermia cases develop in air temperatures between 30-50°F. The single most important aspect of life-threatening hypothermia is a fall in the deep core temperature of the body. Lower body temperature will very likely result in reduced mental alertness, reduction in rational decision making, or loss of consciousness with the threat of fatal consequences.

Table 10-3
Wind Chill

COOLING POWER OF WIND ON EXPOSED FLESH EXPRESSED AS EQUIVALENT TEMPERATURE

Estimated Wind Speed (in mph)	Actual Temperature Reading (°F)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (°F)											
Calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect)	***LITTLE DANGER*** In<hr with dry skin. Maximum danger of false sense of security.				***INCREASING DANGER*** Danger from freezing of Exposed flesh within One minute.				***GREAT DANGER*** Flesh may freeze within 30 seconds.			
	Trench foot and immersion foot may occur at any point on this chart.											

10.14.4.0.2. Persons working outdoors in temperatures at or below freezing may be frostbitten. Extreme cold for a short time may cause severe injury to the surface of the body, or result in profound generalized cooling, causing death. Areas of the body that have high surface-area-to-volume ratio such as fingers, toes, and ears are the most susceptible.

10.14.4.0.3. Local injury resulting from cold is included in the generic term frostbite. There are several degrees of damage. Frostbite of the extremities can be categorized into:

a. **Frost Nip or Initial Frostbite.** Characterized by sudden blanching or whitening of skin.

b. **Superficial Frostbite.** Skin has a waxy or white appearance and is firm to the touch, but tissue beneath is resilient.

c. **Deep Frostbite.** Tissues are cold, pale, and solid; extremely serious injury.

d. **Systemic Hypothermia.** This condition is caused by exposure to freezing or rapidly dropping temperature. Its symptoms are usually exhibited in five stages: 1) shivering; 2) apathy, listlessness, sleepiness, and sometimes rapid cooling of the body to less than 95°F; 3) unconsciousness, glassy stare, slow pulse, and slow respiratory rate; 4) freezing of the extremities; and finally, 5) death.

10.14.4.0.4. Treatment of cold stress includes bringing the body core temperature back to its normal temperature of 98.6°F. Personnel exhibiting symptoms of cold stress should be brought into a warm area and allowed to rest and warm up. Warm, non-alcoholic, decaffeinated drinks (not coffee) or soup should be given to increase body temperature, and re-warming should be gradual.

10.14.4.0.5. For frostbite emergency treatment, the victim should be sheltered from the wind and cold and given warm drinks. If superficial, the frozen area should be covered with extra clothing or warmed against the body. Do not use direct heat, and do not pour hot water over or rub the affected area. Warming should be gentle and gradual. If the frostbite is deep (area is frozen and hard to the touch), immediate medical attention should be obtained.

10.14.4.0.6. For hypothermia emergency treatment, all stages are treated by either passive or active re- warming. This is accomplished by better conservation of the patient's body heat. It is important to note that if a victim is found in a remote area, despite the death-like appearance, the person may be saved. All attempts should be made to revive the victim. Active re-warming means heat is applied to the victim by an external source, either to the skin surface and/or through the core. Treatment includes:

a. Preventing further heat loss. Remove the victim to a warm, dry place.

b. Remove wet clothing piece-by-piece and dry underlying skin.

c. Dress in several layers of warm, dry clothing, giving preference to the central body core rather than the extremities.

d. Cover the victims head, then wrap the victim in blankets.

e. If the victim is conscious, help him/her to drink hot fluids.

f. Monitor oral body temperature every 15 minutes. If the body temperature falls below 98.6°F, the team member should not be allowed outside until the body temperature returns to normal.

g. In more severe cases of hypothermia, implement the above actions, but also institute some type of active re-warming, including:

   – Electric pads or blankets.

   – Hot-air blowers or heaters.

   – Heated blankets or clothes.

   – Use of human body heat.

h. It is important to watch for signs of return of the normal thermoregulatory mechanisms (shivering, teeth chattering, etc.) and to monitor mental status.

i. The victim should be transferred to a medical facility after the emergency care steps have been initiated and should not be allowed to return to work for at least 48 hours.

j. Perform CPR if the victim is has no pulse and not breathing.

k. Avoidance of cold stress emergencies can be performed by the general practices state below:

   – Wear layered clothing, including a water-repellent outer layer.

   – Wear gloves, socks, and a hat that are synthetic or wool insulated.

   – Remove outer layers of clothing during breaks to prevent inner layer from getting wet from perspiration.

   – Eat well balance meals and maintain an adequate intake of fluids.

   – Seek shelter in a warm protected area when signs and symptoms of cold stress become evident.

10.14.4.0.7. **Table 10-4** provides a work/warm-up schedule for a 4-hour shift as it relates to temperature and wind speed. This schedule will be applied during all field work.

Table 10-4
Threshold Limit Values Work/Warm-Up Schedule for 4-Hour Shift*

Air Temperature-Sunny Sky		No Wind		5 MPH Wind		10 MPH Wind		15 MPH Wind		20 MPH Wind	
°C (approx.)	°F (approx.)	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks
-26° to -28°	-15° to -19°	Normal	1	Normal	1	75 min.	2	55 min.	3	40 min.	4
-29° to -31°	-20° to -24°	Normal	1	75 min.	2	55 min.	3	40 min.	4	30 min.	5
-32° to 34°	-25° to -29°	75 min.	2	55 min.	3	40 min.	4	30 min.	5		
-35° to -37°	-30° to -34°	55 min.	3	40 min.	4	30 min.	5				
-38° to -39°	-35° to -39°	40 min.	4	30 min.	5						
-40° to -42°	-40° to -44°	30 min.	5								
-43° & below	-45° & Below	Non-emergency work should cease		Non-emergency work should cease		Non-emergency work should cease		Non-emergency work should cease		Non-emergency work should cease	

Schedule applies to any 4-hour work period with moderate to heavy work activity, with warm-up periods of 10 minutes in a warm location and with an extended break (e.g., lunch) at the end of the 4-hour work period in a warm location. For Light-to-Moderate Work (limited physical movement): apply the schedule one step lower. For example, at -35°C (-30°F) with no noticeable wind (Step 4), a worker at a job with little physical movement should have a maximum work period of 40 minutes with 4 breaks in a 4-hour period (Step 5).

The following is suggested as a guide for estimating wind velocity if accurate information is not available:

a. 5 mph: light flag moves

b. 10 mph: light flag fully extended

c. 15 mph: raises newspaper sheet

d. 20 mph: blowing and drifting snow.

If only the wind chill cooling rate is available, a rough rule of thumb for applying it rather than the temperature and wind velocity factors given above would be:

a. Special warm-up breaks should be initiated at a wind chill cooling rate of about 1750 W/m^2.

b. All non-emergency work should have ceased at or before a wind chill of 2250 W/m^2. In general, the warm-up schedule provided above slightly under-compensates for the wind at the warmer temperatures, assuming acclimatization and clothing appropriate for winter work. On the other hand, the chart slightly over-compensates for the actual temperatures in the colder ranges because windy conditions rarely prevail at extremely low temperatures.

Threshold limit values apply only for workers in dry clothing.

10.15 Crystalline Silica Plan

Operations that could occupationally expose personnel to crystalline silica are not associated with this PWS.

10.16 Night Operations Plan

Shaw will only perform site remedial investigation activities during daylight hours. A night operations plan is not required for this PWS.

10.17 Fire Prevention Plan

10.17.0.0. Any Shaw activities that could potentially cause a spark will be carefully monitored. The most likely potential for fire is during MEC disposal operations when fire could be initiated by the use of explosives, especially in a wooded environment. At least one 10 BC Rated fire extinguisher will be kept in each site vehicle and maintained on site during explosives detonation operations. The SUXOS will ensure that the extinguishers are inspected monthly and prior to each detonation. In addition, the SUXOS and UXOSO will assess vegetation conditions prior to each detonation. If the vegetation is dry and may pose a wildfire hazard, precautionary measures will be taken which may include spraying water on the area or other measures. The SUXOS will ensure that the fire department has been notified of intended detonations.

10.17.0.1. The following standard safety measures will also be implemented during site field activities to minimize the risk of fire and/or explosion:

a. Smoking is permitted on site only in the designated smoke area at least 50 ft from operations with a potential fire hazard.

b. Good housekeeping procedures will be required on site to keep work areas clear of accumulating combustible scrap and debris.

c. Material storage methods will be in accordance with manufacturers' recommendations.

d. Flammable liquids will be stored in approved portable containers.

e. All handling or use of flammable and combustible liquids shall be conducted by trained personnel.

f. Entry and exit pathways and fire lanes shall be kept clear of debris or obstacles.

g. Work areas will be cleared of excess vegetation and obstructions.

10.17.0.2. A fire watch or patrol team will be required to patrol the vicinity of combustible materials exposed to ignition sources. The watch shall provide surveillance for signs of smoldering material for at least one hour after the initial exposure.

10.17.0.3. Any fire, no matter how small, must be reported to the PM, HSM, OESS and SEAD representative.

10.18 Wild Land Fire Management Plan

Wild land fire management plans are not required based on the current PWS.

10.19 Hazardous Energy Control Plan

A lockout/tagout site-specific plan is not required based on the current PWS.

10.20 Critical Lift Plan

Critical lift plans are not required based on the current PWS.

10.21 Contingency Plan for Severe Weather

10.21.0.0. Severe weather can take many forms. Thunder and lightning storms, earthquakes, hail, high winds, and tornados are a few examples. Sudden changes in the weather, extreme weather conditions, and natural disasters can create a number of subsequent hazards. Generally, poor working conditions arise, and slip, trip, and fall hazards exist. Natural disasters can create many secondary hazards, such as release of hazardous materials to the environment, structure failure, and fires.

10.21.0.1. Routinely monitoring weather conditions and reports may help reduce the impact of severe weather and natural disasters. It may be necessary to halt certain hazardous operations or stop work altogether to allow the situation to pass. The UXOSO must decide what operations, if any, are safe to perform based on existing conditions and anticipated conditions. If work stoppage occurs, the OESS and Shaw HSM, and PM must be immediately notified.

10.21.0.2. The best protection against most severe weather episodes is to avoid potential exposure. This avoidance means seeking shelter before the storm hits. Stay away from pipes and electrical equipment should lightning be a threat, and watch for damage caused by lightning strikes nearby.

10.22 Float Plan

No operations are expected to require the use of vessels or skiffs during the site remediation. A float plan is not required based on current PWS.

10.23 Site Specific Fall Protection and Prevention Plan

No operations are expected to entail work at heights greater than 6 ft. A fall protection plan is not required based on current PWS.

10.24 Demolition Plan

A demolition plan, including engineering evaluation and lead-based paint and asbestos surveys, is not required based on the current PWS.

10.25 Excavation and Trenching Plan

Utility clearances and dig permits will be coordinated with SEAD for all excavation sites. Shaw procedure EIG-HS-308, Underground/Overhead Utility Contact Prevention shall be followed. Shaw procedure EIG-HS-307, Excavation and Trenching will be followed. If utilities are identified within proposed anomaly excavation locations and excavation footprint, Shaw will coordinate utility shut-offs through SEAD. A safe means of access and egress will be provided for excavations 4 ft or greater. If an excavation to 5 ft is required the side wall slope shall be a minimum 1-1/2 to 1. All excavation activities shall be evaluated by an excavation competent person. No excavations are anticipated adjacent to active roadways where traffic control measures would apply. Qualified UXO technicians will provide construction support during anomaly investigations in accordance with EM 385-1-97.

10.26 Emergency Rescue (tunneling)

Tunneling will not occur under the current PWS.

10.27 Underground Construction Plan

An underground construction plan is not required based on the current PWS.

10.28 Compressed Air Plan

A compressed air plan is not required based on the current PWS.

10.29 Formwork and Shoring Erection and Removal Plan

A formwork and shoring erection and removal plan is not required based on the current PWS.

10.30 Pre-Cast Concrete Plan

A pre-cast concrete plan is not required based on the current PWS.

10.31 Lift Slab Plan

A jacking (lift) slab plan is not required based on the current PWS.

10.32 Steel Erection Plan

A steel erection plan is not required based on the current PWS.

10.33 Site Safety and Health Plan for HTRW Work

The SSHP for Hazardous, Toxic, and Radioactive Waste (HTRW) operations is provided in **Attachment D-5**.

10.34 Blasting Safety Plan

Controlled explosive detonation of MEC will be performed by qualified UXO personnel in accordance with the Work Plan.

10.35 Diving Plan

Diving operations will not be performed under the current PWS.

10.36 Confined Space Program

Confined or permit required confined space entry will not be performed under this PWS.

11.0 CONTRACTOR INFORMATION

11.1 Activity Hazard Analysis

Detailed, project-specific AHAs are provided in the SSHP (**Attachment D-5**) for each major phase/activity of work. Before initiating a work activity presenting hazards not identified in the initial AHAs, the UXOSO will update the AHAs in consultation with the HSM. The AHA describes steps to safely mitigate classic safety hazards, explosive ordnance and explosives hazards, and chemical, physical, and biological hazards.

11.2 Job Safety Analysis

Shaw H&S SOP EIG-HS-045, Job Safety Analysis (JSA) (**Attachment D-2**), will be used daily and whenever activities, site conditions, or operations change. The JSA is an effective management technique for identifying hazardous conditions and unsafe acts similar to the AHA, but is filled out by the personnel actually performing the work. The JSA is an opportunity for personnel to stop and analyze the individual steps or activities, which together create a job or specific work duty, and to detect any actual or potential hazards that may be present. This process can identify less obvious potential hazards that may go undetected during routine management observations or audits. It should be understood that changing conditions that a work crew encounters during a work period (inclement weather, another contractor began work in area, etc.) requires that the JSA be modified to address the new hazards. The JSA should be changed to reflect new conditions in the task being performed or new hazards not identified previously.

11.3 Hazard Assessment Resolution Process

11.3.0.0. HARP is brief, paperless, general risk assessment made by employees in each work area. The objective of HARP is to identify and eliminate potential real-time workplace hazards that could lead to an accident.

11.3.0.1. HARP requires workers to take time (2 minutes) before starting a job to become aware of the immediate work environment so as to detect conditions unanticipated by our work planning. This involves a three-step process:

a. Assess the hazard(s) and risk(s) to identify what could go wrong and what is the worst thing that could happen.

b. Analyze the situation to determine how to reduce the risks. Evaluate each identified risk and implement the appropriate safeguards to control the hazards.

c. Act to ensure safe operations:

- Take the necessary steps to complete the job safely.
- Follow written standards and procedures (SSHP, AHAs, JSAs, SOPs, etc.).
- Don't proceed until it's safe.

11.3.0.2 In performing the HARP, focus attention on surroundings, equipment, tools, PPE, and critical steps prior to focusing on the task; consider the chemical, physical, and environmental hazards associated with the task.

11.3.0.3. Risk reduction is a critical component of HARP. Such risks shall be avoided:

a. Hurrying;
b. Thinking the job is routine or simple;
c. Believing nothing bad can happen;
d. Not talking about precautions with co-workers; and,
e. Not raising a "gut feel."

11.3.0.4. The appropriate hazard resolution must take place before proceeding with the task:

a. Communicate hazards and precautions to take with co-workers and supervisor.
b. Eliminate or control the hazards. The implementation of administrative controls is sometimes effective, i.e., marking the hazard with warning tape, signs, or tags.
c. If the risk is unacceptable or if a hazard cannot be satisfactorily controlled, then stop work and contact the SUXOS or UXOSO.

12.0 SITE SPECIFIC HAZARDS AND CONTROLS

Detailed site specific hazards and controls are provided in the AHAs for each activity conducted during the remedial investigation. The AHAs for the following activities are provided in Appendix 1 of the SSHP (**Attachment D-5**):

a. Site Mobilization/Preparation;

b. Vehicle Operations;

c. Analog Aided Visual Site Inspection;

d. Vegetation Removal;

e. Geophysical Survey Operations;

f. Fueling Operations;

g. Excavation of MEC;

h. Operation of Earth Moving Machinery and Material Handling Equipment;

i. MEC Demolition Operations; and,

j. Ash Handling.

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13.0 REFERENCES

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EM, 2008, 385-1-97, *Explosives – Safety and Health Requirements Manual*, U.S. Army Corps of Engineers. 15 September.

Parsons, 2005, *Closure Plan for the Open Burning Tray in Solid Waste Management Unit – SEAD-23.* Prepared for U.S. Army Engineer Division, Huntsville and Seneca Army Depot. October.

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Attachment D-1

Resumes and Training Records for Key Project Safety Personnel

Last Updated: 08 Jul 2011

James R. Joice

Professional Qualifications

Mr. Joice has participated in hundreds of planned remediation and emergency response projects. His duties have included the development, implementation, oversight, and enforcement of Health and Safety Plans, developing respiratory protection and Personal Protective Equipment (PPE) programs for working in potentially hazardous environments, Site Safety and Health Officer (SSHO), supervising project safety personnel, monitoring subcontractor activities, and verifying regulatory compliance. He also audits program effectiveness, specifies and performs air monitoring, investigates incidents, provides training, and tracks program and project safety performance.

Education

Bachelor of Science, Zoology, Ohio State University, Columbus, Ohio, 1978

Additional Training/Continuing Education

OSHA 8-Hour Hazardous Waste Operations and Emergency Response Refresher, Findlay, Ohio, 2008
OSHA 8-Hour HAZWOPER Supervisor, OHM Corporation, 1989
OSHA 40-Hour Hazardous Waste Operations and Emergency Response, OHM Corporation, 1987

Registrations/Certifications/Licenses

Certified Hazardous Materials Manager (CHMM), 1989, 1807, Active, Nationwide
Certified Industrial Hygienist (CIH), 1991, CP5341, Active, Nationwide
Certified Safety Professional (CSP), 2006, 19155, Active, Nationwide

Experience and Background

05/2002 - Present
Manager, Environmental, Health, and Safety, Shaw Environmental & Infrastructure, Inc., Federal, Findlay, Ohio

Responsibilities include providing safety and industrial hygiene support to client programs, projects and office staff. Recent assignments have included:

AFCEE WERC 09 (Program Health and Safety Manager)

AFCEE 4PAE08 (Program Health and Safety Manager)

ERRS 1 (Program CIH)

ERRS 6 (Program Health and Safety Manager)

FUSRAP Maywood - Maywood, NJ (Program Health and Safety Manager)

FUSRAP SLDS - St. Louis, MO (Project CIH)

FUSRAP SLAPS - St. Louis, MO (Project CIH)

FUSRAP Linde - Tonawanda, NY (Project CIH)

NAVFAC RAC IV (Program Health and Safety Manager)

NAVFAC RAC V (Program Health and Safety Manager)

Naval Ammunition Depot - Hastings, NE (Project CIH)

RVAAP MMRP RI ? Ravenna, OH (Project Health and Safety Manager)

USACE Louisville MARC (Program Health and Safety Manager)

USACE Louisville A&E (Program Health and Safety Manager)

The following is a summary of key projects:
Site Safety Officer, Ellsworth Airforce Base, US Army Corps of Engineers, Rapid City, SD, 01/1995 - 11/1997
Installation of several landfills and a large scale soil vapor extraction system with incinerator.

05/1998 - 05/2002
Manager, Health and Safety, IT Corporation (The Shaw Group, Inc., acquired substantially all of the operating assets of The IT Group, Inc., on May 23, 2002), Findlay, Ohio

Responsibilities include providing safety and industrial hygiene support to client programs, projects and office staff. Assignments included:

Naval Ammunition Depot - Hastings, NE

FUSRAP SLDS - St. Louis, MO

Sunflower Army Ammunition Plant - DeSoto, KS

Lake City Army Ammunition Plant - Independence, MO

NICOR Mercury Restoration Project - Chicago, IL

Alaska Railroad - Talkeetna, AK

The following is a summary of key projects:
On-site Health and Safety Manager, NICOR Mercury Restoration Project, NICOR, Chicago, IL, 09/2001 - 09/2002
Inspected thousands of homes for mercury contamination and remediated residential mercury spills.

Site Safety Officer, Minot Anhydrous Ammonia Derailment, Superior Special Services, Inc., Minot, ND, 02/2002 - 02/2002
Tranfer of anhydrous ammonia and flaring residual material from damaged railcars.

Site Safety Officer, Alaska Railroad derailment, Alaska Railroad, Talkeetna, AK, 12/1999 - 01/2000
Tranferred jet fuel from damaged railcars.

06/1996 - 05/1998
Manager, Health and Safety, OHM Remediation Services, Corp., Midwest Region, Findlay, Ohio

Responsibilities include providing on-site safety and industrial hygiene support to client project. Assignment included:

Ellsworth Air Force Base

03/1993 - 06/1996
President, Environmental Hygienics, Inc., Findlay, Ohio

Private consultant. Performed industrial hygiene and safety consulting services for corporations and businesses. Significant field project experience included serving as the on-site Safety and Health Officer at Midway Naval Air Station, Midway Island. Also was adjunct faculty member (Environmental Technologies Program), Owens Community College, Findlay, Ohio, 01/94-05/96. Instructor of environmental science, water and wastewater treatment, and industrial hygiene.

The following is a summary of key projects:
On-site Safety and Health Officer, Midway Naval Air Station, US Navy, Midway Island, 01/1994 - 08/1994
Managed the site safety and health program during the construction, operation/maintenance of groundwater recovery and treatment, thermal oxidation, and SVE systems; as well as the demolition of large aboveground storage tanks.

01/1990 - 03/1993
Manager, Health and Safety, OHM Remediation Services, Corp., Midwest Region, Findlay, Ohio

Managed all aspects of the health and safety program for the Midwest Region of OHM Remediation Services Corp. Mr. Joice developed and implemented the safety and health plans and provided on-site safety and health support as required for planned remediation and emergency response projects. He supervised numerous safety and industrial hygiene technicians. He also facilitated safety training, investigated incidents, and audited projects for compliance with procedures and regulations.

01/1986 - 01/1990
Facilities Safety Manager and Regulatory Compliance Coordinator, OHM Remediation Services, Corp., Corporate Headquarters, Findlay, Ohio

Verified the corporate facilities were in compliance with OSHA and EPA regulations. Mr. Joice managed the safety and hazardous waste compliance programs for the facilities. Provided worker safety training for facilities and field personnel. He also, served as the on-site Safety and Health Officer for numerous remediation and emergency response projects. Conducted site and facility health and safety inspections and developed and implemented site safety and health plans.

01/1981 - 01/1986
Analytical Chemist, OHM Remediation Services, Corp., Findlay, Ohio

While working from both fixed-base and mobile laboratories, Mr. Joice provided technical and analytical support for remediation projects and emergency response incidents. These projects encompassed a variety

of environmental challenges at Super-fund cleanup sites, commercial and military facilities, and at train derailments. Mr. Joice also managed the gas chromatography department at the corporate laboratory in Findlay, Ohio.

12/1979 - 01/1981
Quality Assurance Specialist, UNIVERSAL COOPERATIVES, INC., Napoleon, Ohio

Mr. Joice managed the quality control laboratory and supervised the formulation department at an agricultural chemical formulation facility. He implemented the quality control procedures for the laboratory operations and conducted quality assurance inspections to verify the products met EPA label specifications. Mr. Joice was also responsible for the tank farm operations and NPDES permitting compliance.

07/1978 - 11/1979
Plant Operator, Municipal Water Teatment Plant, Defiance, Ohio

Mr. Joice served as a Licensed Plant Operator at a 15-million gallon per day drinking water treatment facility. He was responsible for operation and maintenance, including sampling and monitoring functions.

Professional Affiliations

American Industrial Hygiene Association, Full, 1991
American Industrial Hygiene Association - Northwest Ohio Chapter, Full, 1991

Douglas L. Schicho, PE, PMP, Project Manager, has 18 years experience with Shaw Environmental, Inc. (Shaw) as an environmental professional. He has a BS in Chemistry and an MS in Environmental Engineering. Over the last 18 years, Mr. Schicho has worked at multiple Army, Air Force and Navy facilities encompassing over 300 sites. His engineering experience has included due diligence (EBS and ECP), Hazardous, Toxic, and Radioactive Waste (HTRW) and Military Munitions Response Program (MMRP) Remedial Investigations/Feasibility Studies (RI/FS), engineering design and remediation activities on DoD sites.

Program Manager, Munitions and Explosives of Concern (MEC) Comprehensive Site Evaluation (CSE) Phase I and Phase II - Program Management responsibilities included coordination with ITSI Program Manager and multiple Shaw project managers. Additional responsibilities included oversight of safety, quality and contractual requirements on five task orders under this contract. Task Orders include CSE Phase II Investigations at Davis Monthan Air Force Base (AFB), Barksdale AFB, Langley AFB, McChord AFB and RI at Pole Mountain (FUDS). CSE Phase I investigations were performed at 37 active Air Force Installations. Historical Records Reviews were performed at 137 active Air Force Sites. These investigations identified and characterized over 300 Munitions Response Areas at these Air Force Installations.

Project Manager, CSE Phase II Investigations - Mr. Schicho was the project manager for CSE Phase II assessments at six active Air Force Installations in six states under this performance based FFP contract. Installations included Wright-Patterson AFB, Tinker AFB, Air Force Plant 6, Air Force Plant 44, Air Force Plant 42, and Robins AFB. Range types included aerial bombing ranges, Explosive Ordnance Disposal ranges, munitions disposal areas, pistol ranges, and skeet ranges.

Project Manager, Environmental Condition of Property (ECP) Assessments Phase I and Phase II (TO10 and 17) - ECP Investigations at Fort Monmouth, Fort Gillem, and Fort McPherson. The objective of the Phase II ECP is to investigate environmental releases which were identified during the Phase I. At the project sites, Mr. Schicho managed the investigation of potential environmental releases from Underground Storage Tanks, industrial waste sewers, dumping and spills associated with historical Army operations. Investigatory techniques included digital geophysical mapping (DGM), Geoprobe investigation of soil and groundwater, surface water sampling, sediment sampling, and the performance of a vapor intrusion investigation of buildings overlying groundwater plumes.

Project Manager, Remedial Investigation, Feasibility Study, Decision Document (DD), and Long-Term Monitoring (LTM) (TO04) - This task order includes 13 individual projects all involving Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) actions at Picatinny Arsenal. RI was completed for the 600 Area Groundwater, a current explosive test range. Proposed Plan (PP) and Record of Decision (ROD) was completed for the Area C/Southern Boundary Groundwater Plume. Mr. Schicho managed and coauthored DDs for this groundwater operable unit which encompasses the majority of groundwater flow off of Picatinny Arsenal. Through statistical analysis of the groundwater data and oriented rock coring to determine flow direction in a complex fractured rock unit, Shaw was able to achieve regulatory concurrence for an LTM solution for this operable unit. FS, PP, and ROD was completed for PICA-111, a propellant manufacturing area. Mr. Schicho was coauthor and manager for the completion of these DDs for this former propellant production area. Waste handling practices at the former propellant area resulted in contamination of soil with metals, dinitrotoluene, and perchlorate.

Project Manager, Remedial Investigation, Feasibility Study, Decision Document, and O&M of Groundwater Pump and Treat Systems (TO17) - The scope of the Picatinny Arsenal Installation Program includes the CERCLA site closure of over 150 sites at the 6,500-acre facility. As the primary support for the Picatinny Installation Restoration Program (IRP), task order 17 includes all facets of the IRP. Tasks included RI of over 50 sites and groundwater operable units, completing FS, PP, and ROD for over 50 sites.

Mr. Schicho managed the Building 24 pump and treat system, which is a 100 gallon per minute groundwater treatment system installed to form a hydraulic barrier preventing TCE contaminated groundwater from discharging to a surface water body. The groundwater pump and treat was eventually shut down with the installation of a permeable reactive barrier designed under this task order.

Project Engineer, Remedial Investigation and Feasibility Study (TO17) - Responsible for all aspects of the preparation of engineering documents for Picatinny Arsenal. Mr. Schicho oversaw the work of junior engineers and reported directly to the project manager. He designed the sampling program for a pyrotechnic range contaminated with MEC, multiple contaminants including polychlorinated biphenyls (PCBs), metals, pesticides, and chlorinated solvents. Under Mr. Schicho's management, the program was implemented and the resultant data used in developing an Engineering Evaluation/Cost Analysis for the excavation and off-site disposal of contaminated soils from the site. Completed the RI for 17 sites. This investigation included geophysics, soil-gas, well installation, dye trace studies, soil boring, test pits, unexploded ordnance avoidance surveys, and media sampling. Site hazards required that some activities be performed in Level B.

Project Engineer, Preliminary Assessment and Site Investigation (PA/SI) (TO01) - Preliminary Assessment/Site Inspection Phase III Areas, Picatinny Arsenal, NJ. Mr. Schicho acted as a task manager for a team of three in the performance of document review, site inspection, engineering drawing review, and personnel interviews. The assessment was performed at the Phase III area of Picatinny Arsenal. This area included a nitroglycerin, high explosive, and propellant manufacturing area, two munitions dumps, as well as two ordnance-testing areas. In all, over 60 sites were evaluated as part of the arsenal CERCLA program. Mr. Schicho oversaw the production of the PA/SI sampling plan and site inspection report. Responsibilities included task management, development of sampling plans, and data management.

Jeffrey J. Tarr, PG, Site Manager, is a Senior Professional Geologist with over 22 years of diverse experience in the environmental field (13 years with Shaw Environmental, Inc. [Shaw]), particularly in the areas of project\site management, Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Site Investigation and Remedial Investigation; Hazardous, Toxic, and Radioactive Waste (HTRW) and Military Munitions Response Program (MMRP) Remedial Investigations/Feasibility Studies (RI/FS); Resource Conservation and Recovery Act (RCRA) regulatory compliance; hazardous and mixed waste management; technical writing; environmental drilling/well installation, sampling and analysis, and health and safety on DoD sites. Mr. Tarr has an AS in Petroleum Engineering Technology and a BS in Geology. He is a licensed professional geologist in three states, including Alabama, Florida, and Georgia. Over the last 22 years, he has worked at multiple Army, Air Force, and Navy installations encompassing over 350 sites.

Mr. Tarr has extensive experience investigating and managing a wide variety of HTRW and MMRP sites, including sites with chemical contamination, munitions and explosives of concern (MEC), and/or unexploded ordnance (UXO) as well as complex hydrogeological issues, at numerous military installations as well as commercial sites. Mr. Tarr has worked closely with the U.S. Army Corps of Engineers (USACE) Mobile District, USACE Huntsville Engineering and Support Center, Alabama Department of Environmental Management (ADEM), and EPA Region 4 on the same Base Realignment and Closure (BRAC) Cleanup Team (BCT) for the past 13 years.

Site Manager/Senior Geologist - Mr. Tarr has been the Site Manager for the BRAC project at Fort McClellan in Anniston, Alabama, for the past 13 years. He is directly responsible for Shaw field personnel and subcontractors. Under Mr. Tarr's site management direction while working closely with Shaw project management and senior UXO personnel, over 300 parcels of land were successfully transferred to the public domain. Mr. Tarr managed in excess of 80 field personnel and subcontractors. Site Management tasks included, but were not limited, to technical support and guidance, coordinating with Army range control personnel and Shaw/subcontractor UXO personnel, field scheduling and cost control, contract oversight, invoice review, hazardous and nonhazardous waste management and overall responsibility for execution of field work in compliance with approved work plans under the CERCLA Total Environmental Restoration Contract (TERC) program. Site Coordinator for HTRW sites including chemical warfare agent (CWA) training sites, weapons training ranges (weapons demonstration ranges, grenade launcher ranges, pistol ranges, skeet ranges, mortar ranges, machine gun ranges, combat and maneuver ranges, and impact areas), munitions disposal areas, fuel training areas, ground scars, boiler plants, radiological sites, and underground storage tank (UST) sites. Additional supervisory activities, including oversight and technical direction for cost schedulers, procurement, project accountants, drilling supervisor, sample coordinator, heavy equipment operators, drilling crews, UXO personnel, geologists, engineers, chemists, surveyors, sample technicians, and solid/liquid waste transportation and disposal contractors.

Below is a brief outline of some of the many tasks/projects that were completed under Mr. Tarr's supervision at the Former Fort McClellan:

Supervised the removal of 7,000 tons of lead-contaminated soil encompassing over an approximately 2.3-acre area located on a steep hillside on U.S. Fish and Wildlife Service property. Soil removal activities included UXO construction support, refinement of lead-contaminated soil areas previously identified during the RI, x-ray fluorescence (XRF) field screening and off-site laboratory analyses, post-excavation confirmation sampling, waste

characterization sampling, and site restoration/supplemental erosion control measures to prevent erosion.

Performed large-scale conventional and remote trenching operations at former artillery and mortar impact zones located within 12 landfills and fill areas possibly contaminated with MEC and/or UXO. Trenching operations were performed to determine the vertical and horizontal extent of the fill areas and to characterize the fill material. Approximately 90 exploratory trenches were excavated and 50 exploratory soil borings drilled within the landfills/fill areas during the 8-month investigation. Trenching required state-of-the-art remote trenching operations with UXO construction support.

Supervised 14 UXO personnel providing MEC anomaly avoidance and MEC construction support for clearing trees, roads, drilling / well installation, sampling, trenching and general construction projects.

Completed two MEC/3X scrap removals including the supervision of 25 field personnel performing excavation of two munitions disposal areas possibly contaminated with 3X scrap material consisting of chemical warfare material and ordnance and explosive scrap at the Former Technical Escort Reaction Area (also known as the Toxic Gas Yard). Specific tasks involved with 3X removal included UXO construction support, chemical agent monitoring, excavation and screening of debris and soil, sorting, packaging and transportation of inert 3X scrap for shipment.

Conducted RIs at several Fort McClellan ranges, including chemical warfare material (CWM) training areas and shell tapping areas (e.g., Range I, Toxic Gas Yard, Range L, and the Old Water Hole). Many of these investigations involved the use of geophysical surveys to identify disposal areas and minicams for CWM avoidance. Chemicals of concern (COCs) identified included lead and arsenic in soil (from Lewisite), chlorinated solvents in groundwater (from decontamination agents), and CWM breakdown products in groundwater. Other RIs involved soil and groundwater contamination at several other CWM sites (T-38, Range 24A, Range J, T-5, T-6, 24Alpha, T-31 and Range K). COCs at these sites included chemical warfare breakdown products and decontamination solutions. UXO and CWM avoidance and construction support activities were conducted as required by the installation commander.

Responsible for hazardous and nonhazardous waste programs, including technical guidance for the management, proper containerization, labeling, storage, treatment, transportation and disposal of investigation-derived waste contaminated with numerous contaminants including, but not limited to, solvents, petroleum hydrocarbons, pesticides, herbicides, and lead.

Successfully completed large-scale drilling programs using various techniques (air rotary, reverse air, rotosonic, hollow-stem), well installation (residuum and double-cased bedrock wells), and sampling programs at 300 parcels under the BRAC program. Drilling operations included rock coring using various coring techniques to determine fractures, bedding planes and fault zones. Utilized downhole video televiewer cameras and geophysical logging, including resistivity, gamma, dip meter and caliper to correlate geologic data to contaminant migration pathways.

Project Manager, Remedial Investigation, Former Sewart Air Force Base, Smyrna, Tennessee - Currently serving as project manager and providing technical expertise under the USACE Louisville AE District FFP Contract. Responsibilities include project management, authoring, editing, preparing, and reviewing technical reports including RI reports and work plans, evaluating analytical data, and preparing summary presentations for the USACE and Tennessee Department of Environment and Conservation (TDEC).

Project Manager, MEC Removal Action and After Action Report - Project manager providing technical expertise (where Shaw is a subcontractor to Bay West) for a task order under the Air Force's MMRP at Arnold Air Force Base in Tullahoma, Tennessee. Primary objectives included MEC clearance support to make munitions response areas (MRAs) safe for reuse and to protect human health and the environment. Performed surface clearance at two former military impact areas; Munitions Response Sites (MRSs) TG027 and TG028, a crater investigation at MRS TG027, and soil removal at the Camp Peay Small-Arms Ranges (SARs); SAR 031 and SAR032. Field activities included, but not limited to, MEC clearance support, digital geophysical mapping (DGM), munitions constituents sampling and analysis, vegetation removal, mag and dig, inspection of Material Potentially Presenting an Explosive Hazard (MPPEH), and disposal of Material Documented as Safe (MDAS), and MEC.

Project Manager, U.S. Army Integrated Training Area Management - Currently serving as project manager (where Shaw is a subcontractor to CALIBRE) supporting the Army ITAM (integrated training area management) program by providing land rehabilitation and maintenance, range and training land assessment, and GIS support for five Army Bases, including Fort Knox, Fort Benning, Fort Jackson, Fort Rucker, and Fort Gordon.

Site Manager/Task Order Manager - Directly responsible for Shaw field personnel and subcontractors for the U.S. Army National Guard Performance Based Fixed-Price Contract at Fort McClellan, Anniston, Alabama. Site Management tasks include technical support and guidance, field scheduling and cost control, contract oversite, invoice review, hazardous and nonhazardous waste management and overall responsibility for execution of field work in compliance with approved work plans. Task management tasks include assisting project manager with daily management tasks, coordinating office and field work, oversite and technical guidance to junior and mid-level scientists. Supervised large-scale drilling and bedrock coring programs to delineate the extent of chlorinated solvents in groundwater at the Former Toxic Gas Area, Pelham Range. Coordinated several soil and groundwater sampling efforts. Co-authored RI reports.

David P. Coe, Senior Unexploded Ordnance Supervisor (SUXOS) is an Unexploded Ordnance (UXO) Senior Supervisor with 24 years of experience. He is familiar in the identification of foreign and domestic military ordnance. Mr. Coe has acted with the capacity of Senior Supervisor, Team Leader, Safety and Quality Control on UXO projects. He has an associates degree in Liberal Arts.

Senior UXO Supervisor and Safety Officer, Kissimmee River Restoration - Supervised six UXO Technicians while supporting a Prime and four other Subcontractors during the realignment of the Kissimmee River. Provided UXO Briefings to over 40 employees while working on the former and current Avon Park Air Force Base Bombing Range. Completed and forwarded Field Activity Daily Logs, Tailgate Safety Meetings and Job Safety Analysis to Shaw Project Manager and both Omaha and Jacksonville Corp of Engineers. Completed weekly work schedules to ensure all contractors were provided UXO Support.

UXO Team Leader, Ft. Ritchie - Supervised a five man team in a subsurface search of military ordnance. Items were located using magnetometers, excavated and disposed of if hazardous. All required documentation, i.e. Dig Permits, Job Safety Analyses, Anomaly Identification Sheets, Explosive Logs, and Field Activity Daily Logs were completed.

UXO Senior Supervisor/Team Leader, Avon Park Bombing and Gunnery Range - Provided ordnance avoidance during surveying and well drilling operations. Managed four, two man teams during surveying of the Kissimmee River Project. Operator of water craft during project. Completed required float plans and Field Activity Daily Logs and approved expense reports and timesheets for all personnel.

UXO Senior Supervisor, Patuxent NAS and Webster Field Remediation - Provided construction support during the excavation of areas containing UXO. Recovered 3- and 5-inch navy projectiles in addition to 100-, 500- and 750-pound general purpose bombs. First Shaw UXO team to use the remote drill to determine filler of items encountered. Attended base meetings and interacted with all base agencies during this project.

UXO Supervisor, Ft. Ord - Supervised a 15 man team during a surface clearance of a rocket and grenade range. Supervised explosive demolition of all hazardous items encountered. Completed required documentation.

UXO Team Member/Team Leader, Camp Hale - Member of a 15 man team during a surface clearance. Located, identified and explosively disposed of all hazardous items encountered. Performed duties as Team Leader as required. Completed required documentation.

UXO Team Member, Yorktown NAS - Provided construction support during excavation of contaminated areas. No ordnance was recovered during this phase.

Master Sergeant, US Air Force, Various, Maryland - United Stated Air Force, Retired Master Sergeant with 23 years of service. Duties included Explosive Ordnance Disposal Team Leader, Safety/Quality Assurance and Shop Superintendent. Provided assistance to local police departments and the Secret Service in support of the President of the United States.

William Wren, Unexploded Ordnance Safety Officer (UXOSO), has 17 years of combined Explosive Ordnance Disposal (EOD)/Unexploded Ordnance (UXO) experience, including 10 years as an Army Ordnance/ EOD officer. Mr. Wren was an instructor of nuclear warhead disassembly as well as primary instructor counter-terrorism and bomb search classes based on training from the U.S. and British Armies. He operated and trained local nationals in the safe use of MHE in support of demolitions operations. Mr. Wren conducted and supervised surface UXO clearance operations using local nationals as well as performed small arms burn operations of over 15 tons NEW per burn. He performed the duties and functions of a Tech II in the Theater of Iraq, destroying an average of 200 tons of captured ammunition every 2 days. He has a BS in Administration from Eastern Kentucky University.

UXOSO, Jacksonville, North Carolina - UXOSO at Camp Lejeune overseeing a 35 man team, including prime contractor personnel. Responsibilities included conducting safety audits, team briefings, UXO training, and client escort for Quality Assurance inspections.

UXO Tech III, Lompoc, California - Team Leader of a 10 man surface sweep team at Vandenberg Air Force Base (AFB). Responsibilities included conducting Tailgate Safety Meetings, preparation of Job Safety Analyses, and identification of munitions and explosives of concern (MEC).

Senior UXO Supervisor (SUXOS), Manchester, New Hampshire - SUXOS at New Boston AFB, supervising three teams with a total of 30 UXO Techs. Responsibilities included operation control/team assignments, interface with the client and coordination with other contractors on site.

UXO Technician III, Alamogordo, New Mexico - Team Leader and quality control (QC) of a Sift Operation at White Sands Missile Range. Responsible for overseeing a 10 man sift team (including equipment operators and UXO Techs, 2 bucket loaders, 1 excavator, and a table sifter) for the recovery of MEC.

UXO Tech III, UXB, Blacksburg, Virginia - UXO QC Specialist (UXOQCS) and UXOSO and previously Team Leader of a MAG and Dig operation. Responsibilities included preparation of QC Reports, Safety Reports, and conduction of safety audits.

UXO Tech III, Yuma, Arizona - Senior Team Leader of a surface sweep team, with two subordinate team leaders, supervised a 25 man team.

UXO Tech III, Albuquerque, New Mexico - Team member of a three man surface sweep team on a Native American reservation.

UXO Tech III, Tobyhanna, Pennsylvania - Team Leader of a surface sweep team.

UXO Tech III, Vieques, Puerto Rico - DEMO Team Leader in Vieques, overseeing a six man team.

UXO Tech III, Adak, Alaska - Team Leader of an eight man surface sweep team.

UXO Tech II, Rancho Cucamonga, California - Surface sweep team member.

UXO Tech II, Quantico, Virginia - Surface sweep team member and worked as an assistant with QC.

UXO Tech II, Elkton, Maryland - Surface sweep team member.

UXO Tech II, Surf City, New Jersey - Surface sweep team member.

UXO Tech II, Camp Navajo, Arizona - Surface sweep team member.

UXO Tech II, Fort Campbell, Kentucky -Surface sweep team member.

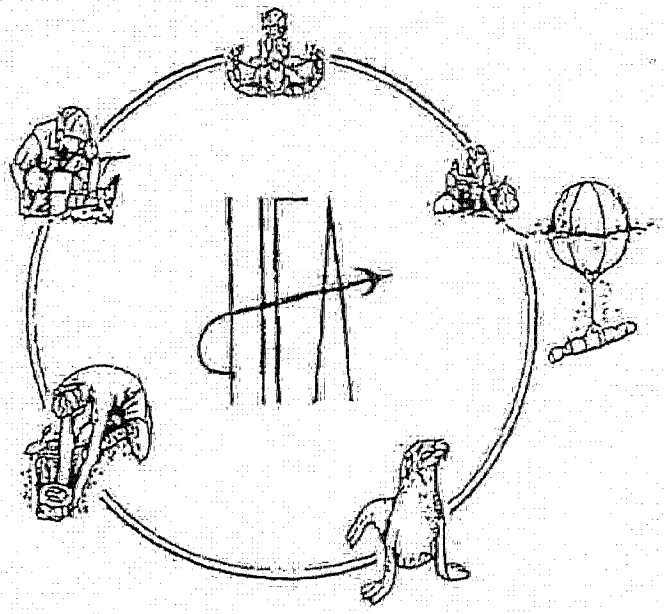
UXO Tech II, Iraq - Worked in Iraq as a DEMO Team member averaging 200 ton shots every other day. Responsibilities included operation control/team assignments, supervision of 400 Iraqis (including responsibility for payroll) and 125 Americans, and conducting weekly and monthly briefings to the U.S. Army.

Commissioned Ordnance/EOD Officer, U.S. Army, Various Locations, Nationwide

Certificate of Training

This Certifies That

David Coe



Satisfactorily Completed the

OSHA 40 - Hour Course

Hazardous Waste Worker
29 CFR 1910.120

Presented by Human Factors Applications, Inc.

Dated this 6th Day of June 19 94

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Student Affiliation:
Shaw Environmental & Infrastructure
4433

Certificate of Completion

This is to certify that

David Coe

has been tested and successfully meets the training requirements for

8-Hour HAZWOPER Refresher

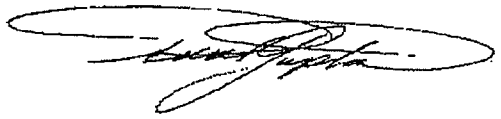
as per 29 CFR 1910.120(e)

Presented

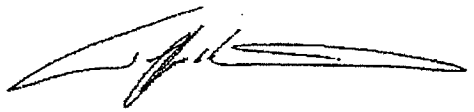
Thursday, November 24, 2011

Compliance Solutions Occupational Trainers, Inc.

Certificate Number: 754832914



Neval Gupta
Vice President



Jeffrey Kline
President/CEO

Compliance SolutionsOccupational Trainers, Inc.

Certificate of Completion

Student Name: David Coe

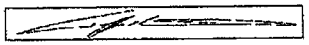
Company: Shaw Environmental & Infrastructure

I Certify the above named student has been tested and trained for:

8-Hour HAZWOPER Refresher

as per 29 CFR 1910.120(e)

Date of Issue: 11/24/2011

By:  President

201100075

ABAG ASSOCIATION OF BAY AREA GOVERNMENTS

CERTIFICATE OF COMPLETION

David Coe

has successfully completed
the course titled

8-hr OSHA Training for Supervisors

on

May 17, 2001

and has earned
0.8 CEUs (Continuing Education Units) from the program

Terry Bursztynsky, Training Director
Sharon Kendrick, Training Coordinator
www.hazmatschool.com; (510) 464-7964

Paul W. Gantt, REA
Safety Compliance Management, Inc.

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PEEL HERE →

DAVE COE

This card certifies that the above individual has successfully completed the objectives and skills evaluations in accordance with the curriculum of the AHA Heartsaver First Aid CPR AED Program. Optional completed modules are those **NOT** marked out:

Child CPR AED Infant CPR [redacted]

AUGUST 2011
Issue Date

AUGUST 2013
Recommended Renewal Date

Training Center Name: ELLIOT HEALTH SYSTEM TC ID #: NH00048

TC Info: 1 ELLIOT, MANCHESTER NH

Course Location: ELLIOT HOSPITAL

Instructor Name: CHRISTOPHER MALLEY Inst. ID #: 11060225985

Holder's Signature: David Coe

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Strike through the modules ***NOT*** completed.

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90-1815 3/11

the IT group

CERTIFICATE of COMPLETION

Presented To

Jeffrey J Tarr

In Recognition of Having Successfully Completed the Prescribed Course of Study for

40-Hour HAZWOPER Training

OSHA 29 CFR 1910.120 (e) (2) (i) through (e) (2) (vii)

I certify that the above trainee has completed this training course as given by The IT Group or one of its subsidiaries.

12/01/1990

EFFECTIVE DATE

Don L. Unruh

DON L. UNRUH, CIH, CSP
Manager, Internal Training Group

the group

CERTIFICATE *of* COMPLETION

Presented To

Jeffrey J Tarr

In Recognition of Having Successfully Completed the Prescribed Course of Study for

8-Hour HAZWOPER Supervisor Training

OSHA 29 CFR 1910.120 (e) (4)

I certify that the above trainee has completed this training course as given by The IT Group or one of its subsidiaries.

08/30/1995

EFFECTIVE DATE

Don L. Unruh

DON L. UNRUH, CIH, CSP
Manager, Internal Training Group

Compliance Solutions

"Today's Training... Tomorrow's Solution"

3980 Quebec St, 2nd Floor Denver, CO 80207-1633 800-711-2706

Student Affiliation:
Shaw Environmental & Infrastructure
4433

Certificate of Completion

This is to certify that

Jeffrey Tarr

has been tested and successfully meets the training requirements for

8-Hour HAZWOPER Refresher

as per 29 CFR 1910.120(e)

Presented

Thursday, February 16, 2012

Compliance Solutions Occupational Trainers, Inc.

Certificate Number: 754836859

Neval Gupta
Vice President

Jeffrey Kline
President/CEO

Compliance SolutionsOccupational Trainers, Inc.

Certificate of Completion

Student Name: Jeffrey Tarr

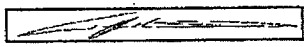
Company: Shaw Environmental & Infrastructure

I Certify the above named student has been tested and trained for:

8-Hour HAZWOPER Refresher

as per 29 CFR 1910.120(e)

Date of Issue 2/16/2012

By:  **President**

American Red Cross

This recognizes that

Jeff Tarr

has completed the requirements for
Standard First Aid

conducted by
Calhoun

Date Completed 8/27/2010

The American Red Cross recognizes this certificate as valid for 3 year(s) from completion date.

American Red Cross

This recognizes that

Jeff Tarr

has completed the requirements for
CPR–Adult, Child and Infant

conducted by
Calhoun

Date Completed 8/27/2010

The American Red Cross recognizes this certificate as valid for 1 year(s) from completion date.

American Red Cross

This recognizes that

Oliver Allen

has completed the requirements for
Standard First Aid

conducted by
Calhoun

Date Completed 8/27/2010

The American Red Cross recognizes this certificate as valid for 3 year(s) from completion date.

American Red Cross

This recognizes that

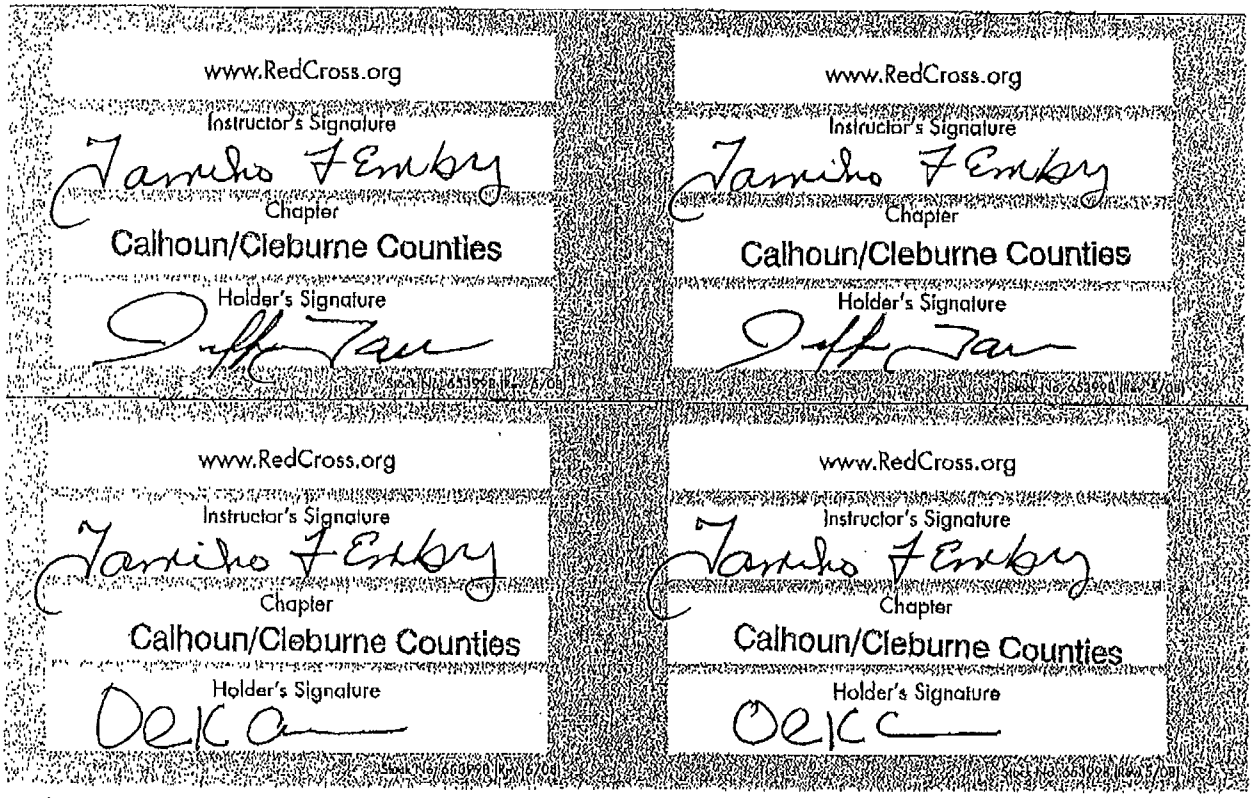
Oliver Allen

has completed the requirements for
CPR–Adult, Child and Infant

conducted by
Calhoun

Date Completed 8/27/2010

The American Red Cross recognizes this certificate as valid for 1 year(s) from completion date.



FIRST AID 37008
CPR

THE NATIONAL

ENVIRONMENTAL TRAINERS

certify that

William Wren

has satisfactorily passed an exam and completed a 40 hour training course entitled

"Hazardous Waste Operations and Emergency Response"

meeting the requirements identified in Title 29 CFR 1910.120. This course is eligible for 3.33 Continuance of Certification (COC) points from the Board of Certified Safety Professionals.

Signature of Instructor

NATIONAL ENVIRONMENTAL TRAINERS

April 30, 2006

Clay A. Bednarz, MS, RPIH

690A East Los Angeles Ave.Suite. 180 Simi Valley , CA 93065
888 309-7233 * 805 306-8027 * 805 526-0377
www.SafetyUnlimited.com

Certifies that

William Wren

has successfully completed

8 Hour HAZWOPER Supervisor Refresher Training

In Accordance With Federal OSHA Regulation 29 CFR 1910.120

Julius P. Griggs
Julius P. Griggs
Instructor #892

4/10/2008
Issue Date

080410413537
Certificate Number

TO VERIFY THE VALIDITY OF THIS CERTIFICATE, go to www.SafetyUnlimited.com/certificate.htm

PEEL HERE

American Heart Association

Learn and Live

Heartsaver® First Aid

WILLIAM WREN

This card certifies that the above individual has successfully completed the objectives and skills evaluations in accordance with the curriculum of the AHA for Heartsaver First Aid Program.

Modules Completed: Ⓐ ● Ⓒ Ⓓ Ⓔ

AUGUST 2010
Issue Date

AUGUST 2012
Recommended Renewal Date

Training Center: ELLIOT HOSPITAL

TC Address/Contact Info: 1 ELLIOT WAY, MANCHESTER NH

Course Location: ELLIOT HOSPITAL

New Hampshire CPR
1-877-412-0882
www.nhcpr.com

Instructor: CHRISTOPHER MALLEY

Holder's Signature

© 2008 American Heart Association *Tampering with this card will alter its appearance.* 80-1202

Fill in the circles of the modules *NOT* completed. This card contains unique security features to protect against forgery.

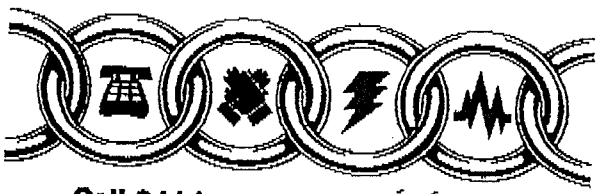
80-1202 R3/

On the front, fill in the circles of the modules *NOT* completed: ●

Course Curriculum completed:

A. Adult First Aid
B. Environmental Emergencies
C. Adult/Child CPR With Mask
D. Adult/Child AED
E. Infant CPR With Mask

Recommended renewal for Heartsaver First Aid is every two years.



Call 911 in case of an emergency

Poison Control Center **1-800-222-1222**

Visit our website: **americanheart.org/cpr**

For training information call: **1-877-AHA-4CPR**

Compliance Solutions

"Today's Training... Tomorrow's Solution"

3980 Quebec St, 2nd Floor Denver, CO 80207-1633 800-711-2706

Student Affiliation:
Shaw Environmental & Infrastructure
4433

Certificate of Completion

This is to certify that

William Wren

has been tested and successfully meets the training requirements for

8-Hour HAZWOPER Refresher

as per 29 CFR 1910.120(e)

Presented

Thursday, February 23, 2012

Compliance Solutions Occupational Trainers, Inc.

Certificate Number: 754839142

Neval Gupta
Vice President

Jeffrey Kline
President/CEO

4433

Compliance SolutionsOccupational Trainers, Inc.

Certificate of Completion

Student Name: William Wren

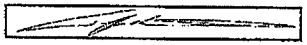
Company: Shaw Environmental & Infrastructure

I Certify the above named student has been tested and trained for:

8-Hour HAZWOPER Refresher

as per 29 CFR 1910.120(e)

Date of Issue 2/23/2012

By:  President

4433

HAZMAT
TRAINING ▲ INFORMATION ▲ SERVICES ▲ INC
An Employee Owned Company

LETTER OF SATISFACTORY COMPLETION

HAZMAT Training, Information and Services, Inc. (Hazmat TISI) hereby certifies that Douglas L. Schicho satisfactorily completed a 40-hour course of instruction titled "The Hazardous Materials Site Worker" on September 17, 1993.

The course addressed the training needs of employees working hazardous material sites where there is significant threat of exposure to hazardous substances, health hazards, or safety hazards.

Hazmat TISI certifies that the course satisfies the initial off-site training requirements for employees specified by the Department of Labor, Occupational Safety and Health Administration, as found in 29 CFR 1910.120(e) Final Rule dated March 6, 1989.

Hazmat TISI provides this certificate based on this individual's demonstration of practical skills and the successful completion of a written examination.

Hazmat TISI recommends that this letter be made a part of the employee's personnel file.

The Department of Labor requires that this individual undergo annual refresher training and recertification.

Edward E. Hartin
Vice President of Operations
Hazmat TISI

TRAINING & CONSULTATION IN HAZARDOUS MATERIALS CONTROL
9017 Red Branch Road ▲ Columbia Maryland 21045
Balt. 410-964-0940 ▲ Wash. 301-621-5349
1-800-777-8474 ▲ FAX 410-964-2331

Talent Shaw Connection™

Building Careers For Growth, Leadership, and Opportunity

This certificate is awarded to

Douglas Schicho

for the successful completion of the course

8-Hour HAZWOPER Refresher

Hours: 8 Hours 0 min Credits: 0

Completion Date: 2/2/2012

Scott Trevise

Scott Trevise, Sr. Vice President
Human Resources

Virgil Barton

Virgil Barton, Sr. Vice President
Quality, EHS, Regulatory Compliance,
Process Improvement

the i group

CERTIFICATE *of* COMPLETION

Presented To

Douglas L. Schicho

In Recognition of Having Successfully Completed the Prescribed Course of Study for

8-Hour HAZWOPER Supervisor Training

OSHA 29 CFR 1910.120 (e) (4)

I certify that the above trainee has completed this training course as given by The IT Group or one of its subsidiaries.

01/28/1998

EFFECTIVE DATE

Don L. Unruh

DON L. UNRUH, CIH, CSP
Manager, Internal Training Group

Attachment D-2

Health and Safety Standard Operating Procedures

ENG 3394	**USACE Accident Investigation Report Form**
SEI-GUIDE-004	**Shaw Environmental and Infrastructure, Inc. Guidelines for Standard Safety Disciplinary Actions**
EIG-HS-010	**Employee Safety and Health Work Rules**
EIG-HS-011	**General Safety Rules for Contractors**
EIG-HS-014	**Severe Weather Policy and Procedures**
EIG-HS-020	**Accident Prevention Program: Reporting, Investigation and Review**
EIG-HS-021c	**Accident Prevention Program: Management Safety Inspections**
EIG-HS-023	**Accident Prevention Program: Employee Safety Incentives and Team Safety Award Program**
EIG-HS-045	**Job Safety Analysis**
EIG-HS-050	**Employee and Subcontractor Health and Safety Training Requirements**
EIG-HS-060	**HAZCOM Program**
EIG-HS-100	**Medical Policies and Procedures**
EIG-HS-101	**Drug and Alcohol Testing**
EIG-HS-102	**Management of Employee Exposure and Medical Records**
EIG-HS-104	**Employee Notification of Industrial Hygiene Monitoring Results**
EIG-HS-307	**Excavation and Trenching**
EIG-HS-308	**Underground/Overhead Utility Contact Prevention**
EIG-HS-315	**Control of Hazardous Energy and Hazardous Material Sources (Lockout/Tagout)**
EIG-HS-400	**Heat Stress**
EIG-HS-401	**Cold Stress**
EIG-HS-402	**Hearing Conservation Program**
EIG-HS-512	**Handling of Blood or Other Potentially Infectious Material**
EIG-HS-600	**Personal Protective Equipment**
EIG-HS-601	**Respiratory Protection**
EIG-HS-800	**Motor Vehicle Operation: General Requirements**

(For Safety Staff only)	REPORT NO.	EROC CODE	**UNITED STATES ARMY CORPS OF ENGINEERS ACCIDENT INVESTIGATION REPORT** *(For Use of this Form See Help Menu and USACE Suppl to AR 385-40)*	**REQUIREMENT CONTROL SYMBOL: CEEC-S-8(R2)**

1. **ACCIDENT CLASSIFICATION**

PERSONNEL CLASSIFICATION	INJURY/ILLNESS/FATAL	PROPERTY DAMAGE	MOTOR VEHICLE INVOLVED	DIVING
GOVERNMENT ☐ CIVILIAN ☐ MILITARY	☐	☐ FIRE INVOLVED ☐ OTHER	☐	☐
☐ CONTRACTOR	☐	☐ FIRE INVOLVED ☐ OTHER	☐	☐
☐ PUBLIC ☐ FATAL ☐ OTHER			☐	

2. **PERSONAL DATA**

a. Name *(Last, First, MI)*	b. AGE	c. SEX ☐ MALE ☐ FEMALE	d. SOCIAL SECURITY NUMBER	e. GRADE

f. JOB SERIES/TITLE	g. DUTY STATUS AT TIME OF ACCIDENT	h. EMPLOYMENT STATUS AT TIME OF ACCIDENT
	☐ ON DUTY ☐ TDY ☐ OFF DUTY	☐ ARMY ACTIVE ☐ ARMY RESERVE ☐ VOLUNTEER ☐ PERMANENT ☐ FOREIGN NATIONAL ☐ SEASONAL ☐ TEMPORARY ☐ STUDENT ☐ OTHER *(Specify)*

3. **GENERAL INFORMATION**

a. DATE OF ACCIDENT *(month/day/year)*	b. TIME OF ACCIDENT *(Military time)* hrs	c. EXACT LOCATION OF ACCIDENT	d. CONTRACTOR'S NAME (1) PRIME: (2) SUBCONTRACTOR:

e. CONTRACT NUMBER	f. TYPE OF CONTRACT	g. HAZARDOUS/TOXIC WASTE ACTIVITY
☐ CIVIL WORKS ☐ MILITARY ☐ OTHER *(Specify)*	☐ CONSTRUCTION ☐ SERVICE ☐ A/E ☐ DREDGE ☐ OTHER *(Specify)*	☐ SUPERFUND ☐ DERP ☐ IRP ☐ OTHER *(Specify)*

4. **CONSTRUCTION ACTIVITIES ONLY** *(Fill in line and corresponding code number in box from list - see help menu)*

a. CONSTRUCTION ACTIVITY (CODE) #	b. TYPE OF CONSTRUCTION EQUIPMENT (CODE) #

5. INJURY/ILLNESS INFORMATION *(Include name on line and corresponding code number in box for items e, f & g - see help menu)*

a. SEVERITY OF ILLNESS/INJURY (CODE) #	b. ESTIMATED DAYS LOST	c. ESTIMATED DAYS HOSPITALIZED	d. ESTIMATED DAYS RESTRICTED DUTY

e. BODY PART AFFECTED	g. TYPE AND SOURCE OF INJURY/ILLNESS
PRIMARY (CODE) #	TYPE (CODE) #
SECONDARY (CODE) #	SOURCE (CODE) #
f. NATURE OF ILLNESS/INJURY (CODE) #	

6. PUBLIC FATALITY *(Fill in line and correspondence code number in box - see help menu)*

a. ACTIVITY AT TIME OF ACCIDENT (CODE) #	b. PERSONAL FLOATATION DEVICE USED?
	☐ YES ☐ NO ☐ N/A

7. MOTOR VEHICLE ACCIDENT

a. TYPE OF VEHICLE	b. TYPE OF COLLISION	c. SEAT BELTS	USED	NOT USED	NOT AVAILABLE
☐☐ PICKUP/VAN ☐☐ AUTOMOBILE ☐☐ TRUCK ☐☐ OTHER *(Specify)*	☐ SIDE SWIPE ☐ HEAD ON ☐ REAR END ☐ BROADSIDE ☐ ROLL OVER ☐ BACKING ☐ OTHER *(Specify)*	(1) FRONT SEAT			
		(2) REAR SEAT			

8. PROPERTY/MATERIAL INVOLVED

a. NAME OF ITEM	b. OWNERSHIP	c. $ AMOUNT OF DAMAGE
(1)		
(2)		
(3)		

9. VESSEL/FLOATING PLANT ACCIDENT *(Fill in line and correspondence code number in box from list - see help menu)*

a. TYPE OF VESSEL/FLOATING PLANT (CODE) #	b. TYPE OF COLLISION/MISHAP (CODE) #

10. ACCIDENT DESCRIPTION *(Use additional paper, if necessary)*

11. **CAUSAL FACTOR(S)** *(Read Instruction Before Completing)*

a. (Explain YES answers in item 13)	YES	NO
DESIGN: Was design of facility, workplace or equipment a factor?	☐	☐
INSPECTION/MAINTENANCE: Were inspection & maintenance procedures a factor?	☐	☐
PERSON'S PHYSICAL CONDITION: In your opinion, was the physical condition of the person a factor?	☐	☐
OPERATING PROCEDURES: Were operating procedures a factor?	☐	☐
JOB PRACTICES: Were any job safety/health practices not followed when the accident occurred?	☐	☐
HUMAN FACTORS: Did any human factors such as, size or strength of person, etc., contribute to accident?	☐	☐
ENVIRONMENTAL FACTORS: Did heat, cold, dust, sun, glare, etc., contribute to the accident?	☐	☐

a. *(CONTINUED)*	YES	NO
CHEMICAL AND PHYSICAL AGENT FACTORS: Did exposure to chemical agents, such as dust, fumes, mists, vapors or physical agents, such as, noise, radiation, etc., contribute to accident?	☐	☐
OFFICE FACTORS: Did office setting such as, lifting office furniture, carrying, stooping, etc., contribute to the accident?	☐	☐
SUPPORT FACTORS: Were inappropriate tools/resources provided to properly perform the activity/task?	☐	☐
PERSONAL PROTECTIVE EQUIPMENT: Did the improper selection, use or maintenance of personal protective equipment contribute to the accident?	☐	☐
DRUGS/ALCOHOL: In your opinion, was drugs or alcohol a factor to the accident	☐	☐

b. WAS A WRITTEN JOB/ACTIVITY HAZARD ANALYSIS COMPLETED FOR TASK BEING PERFORMED AT TIME OF ACCIDENT?

☐ YES *(If yes, attach a copy.)* ☐ NO

12. **TRAINING**

a. WAS PERSON TRAINED TO PERFORM ACTIVITY/TASK?	b. TYPE OF TRAINING.	c. DATE OF MOST RECENT FORMAL TRAINING.
☐ YES ☐ NO	☐ CLASSROOM ☐ ON JOB	(Month) (Day) (Year)

13. **FULLY EXPLAIN WHAT ALLOWED OR CAUSED THE ACCIDENT; INCLUDE DIRECT AND INDIRECT CAUSES** *(See instruction for definition of direct and indirect causes.) (Use additional paper, if necessary)*

a. DIRECT CAUSE

b. INDIRECT CAUSE(S)

14. **ACTION(S) TAKEN, ANTICIPATED OR RECOMMENDED TO ELIMINATE CAUSE(S).**

DESCRIBE FULLY:

15. **DATES FOR ACTIONS IDENTIFIED IN BLOCK 14.**

a. BEGINNING (Month/Day/Year)	b. ANTICIPATED COMPLETION (Month/Day/Year)		
c. SIGNATURE AND TITLE OF SUPERVISOR COMPLETING REPORT CORPS _____ CONTRACTOR _____	d. DATE *(Mo/Da/Yr)*	e. ORGANIZATION IDENTIFIER *(Div, Br, Sect)*	f. OFFICE SYMBOL

16. **MANAGEMENT REVIEW** *(1st)*

a. ☐ CONCUR b. ☐ NON CONCUR c. COMMENTS

SIGNATURE	TITLE	DATE

17. **MANAGEMENT REVIEW** *(2nd - Chief Operations, Construction, Engineering, etc.)*

a. ☐ CONCUR b. ☐ NON CONCUR c. COMMENTS

SIGNATURE	TITLE	DATE

18. **SAFETY AND OCCUPATIONAL HEALTH OFFICE REVIEW**

a. ☐ CONCUR b. ☐ NON CONCUR c. ADDITIONAL ACTIONS/COMMENTS

SIGNATURE	TITLE	DATE

19. **COMMAND APPROVAL**

COMMENTS

COMMANDER SIGNATURE	DATE

*U.S. GOVERNMENT PRINTING OFFICE: 1993-0-791-757

10. ACCIDENT DESCRIPTION ***(Continuation)***

13a. DIRECT CAUSE ***(Continuation)***

13b. INDIRECT CAUSES *(Continuation)*

14. ACTION(S) TAKEN, ANTICIPATED, OR RECOMMENDED TO ELIMINATE CAUSE(S) *(Continuation)*

Shaw Environmental and Infrastructure, Inc.
Guidelines for Standard Safety Disciplinary Actions

SEI-GUIDE-004

This document is for the purpose of providing information about the types of conduct, including but not limited to those that constitute just cause for disciplinary actions that may be taken by Shaw.

This guideline is applicable for all projects under the management of Shaw Environmental & Infrastructure, Inc.

Approved By

George Bevan, President

Bill Winkler – President, Federal Business Line

Jeff Jenkins – President, CS&L Business Line

Scott Waguespack, Executive Director of Human Resources

Troy Allen, Executive Director of Health & Safety

September 24, 2009
Effective Date

Guidelines for Standard Safety Disciplinary Actions

1.0 PURPOSE

This guideline has been developed to provide a more consistent approach to disciplinary action when safety violations occur within Shaw E&I. The disciplinary actions imposed may include verbal and written warnings, suspension, or termination as defined in HR207 "Employee Discipline".

This document is for the purpose of providing information about the types of conduct, including but not limited to those that constitute just cause for disciplinary actions and possible disciplinary actions that may be taken by Shaw. This guideline does not require Shaw to impose any particular discipline or progressive discipline, and does not limit Shaw's rights to discipline, suspend, or discharge any employee within Shaw's discretion. Employee's that are part of an active Collective Bargaining Agreement (CBA) will be subject to the disciplinary action guidelines as specified in the CBA under which they are covered.

The employee's direct supervisor and/or functional manager are responsible for ensuring that violations of health and safety policies, procedures, and regulations are dealt with in an appropriate and consistent manner. The following guidance should be utilized to determine disciplinary actions for safety violations.

2.0 TYPES OF VIOLATIONS

Safety violations are typically categorized as minor, moderate, or serious. Additionally, concerning second or repeat violations, it should be understood that a violation should not be compounded or considered repeat / second violation if the previous violation occurred more than 3 years prior. The following provides the disciplinary procedures to be used for the specific class of violation.

2.1 For a **Minor** safety violation, (see examples below), the employee's direct site supervisor or functional manager will meet with the employee(s) and discuss the nature of the safety violation. The recommended corrective action should be selected to prevent future violations.

2.1.1 Should a second, Minor safety violation occur to the same employee, the direct site supervisor and functional manager will meet with the employee and issue a written warning to the employee. The direct supervisor must use the Disciplinary Action Form (Attachment 1). A copy of the Disciplinary Action Form must be submitted to the employee's designated Human Resources representative for review prior to issuing the written warning. A further minor violation either being of the same safety issue by the same employee or a different offense may result in another written warning, suspension from work without pay (non-exempt) for a reasonable period of time, or the direct supervisor may recommend a Discharge Termination. These further violations provide

for indicators of continued unacceptable behavior and should be accounted for when determining a disciplinary action. The designated Human Resources representative must be consulted prior to suspension or termination.

> NOTE: Under the Fair Labor Standards Act (FSLA), an exempt employee can only be suspended for disciplinary reasons with a reduction in salary, for a violation of a serious safety rule. Exempt employees can be reassigned or instructed not to report to work pending the supervisor's decision whether to recommend termination. However, they must continue to be paid their regular salary.

2.2 A **Moderate** (see examples in section 3.0) safety violation will require the direct supervisor and functional manager to document a verbal or prepare a written warning (using the Disciplinary Action Form) for the safety violation. A copy of the Disciplinary Action Form must be submitted to the Human Resources representative for review prior to issuing the written warning.

In event of a repeat Moderate safety violation by the same employee(s), another written warning may be issued to the employee(s) and the designated Human Resources representative should be contacted to determine if suspension or termination is warranted.

2.3 If a **Serious** safety violation occurs, it will require that, in most cases, the direct supervisor or person observing the violation had to immediately intervene and/or stop the activity. The employee's direct supervisor and functional manager will complete the Disciplinary Action Form for the safety violation that was observed. The designated Human Resources representative shall then be contacted to determine the next course of action, such as suspension or termination (as warranted).

2.3 If a **Terminable** safety violation occurs, it will require that, in most cases, the direct supervisor or person observing the violation had to immediately intervene and/or stop the activity. The employee's direct supervisor and functional manager will complete the Disciplinary Action Form for the safety violation that was observed. The designated Human Resources representative shall then be contacted to determine the appropriate course of action in accordance with requirements set forth in the Human Resources termination process.

Type of Violation	**Recommended Action**
Minor	Verbal warning (but always documented in field notes)
Moderate	Documented verbal or written warning
Serious	Written disciplinary action; suspension or termination
Terminable	Termination

3.0 EXAMPLES OF SAFETY VIOLATIONS

The following provides typical examples for each class of safety violation. The employee's direct supervisor is responsible for recommending the classification of the violation to the Human Resources representative. The Human Resources representative shall make the final classification of the violation, after consultation with a Health and Safety Manager.

3.1 **Minor** Safety Violation

- Failure to wear specified personal protective equipment, e.g., safety glasses, gloves, safety shoes/boots, etc.
- Failure to perform daily heavy equipment or vehicle inspections
- Performing unsafe work practices
- Horseplay, which doesn't result in an accident or injury
- Failure to attend a scheduled safety meeting
- Improperly dismounting heavy equipment

3.2 **Moderate** Safety Violation

- Repeat of Minor safety violation
- Failure to report a minor first aid injury within a day of the incident, e.g., small cut on finger requiring a band-aid, bee sting, dust particle in eye
- Failure to immediately report an accident or injury, including any equipment or property damage
- Failure to wear specialized PPE, e.g. face shield, respiratory protection, etc.
- Performing unsafe work practices after being corrected
- Horseplay, which didn't but could have resulted in an accident or injury
- Abuse of safety equipment
- Violation of company 60-pound lifting limit or lifting limit of less than 60 pounds designated by a medical professional
- Failure to follow restricted activity guidelines directed by a medical professional
- Neglect in care of company or client vehicles (example GSA)

3.3 **Serious** Safety Violation

- Repeat of Moderate violation
- Knowingly performing unsafe work practices, which could have or did result in serious injury to the employee or other personnel
- Possession/use of drugs (without a prescription) or alcohol on company projects/premises
- Positive drug or alcohol test
- Unauthorized use of company or client vehicles
- Citation for reckless driving or open alcohol container while on company business
- Leaving the scene of an automobile accident without contacting the police, regardless of fault
- Not immediately reporting a work related auto accident, regardless of fault
- Not immediately reporting a work related driving under the influence citation
- Not immediately reporting a work related open alcohol container citation

- Not immediately reporting a work related hit and run citation
- Horseplay that results in employee injury
- Destroying or damaging company, client or another employee's property
- Tampering with safety equipment
- Direct refusal to wear the designated PPE for a task
- Direct refusal to follow established company Health and Safety Policy

3.4 **Terminable** Safety Violation

- Failure to wear fall protection or not being tied to an anchor point when required
- Disregard for a required lockout / tag out
- Upon conviction or upon pleading no contest to a DUI/DWI while driving on company business

4.0 REFERENCES

HR207 "Employee Discipline"

ATTACHMENT 1 - DISCIPLINARY ACTION FORM

Employee Name	Employee Number	Position
Date of Hire	Resource Manager	Supervisor Imposing Discipline

I – PERFORMANCE PROBLEM OR MISCONDUCT

The supervisor should complete the applicable provisions of this section.

Most recent date and time of Performance Problem or Misconduct: _____

Location of Incident or Problem: _____

Describe Problem or Misconduct: _____

_____

_____

_____

Describe Explanation Offered by the Employee: _____

_____

_____

_____

II – PRIOR RECORD OF COUNSELING

Has employee received any prior warning? □ Yes □ No

If yes, was the prior warning for the same or a similar problem/offense? □ Yes □ No

Briefly explain: _____

_____

_____

If the prior warning was for a different problem or type of misconduct, explain: _____

_____

_____

Was the prior warning verbal or written? □ Verbal □ Written □ Both

Date(s) or prior counseling and by whom: _____

III – PRIOR DISCINIPLARY ACTION TAKEN

□ Verbal Warning □ Written Suspension □ Demotion
□ Written Warning □ Transfer □ Suspension
□ Extension of Probation
□ Loss of Privileges (Explain): _____
□ Termination □ Other _____

IV – CURRENT DISCINIPLARY ACTION TAKEN

□ Verbal Warning □ Written Suspension □ Demotion
□ Written Warning □ Transfer □ Suspension
□ Extension of Probation
□ Loss of Privileges (Explain): _____
□ Termination □ Other _____

V – REQUIRED CORRECTIVE ACTION PLAN

The employee must address and correct the problem:

□ Immediately □ Within _____Days

Corrective steps to be taken by employee: _____

_____

_____

ACKNOWLEDGMENTS

Prepared by (Print & Sign):	Position / Job Location:	Date:
_____ _____		

Human Resources Department Review

Reviewed by (Print & Sign):	Position / Office Location:	Date:
_____ _____		

I certify that I have read this disciplinary action form and fully understand it.

_____ _____

Employee Signature Date

A copy of this form shall be placed in the employee file.

Note: Additional page(s) can be added, as required, making reference to relevant Section(s) where additional space is required to accurately and completely clarify any Section.

1. PURPOSE

This procedure establishes the method of distribution for the employee Health and Safety Manual. This manual is not intended to be an all-inclusive document, but rather an outline of general health and safety guidelines applicable to all employees.

2. SCOPE

This procedure applies to all Shaw Group Inc. Environmental & Infrastructure Group (E&I) employees.

2.1 Exception Provisions

Variances and exceptions may be requested pursuant to the provisions of Procedure No. EIG-HS-013, "Health and Safety Procedure Variances."

3. REFERENCES

- Procedure No. EIG-HS-013, Health and Safety Procedure Variances

4. DEFINITIONS

- **Company**—All wholly-owned subsidiaries of Shaw E&I.

5. RESPONSIBILITY

5.1 Procedure Responsibility

The Senior Director of Health and Safety is responsible for the issuance, revision, and maintenance of this procedure.

5.2 Action/Approval Responsibilities

The Responsibility Matrix is shown as Attachment 1, "Responsibility Matrix."

6. PROCEDURE

Project and office managers are to ensure that each employee at his/her location is provided with a copy of the Health and Safety Manual. All newly hired employees will be provided a copy of this manual as part of their new hire orientation package. Employees are encouraged to read and retain this manual for future reference. Specific questions should be addressed to their manager or health and safety representative.

The employee's manager is responsible for collecting completed copies of the signature card found at the end of the manual, and for forwarding these cards to the Human Resources Department. Additional copies of this manual can be obtained from the various Human Resources Departments located throughout the company.

7. ATTACHMENTS

- Attachment 1, Responsibility Matrix

8. FORMS

None

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9. RECORDS

None

10. REVISION HISTORY AND APPROVAL

Revision Level Revision Date	Revision Description	Responsible Manager
00 4/24/2002	Initial issue	Warren Houseman
01 6/04/2009	No significant changes have been made to the content of this procedure. Numerous sentence structure problems were corrected.	Mike Zustra
02 8/25/2011	Modified format only to align with Governance Management framework.	Andrew Johnson

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Attachment 1
Employee Health and Safety Manual
Responsibility Matrix

Action	Procedure Section	Responsible Party			
		Human Resources Representative	Project/ Office Manager	Health and Safety Representative	Senior Director of Health and Safety
Issue, Revise, and Maintain Procedure	5.1				X
Ensure Current Employees are Provided a Copy of the Manual	6		X		
Provide New Hires With a Copy of the Manual	6	X			
Answer Employee Questions Pertaining to Manual	6		X	X	
Forward Completed Signature Cards to Human Resources Department	6		X		

1. PURPOSE

The purpose of this procedure is to promulgate the General Safety Rules for Contractors. This document sets forth in broad terms the health and safety requirements to which a contractor is expected to conform while working under contract with Shaw Environmental & Infrastructure, Inc. (Shaw E&I).

2. SCOPE

This procedure applies to all Shaw E&I contractors.

3. REFERENCES

- Shaw E&I Procedure No. EIG-PS-104, Qualification of Sources

4. DEFINITIONS

- **Contractor**—As used in this procedure, means a party in either the Prime or Subcontractor role or otherwise, providing supplies/services to Shaw E&I and performing some obligations of a particular prime contract.
- **Contractor prequalification**—The process of ensuring that an individual or firm possesses the required capabilities so that both Shaw E&I and the Contractor are protected in the event of a failure to perform, an accident, or a difference of opinion as to the terms and conditions or performance. This prequalification process is governed by Shaw Procedure EIG-PS-104, "Qualification of Sources."

5. RESPONSIBILITIES

5.1 Procedure Responsibility

The Executive Director of Health and Safety is responsible for the issuance, revision, and maintenance of this procedure.

5.2 Action/Approval Responsibilities

The Responsibility Matrix can be found as Attachment 1, "Health and Safety Rules for Contractors Responsibility Matrix."

6. PROCEDURE

Attachment 2, "General Safety Rules for Contractors," has been created for the express purpose of circulating prescribed safety and health rules for contractors working on Shaw E&I projects, whether in-house or for clients. This publication should be widely distributed to our contractors and the rules contained therein stringently enforced. These rules are supported by years of experience in the field and are considered equally applicable to our own operations as well as our contractors.

6.1 Procurement Department

Shaw E&I procurement specialists will forward copies of the attached documents to prospective contractors as part of the contractor prequalification process prescribed by Shaw E&I Procedure No. EIG-PS-104, "Qualification of Sources." They will assure completion of the General Site Safety Rules for Contractors Receipt and maintain copies with the procurement file.

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6.2 Document Availability

Stocks of the attachments will be maintained in the procurement system for issuance upon submittal of a request to the Procurement Department. In addition, local health and safety personnel will maintain a small working stock of the publications for ready issue.

6.3 Document Updates

It is desired to make these safety and health documents truly functional publications. To that end, suggestions for improvement are encouraged. Recommended changes should be submitted to local health and safety personnel for transmittal to the Executive Director Health and Safety for consideration and incorporation.

7. ATTACHMENTS

- Attachment 1, Health and Safety Rules for Contractors Responsibility Matrix
- Attachment 2, General Safety Rules for Contractors Receipt

8. FORMS

None

9. RECORDS

- General Safety Rules for Contractors Receipt

10. REVISION HISTORY AND APPROVAL

Revision Level Revision Date	Revision Description	Responsible Manager
00 03/30/2006	Initial Issue	Troy Allen
01 8/31/2010	Attachment 2, General Safety Rules for Contractors, has been revised and reformatted.	Troy Allen
02 5/4/2011	Attachment 2 paragraph. “Safety”, added line for participation in safety meetings etc. and requirement to review hazard assessment	David Quinn
03 8/25/2011	Modified format only to align with Governance Management framework.	Andrew Johnson

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Attachment 1
Health and Safety Rules for Contractors Responsibility Matrix

Action	Procedure Section	Responsible Party		
		Procurement Specialist	Local Health and Safety Representative	Executive Director of Health and Safety
Issuance, revision and maintenance of this procedure	5.1			X
Distribute General Safety Rules	6.1	X		
Maintain General Safety Rules Receipts	6.1	X		
Submit Recommended Changes	6.3		X	
Update General Safety Rules	6.3			X

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Attachment 2
General Safety Rules for Contractors

Shaw Environmental & Infrastructure, Inc.

General Safety Rules for Contractors

Health & Safety Office 4171 Essen Lane, Baton Rouge, LA 70809, 225-932-2500

Introduction

The rules and requirements contained in this booklet have been written for the guidance of Contractors who are to perform work under contract with any member company of Shaw Environmental & Infrastructure, Inc. (Company). This booklet prescribes minimum requirements only and is incorporated by reference in Company Procedure No. EIG-PS-104. The Contractor, working in conjunction with the company representative, will be expected to establish such additional rules and procedures as may be necessary to conduct a safe operation and comply with Company, regulatory, and insurance requirements, and those of our clients. The term Contractor, as used in this booklet, shall be understood to include any and all persons, sole proprietorships, partnerships, corporations, or other business ventures under contract, oral or written, to the Company. Contractor is responsible for informing its subcontractors of these requirements, for directing and supervising work of subcontractors, and for assuring that its subcontractors adhere to the requirements herein. The Company may request Contractor to provide proof of its subcontractors' adherence to all rules and regulations and will prohibit access to Company property or job sites or our client's property for those Contractors not in compliance. In order to assist Contractor in following these instructions, a Company Representative will be assigned to the Contractor to act as the Company agent in all matters relative to work activities at Company facilities or job sites. Under no circumstances shall any work be started until the Company Representative has been contacted; a job orientation and Tailgate Safety meeting has been conducted; and all permits, insurance, and company, client, and regulator pre-job requirements have been met.

General Safety Rules and Requirements

Accident Reporting

All incidents (personal and property damage) shall be reported immediately to the Company Representative. A written report shall be prepared documenting the incident and corrective measures taken to prevent recurrence. Accident reporting shall comply with Company Procedure No. EIG-HS-020 including the Accident Review Board process.

Alcohol, Firearms, etc.

Alcoholic beverages, illegal drugs or narcotics, or guns and ammunition are not permitted on Company property or job sites. Personnel under the influence of alcohol or drugs shall not be allowed on Company property or job sites.

Approvals

The Contractor shall be required to obtain pertinent work permits or authorizations and approval from the Company Representative before:

- Working on existing pipelines or equipment
- Entering tanks or closed vessels
- Entering any designated high-hazard areas
- Using torches, electrodes, electric motors, forges, soldering irons, any open flames, or any device which could produce sparks or ignition source
- Closing walkways, roads, or restricting traffic
- Starting excavations
- Removing tanks from excavations
- Backfilling excavations
- Using utilities such as: steam, water, compressed air, or electricity
- Sandblasting, spray painting, or guniting
- Storing flammable materials such as gasoline, oil, paints, compressed gas cylinders, etc.
- Walking or working on roofs of buildings or equipment
- Drilling, boring, preparing test pits, or using geophysical equipment or any other exploratory equipment requiring penetration of surfaces
- Operating cranes or similar equipment near overhead power lines, pipelines, or underground utilities
- Opening or cutting through firewalls or beams
- Fueling or repairing Contractor operating equipment on Company property or job sites

Security

For security reasons, entrance to and exit of Company facilities and job sites is restricted to those areas designated as the Contractor's work area.

Vehicle Safety

- All vehicles must be parked in authorized areas only.
- There will be no passing of moving vehicles at job sites where there are narrow roads and short-sight distances.
- Company vehicles will only be operated by personnel with valid licenses and good driving records (ref. Company Procedure No. EIG-HS-800).
- Vehicles shall have all required inspection and operating permits.
- Seat belts shall be used for all drivers and passengers.

Speed Limits

All vehicles on Company job sites and facilities must observe a maximum speed limit of 10 mph, unless otherwise posted.

Other General Requirements

- This booklet focuses on Federal and Company standards. Where State and local standards exist and are more stringent, their provisions shall be followed.
- The Company site Health and Safety Plan and the most current version of Company procedures shall be followed.
- The Company has established a lifting limit of 60 pounds. Above this weight, additional personnel and/or materials handling equipment are required.
- All bridges intended for vehicular traffic shall be constructed to withstand twice the load of the heaviest vehicle anticipated.
- All Contractor equipment, such as pipe, rebar, etc., shall be kept out of traffic lanes and access ways. Equipment shall be stored in a manner that ensures the safety of the Company and Contractor employees at all times.
- All surfaces a person could reasonably contact should be free of splinters, nails, or protrusions that may cause injury.

Contractors are expected to brief their employees on these requirements and enforce these rules with their employees. Company management may stop or suspend work at any time the Contractor fails to comply with company rules and regulations.

Safe Work Practices

Confined Space Entry

Confined spaces include storage tanks, bins, sewers, in-ground vaults, degreasers, boilers, vessels, tunnels, manholes, pits, certain excavations, etc. These enclosures, because of inadequate ventilation and/or the introduction of hazardous gases and vapors, may present conditions that could produce asphyxiation or injury.

Before entering a confined space, Contractor must notify the Company Representative of intent to enter. The Company Representative will review with Contractor the safe entry requirements which include:

- **Permits –** All confined space entries are initially considered permit-required until/unless the space meets the requirements of Company Procedure No. EIG-HS-300 for nonpermit required confined spaces.
- **Removal of Contents –** Confined spaces must be clean; free of hazardous materials/chemicals; and, where necessary, purged by water or other equivalent means, insofar as is feasible or possible.
- **Isolation –** All input lines that discharge into a confined space shall be disconnected, blanked, capped, or isolated. The use of a single in-line valve shut-off as the sole means of isolating the confined space from any input lines is prohibited.
- **Electrical Lockout –** Where electrical devices located within the confined space (motors, switches, etc.) are to be repaired or worked on, the line-disconnect switches supplying the power must be tagged and locked in the "OFF" position. The lock key is to be kept by the person performing the job, and only this person is authorized to unlock the switch and remove the tag upon completion of the job. Where more than one person is working on the line, each must place a lock on the switch and retain their own key. Where there are multiple sources of power to an electrical device that supplies power to the device through an automatic or manual bus transfer switch, lockout devices must be placed on the breaker nearest to the electrical device that is to be isolated, and an electrician shall test the power supply lines to ensure that power has been secured. Line-disconnect switches supplying power to any mechanical apparatus in the confined space (mixers, conveyors, etc.) must also be tagged and locked in the "OFF" position. This must be done for any entry, even though work will not be performed on the apparatus itself.
- **Securing of Covers –** All manhole and cleanout covers shall be removed and the openings maintained clear of any obstructions. When hinged doors or lids are provided, they shall be secured so they cannot be closed.
- **Testing Atmosphere –** A qualified person (see Company Procedure No. EIG-HS-300 or 29 CFR 1910.146) shall make appropriate tests of the atmosphere in the confined space and place a record of the test results at the entrance to the confined space. Testing shall ensure the following:

  - Combustible gas and vapor concentrations do not exceed 10 percent of the lower explosive limit.
  - Oxygen content is not less than 19.5 percent and no greater than 23.5 percent.
  - Appropriate respirator protective equipment and other appropriate personal protective devices have been provided for all employees when concentrations of toxic materials exceed established exposure limits.
- **Continuous Monitoring –** If the nature of the work to be performed introduces, or has the potential to introduce, harmful air contaminants, continuous monitoring of the atmosphere is required. If tests indicate evidence of dangerous air contaminants, and/or the oxygen content drops below 19.5 percent or rises above 23.5 percent, all personnel shall evacuate the confined space immediately.
- **Personal Protective Equipment –** All Contractor employees must be instructed in accordance with OSHA regulations regarding personal protective clothing, hard hats, respirators, lifelines, and harnesses. Such instructions shall be received and documented before entering any confined space. Contractor shall arrange for confined space rescue services as required by 29 CFR 1910.146, prior to entry.

Compressed Gas Cylinders

- Valve protection caps shall be in place when compressed gas cylinders are transported, moved, or stored.
- Cylinder valves shall be closed when work is finished and when cylinders are empty or are moved.
- Compressed gas cylinders shall be secured (roped or chained), in an upright position at all times, except when cylinders are actually being hoisted or carried.
- Gas regulators shall be in proper working order while in use and shall only be of the type approved for the application.
- If a leak develops in a gas cylinder, don appropriate safety equipment and immediately remove the cylinder to a safe location. If the leak cannot be corrected, report it to the Company Representative.
- Cylinders shall be permanently marked or stenciled to identify the type of gas in the cylinder.
- All compressed breathing air shall meet ASTM specifications for breathing air quality.
- Oil and oily rags shall be kept away from oxygen equipment.

Cranes, Hoists, and Other Heavy Equipment

- Contractor personnel will not be permitted to use hoists and powered apparatus belonging to the Company unless approval is obtained in each instance from the Company Representative.
- Roll over protection shall be used when conditions or regulations call for such use.
- Documentation of operator qualifications shall be on file.
- Contractor shall present to the Company site supervisor for review the documentation for permits, testing and inspection on cranes and heavy equipment, and shall make maintenance records available as requested.

Cutting or Welding

- “Hot work” authorization must be obtained from the Company Representative before any welding, cutting, or other “hot work” is done. “Hot work” permits and results of tests are to be submitted to the Company Representative at the completion of the job or at the end of each workday.
- Noncombustible or flameproof shields or screens must be provided to protect welder or others who might be harmed by direct rays or arc.
- Goggles, gloves, aprons, and other personal protective equipment appropriate to the job shall be used.

High Fire-Hazard Areas

- Contractor personnel are responsible to see that a fire watch is maintained and all adjacent combustible materials are protected or removed as designated by the Company Representative.
- Contractor shall provide their own calibrated combustible gas meter or other instruments for checking areas before beginning hot work.
  - Documentation of instrument calibration shall be submitted to the Company Representative.
  - Contractor is responsible for all testing and monitoring required by applicable regulations, assuring work place safety and providing test results to the Company
  - The Company shall have the right, not the responsibility, to perform additional testing. Company testing shall not be in lieu of Contractor’s requirement.
- Contractor shall provide fire extinguisher(s) for welding and cutting, as designated by the Company Representative.
- Contractor shall provide a fire watch for 30 minutes AFTER cutting is completed.

Electrical Safety

- All noncurrent-carrying metal parts of fixed, portable, or plug-connected equipment shall be grounded. Because ground wires can break, they shall be tested with an electrical resistance meter to assure conductivity as often as necessary to assure safety.
- Extension cords shall be the three-wire type for grounded tools and shall be protected from damage; do not fasten with staples or extend across an aisle way or walkway. Worn or frayed cords shall not be used. Cords shall not be run through doorways where the door could cut or damage them.

- Exposed bulbs on temporary lights shall be guarded to prevent accidental contact, except where bulbs are deeply recessed in the reflector. Temporary lights shall not be suspended by their electric cords unless designed for this use. Explosion-proof bulb covers shall be used when contact with flammable vapors or gases is possible, and shall meet Class 1, Division 1 requirements.
- Receptacles for attachment plugs shall be of the approved, concealed, contact type. Where different voltages, frequencies, or types of current are supplied, receptacles shall be of such design that attachment plugs are not interchangeable.
- All field/construction shall require ground fault interrupters and watertight connectors.

Emergency Equipment

- The Company's fire equipment is not to be moved, relocated, or otherwise rendered inaccessible unless specific permission is granted in each case by the Company Representative.
- Self-contained breathing apparatus, first aid equipment, fire blankets, stretchers, eyewash fountains, and deluge showers are not to be moved, relocated, blocked, or used without the express permission of the Company Representative.

Excavations and Trenches

- Before any excavation work begins, all required permits shall be obtained.
- All work shall be in accordance with 29 CFR 1926 Subpart P and Company Procedure No. EIG-HS-307.
- The Contractor's Competent Person shall be identified to the Company Representative, including documentation of qualifications.
- When contractor is responsible for design of excavation, shoring, trenches, or barrier walls, full design/approval (i.e., P.E.) documentation shall be presented to the company Representative.

Fall Protection

- Contractor shall ensure employees on a walking/working surface 6 feet or higher above a lower level are protected by guardrail systems, personal fall arrest systems, or safety net systems.
- Safety harnesses and lifelines (including extracting devices for top entry spaces) are required on all work performed in permit-required confined spaces.
- All lifelines shall be safely secured to stable and adequate supports.
- Contractor activities shall comply with 29 CFR 1926 Subpart M-Fall Protection.

Fire Prevention

Company Representative, or his designee, is authorized to correct any condition he may consider a fire hazard. In any emergency, the site personnel are authorized to act directly with Contractor's Supervisor in regard to fire hazards without waiting for the Company Representative.

Floor Openings

- Floor openings shall be guarded by substantial barriers, railings, and/or covering materials strong enough to sustain twice the load of employee's equipment and materials that may be imposed on the cover at any one time. Barriers will be supplied by the Contractor.
- Where a danger of falling exists for personnel, elevated floor areas must be provided with guardrails. In addition, toe boards shall be provided when the possibility of falling objects striking personnel below exists.

High-Hazard Areas

Although this list is not all inclusive, there are certain areas and operations at Company facilities and job sites where extra precautions must be taken because of the nature of the hazards. When starting up any operation, Contractor is required to check with the Company Representative for a review of the safety and health rules that apply before entering any of the following areas:

- Confined spaces (tanks, manholes, vaults, pits, etc.)
- Building roof areas
- Laboratories
- Excavations
- Chemical storage and disposal areas

Contractor is also required to check with the Company Representative before any work is done on flammable gas or solvent lines; a tank or vessel that presently contains, or has contained, a flammable material; and before making an excavation anyplace on the site.

Housekeeping

- Material shall be carefully stacked and located so that it does not block aisles, doors, self-contained breathing apparatus, fire extinguishers, fire blankets, stretchers, emergency eyewash fountains, emergency safety showers, fixed ladders, stairways, or electrical breaker panels.
- Nails protruding from boards must be removed or bent over.
- All work areas shall be kept clear of scrap lumber and all other debris.
- Combustible scrap, waste materials, and debris shall be removed at regular and frequent intervals.
- Containers shall be provided for the collection and separation, by type, of refuse. Covers shall be provided on containers used for flammable, combustible, or harmful substances.
- Overhead storage of debris, tools, equipment, pipes, etc., is prohibited.
- At the end of each workday, Contractor shall provide for pick-up of all debris such as paper, rags, empty cans and bottles, etc.

Ladders

- The use of ladders with broken or missing rungs or steps, broken or split handrails, or with other faulty or defective construction is prohibited.
- Ladders must not be placed adjacent to a door unless the door is locked or guarded.
- Metal ladders shall not be used for electrical work.
- Tie off top of ladder to structure.

Medical Service and First Aid

- Preplanned emergency medical service shall be provided as designated by Contractor and approved by the Company Representative.
- Contractor shall provide a first aid kit for Contractor employees that meets or exceeds minimum OSHA requirements.
- Compliance with Bloodborne Pathogens Standard (29 CFR 1910.1030) and Company Procedure No. EIG-HS-512 is required.

Overhead Work

No overhead work shall be performed when, as a result of that work, the possibility of a falling object striking any person exists. Do not work above any person at any time.

Personal Protective Clothing and Equipment

In certain construction and maintenance operations, personal protective equipment such as safety glasses, chemical goggles, respirators, hard hats, and protective clothing is required. The type of protective equipment to be worn will be determined by the degree of exposure to the potential hazard. There will be very few occasions when hard hats and eye protection will not be required at Company job sites. When in doubt of the safety measures to be observed, Contractor shall contact the Company Representative. This shall not, however, relieve Contractor of the responsibilities to determine appropriate protection. Eye protection is required when engaging in such operations as the following:

- Drilling, chipping, grinding, wire brushing
- Handling caustics and acids
- Breaking bricks or concrete
- Hammering chisels, drift pins, etc.
- Burning or welding
- Other situations that create a possible eye hazard (e.g., chemical environments)

Photographs

Only Company photographers are permitted to carry cameras or take pictures. If progress or finished construction photographs are desired, request for same should be made through the Company Representatives.

Power/Air-Actuated Tools

- Power/air-actuated tools are not to be used on Company property or job sites without prior approval of the Company Representative.
- Explosive-actuated fastening tools shall meet ANSI design requirements. A tool that does not meet these design standards cannot be used.
- A tool shall never be left unattended in a place where it would be available to unauthorized persons.
- The tools shall not be used in explosives or flammable atmospheres.

Safety

Company Representative and designees are authorized to stop any work they may consider hazardous to Company personnel or equipment or Contractor personnel.

Subcontractor personnel shall participate in all safety meetings, JSA's, JSA reviews etc. Subcontractor is required to review all hazard analysis for tasks where subcontractor personnel will participate.

Scaffolds

- All scaffolds, whether fabricated on site, purchased, or rented, shall conform to the specifications found in Safety Requirements for Scaffolding (ANSI A10.8) and 29 CFR 1910.28 or 1926.451, as appropriate. Rolling scaffolds shall maintain a four-to-one height-to-base ratio.
- The footing or anchorage for a scaffold shall be sound, rigid, and capable of carrying the maximum intended load without settling or displacement.
- Unstable objects, such as barrels, boxes, loose bricks, or concrete blocks, shall not be used to support scaffolds or planks.
- No scaffold shall be erected, moved, dismantled, or altered except under the supervision of competent persons.
- Scaffolds and their components shall be capable of supporting, without failure, at least four times the maximum intended load.
- Guardrails and toe boards shall be installed on all open sides and ends of platforms more than 10 feet above the ground or floor.
- Scaffolds measuring 4 to 10 feet in height, and having a horizontal dimension of less than 45 inches, shall have standard guardrails installed on all open sides and ends of the platform.
- Wire, synthetic, or fiber rope used for suspended scaffolds shall be capable of supporting at least six times the rated load.
- No riveting, welding, burning, or open flame work shall be performed on any staging suspended by means of fiber or synthetic rope.
- Tested fiber or approved synthetic ropes shall be used for or near any work involving the use of corrosive substances.

Smoking and Open Flames

Smoking and the use of open flames are strictly prohibited in areas where flammable liquids, gases, or highly combustible materials are stored, handled, or processed. Obey "No Smoking" signs. Smoke only in designated areas.

Solvents and Paints

- Adequate ventilation must be maintained at all times when paints or solvents are used.
- Personnel should use proper respiratory protection and protective clothing when toxicity of the material requires such protection.
- Flammable solvents and materials shall not be used when possible sources of ignition exist.
- Flammable paints and solvents must be stored in an approved (Factory Mutual or Underwriters Laboratories) flammable liquids storage cabinet when storage is required inside buildings. If an approved cabinet is not available, paints and solvents must be removed from the building when not in use.
- Flammable liquids must be dispensed in safety cans with flash arresters bearing a Factory Mutual or Underwriters Laboratories approval. These containers must be clearly identified as to their contents.
- Material Safety Data Sheets, for materials used by the contractor, shall be maintained by the Contractor, and a copy provided to the Company Representative.

Tarpaulins

When tarpaulins are required for the deflection of hot slag, dust, paint drippings, etc., or as security barriers, they shall be flame-resistant and in good condition.

Tools

- Hand and power tools shall be kept in safe operating condition. Mushroomed heads on cold chisels, star drills, etc., are unsafe and shall not be used. Hammers shall have handles which are not cracked, split, or broken.
- Nonsparking tools may be necessary in certain areas where flammable materials are handled or where sparks could create an explosion.

Transporting Material and Equipment

- Extreme care must be taken while carrying sections of pipe, conduit, and other materials to assure safety to the Company and client personnel and property. This includes, but is not limited to, flagging and use of two people to carry pipe of lengths greater than 10 feet.
- Tools, material, and equipment must not be left unattended in access ways.
- Tools, material, and equipment shall not be removed from the job site without permission of the Company Representative.

Walking and Working Surfaces

- Workroom floors shall be clean and, to the extent possible, dry.
- Drainage mats, platforms, or false floors should be used where wet processes are performed.
- Floors shall be free from protruding nails, splinters, holes, and loose boards or tiles.
- Permanent aisles or passageways shall be marked.
- Floor holes shall be protected by covers that leave no openings more than 1 inch wide.
- Floor openings into which persons can accidentally walk shall be guarded by a standard railing and toe boards.
- Open-sided floors, platforms, and runways higher than 4 feet shall be guarded by standard railings.
- Toe boards shall be used wherever people can pass below, or where hazardous equipment or materials are located below.

Warning Signs

- All posted warning, safety, and security signs and barriers shall be observed.
- Additionally, Contractor shall provide warning signs, barriers, barricades, etc., wherever such protection is needed.
- Where signs and barricades do not provide adequate protection, particularly along a road, flagmen shall be used.

General Safety Rules for Contractors Receipt

Receipt of "General Safety Rules for Contractors" is hereby acknowledged. The information contained within has been read and will be adhered to when performing contractual obligations on behalf of Shaw Environmental & Infrastructure Inc.

Executed this _____ day of _____, _____

By: _____
(Signature)

_____
(Name Printed)

_____
(Title)

For: _____
(Company Name)

_____

_____
(Company Address)

_____
(Phone Number)

1. PURPOSE

The purpose of this procedure is to provide general guidance to office and site personnel regarding emergency planning and actions to be taken during severe weather conditions such as hurricanes, tornadoes, high winds, severe thunderstorms, and winter storms.

2. SCOPE

This procedure applies to all personnel and subcontractors of The Shaw Group Inc.'s Environmental & Infrastructure Group (Shaw E&I) working in offices or on projects where severe weather safety requirements are applicable, and to all Shaw E&I office and project locations where severe weather may occur.

Variances and exceptions may be requested pursuant to the provisions of EIG-HS-013, "Health and Safety Procedure Variances."

3. REFERENCES

- Procedure No. EIG-HS-013, Health and Safety Procedure Variances

4. DEFINITIONS

- **Thunderstorm**—A storm normally accompanied by heavy rains, hail, lightning, thunder, high winds, and tornadoes. A severe thunderstorm can be very destructive.
- **Tornado**—A violent destructive whirling wind accompanied by a funnel-shaped cloud which progresses in a narrow path over land. Tornadoes are violent storms of short duration which occur during all seasons and in all 50 states.
- **Hurricane**—A tropical storm with winds of 74 miles per hour (mph) or greater that is usually accompanied by heavy rain, thunder, or lightning and sometimes moves into temperate latitudes. The path of destruction can be as wide as 500 miles. The hurricane season begins June 1 and ends November 30 in the northern hemisphere.
- **Tornado or Severe Thunderstorm Watch**—Issued when conditions are favorable for a tornado or severe thunderstorm to develop.
- **Tornado Warning**—Issued when a tornado or funnel cloud has been spotted or indicated on radar.
- **Severe Thunderstorm Warning**—Issued when a severe storm is occurring or has been spotted on radar. A severe thunderstorm has winds of 58 mph or greater, or hail three-fourths of an inch in diameter or larger.
- **Hurricane Watch**—Issued for a coastal area when there is a threat of hurricane conditions within 24 to 36 hours.
- **Hurricane Warning**—Issued when hurricane conditions are expected in a specific coastal area in 24 hours or less.
- **Winter Storm/Blizzard**—Issued for your area, that means that hazardous winter weather conditions (snow greater than 6 inches in 24 hours, winds gusting over 35 mph, or visibility less than ¼ mile) are expected in the next 12 to 36 hours.

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5. RESPONSIBILITY

5.1 Procedure Responsibility

The Senior Director of Health and Safety is responsible for the issuance, revision, and maintenance of this procedure. California-based Health and Safety Management is responsible for submitting change requests to the Senior Director of Health and Safety for revisions and approval.

5.2 Action/Approval Responsibilities

The Responsibility Matrix is shown as Attachment 1, “Responsibility Matrix.”

6. PROCEDURE

Severe weather and its accompanying hazards pose a threat to the safety of employees and property. For this reason, it is of vital importance that adequate precautions be taken to minimize their effect. This procedure should be followed whenever a potential severe weather threat to life and/or property exists. Expedient and proper response is required by all local personnel to minimize the possibility of injury and/or property damage due to severe weather conditions. The key to dealing with any type of severe weather is to develop an Emergency Management Plan for the types of severe weather that may be encountered at the specific office or project location.

6.1 Responsibilities

The Office Manager/Project Site Supervisor is responsible for implementing and enforcing this procedure. When there are watches, warnings or indications of impending severe weather, conditions shall be monitored by the Office Manager/Project Site Supervisor and appropriate precautions must be taken to protect personnel and property. Use a National Oceanic and Atmospheric Administration (NOAA) weather radio with a tone alert to keep informed of watches and warnings issued for your area.

The Office Manager is responsible for updating the portion of the office “Emergency and Security Management Plan” that addresses severe weather. The Safety Representative is responsible for monitoring compliance with this procedure.

6.2 Thunderstorms

Employees shall seek shelter indoors or inside a vehicle during a thunderstorm. Lightning is a thunderstorm’s most dangerous component (see Section 6.3).

The rains accompanying a thunderstorm may create flooding conditions. National Weather Service advisories shall be monitored for flash flood warnings. Employees shall be instructed to avoid flood plains, drainage ditches, and dried creek beds when a flash flood warning is issued.

Employees must take certain precautions while driving during a thunderstorm. When poor visibility is encountered, the driver shall stop his vehicle until visibility improves. When lightning is in the immediate area, the employee shall seek shelter indoors, or remain in the vehicle away from interior metal parts. When high winds or flooding accompany the thunderstorm, the employee shall seek an appropriate protected area.

Employees shall not be permitted to work on or operate cranes during a thunderstorm. To prevent damage or injury, cranes shall be grounded. If the crane is located on a barge or other vessel, the crane shall be adequately bonded. The crane's boom shall be lowered when winds exceed approximately 30 mph. Barges and other vessels shall be secured to a stationary source.

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6.3 Lightning

Lightning causes around 100 deaths in the United States annually (more than hurricanes and tornadoes combined). Lightning can strike up to several miles away from the thunderstorm.

At project sites, the Site Supervisor will proactively monitor conditions that may produce lightning and thunderstorms. A daily weather forecast will be tracked and communicated to site personnel. All outside activities will be suspended when lightning is in the immediate area. Outdoor activities will resume when 30 minutes have passed since the last observed lightning flash. Other recommendations include:

- Avoid using the telephone or other electrical appliances.
- Avoid water. Avoid the high ground. Avoid open spaces. Stay away from trees.
- Avoid all metal objects including electric wires, fences, metal pipes, machinery, motors, power tools, etc.
- Lower crane booms and keep clear of long boom cranes.
- Find shelter in substantial buildings or in a fully enclosed vehicle such as a car, truck, or van with the windows completely shut. Keep hands on lap while in a vehicle, if possible.
- If lightning is striking nearby and you are caught outside or you feel your hair standing on end, you should:
  - Crouch down/squat. Put feet together. Place hands over ears to minimize hearing damage from thunder. Do not lie flat!
  - Avoid proximity (minimum 15 feet) to other people.

6.4 Hurricanes

Hurricanes and tropical storms are most likely to occur between June and November. At office locations where hurricanes are possible, employees should follow the guidance provided in the office "Emergency and Security Management Plan." Project locations that are in areas where hurricanes are possible should develop a "Hurricane Preparedness Plan" (see Attachment 2, "Project Site Hurricane Preparedness Plan Template," for a template). The Project Manager is responsible for developing a "Hurricane Preparedness Plan" for their project.

Upon issuance of hurricane warnings, the Office Manager or Site Supervisor shall designate an individual to be responsible for monitoring the hurricane path reported by the National Weather Service. The designated individual shall maintain a weather chart indicating the path and progress of the storm and noting projections furnished by the National Weather Service advisories. The location of the eye, or center of the storm, should be determined as near as possible.

If evacuation is necessary, the local governmental agencies evacuation plan shall also be followed.

To protect the project site against the destructive winds associated with hurricanes, the following preparations shall be made:

- All loose material shall be securely anchored or stored before the storm arrives. Special attention shall be paid to flat, light, and empty containers.
- Windows that may be affected shall be taped or boarded. Larger windows may be broken by high winds, while smaller windows may be broken by windblown objects.
- All unfinished masonry walls and forms for concrete walls shall be additionally braced.

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- Tarpaulins and temporary covers shall be confirmed waterproof and tightly secured.
- Light siding shall be secured.
- All small buildings shall be tied down to deadmen or similarly anchored. These include such buildings as trailers, portable toilets, and craft change houses.
- Roofs shall be made as clear as possible. Items not completely installed, such as vents, chimneys, heating and ventilating ducts shall be secured.
- Openings or ducts from fans, ventilators, and air conditioners shall be mechanically closed.
- Small, lightweight equipment shall be placed in warehouses or buildings, or be weighted down.
- Scaffolds shall be taken down or adequately secured.

To protect the site from heavy driving rains and flood waters, the following preparations shall be made:

- Equipment shall be placed on high ground or where it will be least affected.
- Entrances and openings subject to flooding shall be protected with sand bags or sand dikes.
- All stationary exterior equipment necessary for continuous site operation shall be protected with tarpaulins and/or sand bags, or by similar means.
- Emergency procedures for electrical shutdown shall parallel normal shutdown procedures.
- Office equipment, files, records, and other important items shall be placed above expected flood level.
- Tanks of flammable, caustic, acidic, gaseous, or corrosive materials, which may float off their foundations, shall be secured. Welding and cutting gas lines should be valved off at the source.
- To prepare the jobsite for an emergency such as a hurricane, certain basic emergency supplies shall be kept available. These supplies include sand, sand bags, tarpaulins, lumber, plywood, polyethylene sheeting, screw anchors, heavy rope, and emergency generators. Battery operated radios and lights shall be kept on hand.
- A hurricane may disrupt normal operations in the area of the jobsite. An adequate supply of fresh drinking water and gasoline shall be stored on the site in case they are not available after the storm.
- Crane booms, when not in use, such as overnight/weekends, shall be lowered to the ground or placed into its stored position. Where this is not possible the load line shall be secured to a suitable object to prevent the crane from swinging.
- Locate and retain pumps and hoses, make preparations for water removal.
- Set up emergency call-out for personnel should the storm strike on a weekend.
- Locate and retain portable generating equipment as needed.
- Fill all tanks. Be prepared to hand pump.
- Remove all construction equipment from low areas that may become flooded.
- Roll-up all welding leads and hoses and do final cleanup of work areas.

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- Check to see that all underground piping and tanks are filled or secured against floating.
- Secure all drawings, files, etc. Provide water/wind protection in case of roof or window damage. Store all calculators, typewriters, etc. Cover printers, copiers, and print paper. Remove all vital records and move to safe storage. Protect and seal all data processing equipment.
- Release employees on a rotating basis to take precautions at home.
- Prior to leaving the job site, turn off power at main switches.

6.5 Tornadoes

When a tornado is expected in or near the area, a tornado watch is issued by the Weather Bureau. When a tornado watch is issued, the Office Manager/Project Site Supervisor shall appoint an individual to monitor the National Weather Service advisories. A tornado warning is issued when a tornado has actually been sighted. The tornado warning will state where the tornado was sighted, where the tornado is expected to move, and when it is expected to affect the area warned.

In office locations where tornadoes are possible, employees should follow the procedures and responsibilities identified in the office “Emergency and Security Management Plan.” A copy of the plan can be viewed on the office homepage or by requesting a copy from the Office Manager.

When a tornado warning is issued, emergency precautions shall be taken immediately. An emergency alarm shall be sounded and all employees shall move to designated emergency shelters. The predetermined shelter should be located in a reinforced building, the basement of a building, an inner hallway on a lower floor, or a similar location away from windows. A large room with a wide, free-span roof shall not be used.

Battery powered radios shall be available in the event of a power failure. During the tornado, alert weather information shall be monitored for further advisories.

Once a tornado has actually been sighted immediate action should be taken to protect employees from being blown away, struck by falling objects, or injured by flying debris. The best protection is an underground shelter or a substantial steel framed or reinforced concrete building. If none of these shelters are available, have employees assemble in an interior hallway, well away from glass windows. Stay away from glass enclosed places or areas with wide-span roofs such as auditoriums and warehouses.

If in a car or mobile home/office type structure, abandon them immediately. Most deaths occur in cars and mobile homes. Leave them and go to a substantial structure or designated tornado shelter.

If in open country and no suitable structure is nearby, lie flat in the nearest ditch or depression and use your hands to cover your head.

After Severe Storms:

- Walk or drive carefully; snakes, scorpions, fallen trees, and power lines may be a hazard.
- Do not attempt to ford water crossing roads.
- Test drinking water for contamination. Wells should be pumped out and tested before drinking.
- Only cleanup crews, medical personnel, and authorized supervisory personnel should be allowed at a disaster area.

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- Do not handle live electrical equipment in wet areas. Electrical equipment should be checked and dried before start-up.
- Use battery powered lanterns or flashlights to examine buildings. Flammables may be inside.
- Report broken utility lines to local authorities.
- Keep tuned to local radio or television for advice and instructions on where to obtain medical care and assistance for housing, clothing, and food.
- Stay out of flooded areas until advised to go back in.
- Dry out water-impacted building interiors as quickly as possible to prevent mold growth.

6.6 Winter Storm/Blizzard Preparedness

If a winter storm "watch" has been issued for your area, that means hazardous winter weather conditions (snow greater than 6 inches in 24 hours, winds gusting over 35 mph, or visibility less than ¼ mile) are expected in the next 12 to 36 hours. You should prepare for the worst:

- Check snow removal equipment.
- Verify adequate supplies of food and water.
- Fill all equipment/vehicle fuel tanks.
- Stockpile rock salt or other less corrosive material to melt ice on walkways, and sand or kitty litter to generate temporary traction.
- Check walkways for debris and tripping hazards that may be covered by snow. Consider visibility of walkways after storm hits and use rope on posts to delineate paths.
- Check drainage to reduce flooding problems during a thaw.
- Consider snow fences to reduce drifting in roads and paths, which could block access. Use a National Oceanic and Atmospheric Administration (NOAA) Weather Radio with a tone alert to keep informed of watches and warnings issued in your area. The tone alert feature will automatically sound when a "watch" or "warning" is issued regardless of weather type.
- Be aware of changing conditions. Temperature may drop rapidly, winds may increase, or snow may fall at heavier rates.
- Consider releasing nonessential personnel due to possibility of deteriorating road conditions.

6.6.1 Winter Storm "Warning" or Blizzard "Warning"

If a winter storm "warning" or blizzard "warning" has been issued for your area, the hazardous winter weather conditions are expected in the next 12 hours or are already occurring.

Stay indoors and dress warmly. Wearing loose layers of loose-fitting, lightweight, warm clothing will keep you warmer. Remove layers to avoid overheating, perspiration, and subsequent chill.

Listen to a battery-powered radio or television for updated emergency information.

Eat regularly. Food provides the body with energy for producing its own heat.

Keep the body replenished with fluids to prevent dehydration. Avoid caffeine and alcohol, which can cause dehydration.

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Conserve fuel. Winter storms can last several days. Suppliers of propane and fuel oil may not be able to replenish depleted supplies during severe weather.

6.6.2 After a Winter Storm

Continue listening to local radio or television or a NOAA Weather Radio for updated information and instructions.

Avoid overexertion. Heart attacks from shoveling heavy snow are a leading cause of death during winter.

Check crane booms, pipe racks, towers, etc. for snow and ice loading. Be aware of the potential for falling ice.

Follow forecasts and be prepared when venturing outside. Major winter storms are often followed by even colder conditions.

6.7 Emergency Evacuations and Site Inspections

When an emergency evacuation is necessary for any severe weather condition, the Office Manager/Project Site Supervisor shall decide whether a small force should remain on site for jobsite maintenance, etc. The emergency evacuation should be in accordance with the procedure in this section. Evacuations of personnel should be made with sufficient time allowed for safe execution of the evacuation; factors such as visibility, road conditions, and traffic congestion should be considered.

After the storm, a team shall thoroughly inspect the site or office before employees return. This inspection team, appointed by the Office Manager/Project Site Supervisor, shall inspect the entire site to assess the damage and determine the repairs.

7. ATTACHMENTS

- Attachment 1, Responsibility Matrix
- Attachment 2, Project Site Hurricane Preparedness Plan Template

8. FORMS

- EIG-HS-014.01, Hurricane Preparedness Checklist

9. RECORDS

- Project Site Hurricane Preparedness Plan
- EIG-HS-014.01, Hurricane Preparedness Checklist

10. REVISION HISTORY AND APPROVAL

Revision Level Revision Date	Revision Description	Responsible Manager
00 9/15/2003	Initial issue	Troy Allen
01 03/17/2009	The Project Site/Construction Site Hurricane Procedure has been deleted from the body of the procedure and a new “Project Site Hurricane Plan Template” has been added as Attachment 2. References to our office-specific “Emergency & Security Management Plans” have been added.	Mike Zustra

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Revision Level Revision Date	Revision Description	Responsible Manager
	The information content provided in the lightning and hurricane Sections have been enhanced.	
02 8/25/2011	Modified format only to align with Governance Management framework.	Andrew Johnson

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Attachment 1
Severe Weather Policy
Responsibility Matrix

Action	*Responsible Party*			
	Project Site Supervisor	**Office Manager**	**Health and Safety Representative**	**Senior Director of Health and Safety**
Issue, Revise, and Maintain Procedure				X
Communicate office "Emergency and Security Plan" to employees		X		
Develop and Communicate Severe Weather Plans to Project Site Personnel	X		X	
Monitor Severe Weather	X	X		
Suspend Work Activities When Lightning is Observed	X			
Purchase and Maintain Supplies	X	X		

Attachment 2
Project Site Hurricane Preparedness Plan Template

HURRICANE PREPAREDNESS PLAN
FOR

Prepared for:

Prepared by:

Reviewed by:

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Acronyms and Abbreviations

COR	Condition of Readiness
FEMA	Federal Emergency Management Administration
HPP	Hurricane Preparedness Plan
mph	Miles per Hour
NOAA	National Oceanic and Atmospheric Administration
PPE	Personal Protective Equipment
PM	Project Manager
SS	Site Supervisor
SSO	Site Safety Officer

1.0 Introduction

This Hurricane Preparedness Plan (HPP) outlines the general responsibilities and actions to be taken in preparation for and response to a hurricane or hurricane warnings at _____ in _____. All personnel should understand that predicting the occurrence and path of a hurricane is difficult, however the risk can be minimized and controlled by following the procedures in this plan.

This procedure is applicable to all site personnel, including subcontractors; temporary construction facilities; and remediation equipment present at _____.

This procedure provides information on how to protect personnel and property in the event of a hurricane. In the _____ area, attention must be paid to all hurricanes, since there is no way to determine with 100 percent accuracy whether a hurricane will actually hit the area until a few hours before landfall.

Table 1, "Hurricane Landfall Forecast Demonstration," demonstrates that the accuracy of forecasting where a hurricane landfall will occur is very low more than 24 hours in advance of a storm.

Table 1
Hurricane Landfall Forecast Demonstration

Hours Before Landfall	Maximum Probability Values
72 Hours	10 Percent
48 Hours	13-18 Percent
36 Hours	20-25 Percent
24 Hours	35-45 Percent
12 Hours	60-70 Percent

2.0 Definitions

The following definitions apply to various terms used in this document:

- **Conditions of Readiness (COR):**
  - **Condition V** – Destructive winds are possible at the _____ site within 96 hours. Normal daily job-site cleanup and good housekeeping practices.
  - **Condition IV** – Destructive winds are possible at the _____ site within 72 hours. Normal daily job-site cleanup and good housekeeping practices. Collect and store in piles or containers, scrap lumber, waste material, and rubbish for removal and disposal at the end of each work day. Maintain the construction site, including storage areas, free of accumulation of debris. Stack form lumber in neat piles less than 4 feet high. Remove all trash debris and other objects which could become missile hazards.
  - **Condition III** – Destructive winds are possible at the _____ site within 48 hours. Maintain Condition IV requirements. Begin securing the job-site for and taking those actions necessary for Condition I that cannot be completed within 18 hours. Cease all routine activities that might interfere with securing operations. Begin collecting and stowing all gear and portable equipment. Make preparations for securing buildings. Review requirements pertaining to Condition II and continue action as necessary to attain Condition III readiness.
  - **Condition II** – Destructive winds are possible at the _____site within 24 hours. Curtail or cease routine activities until securing operations are complete. Reinforce or remove form work and scaffolding. Secure machinery, tools, equipment and materials, or remove from job site. Expend every effort to clear all missile hazards and loose equipment from the job-site.
  - **Condition I** – Destructive winds are possible at the _____ site within 12 hours. Perform and complete all remaining actions required for lower conditions of readiness. Secure the job-site and leave the government premises.
- **Destructive Winds** – Generally winds reaching or exceeding the force of a tropical storm (greater than or equal to 39 miles per hour [mph] or 34 knots). Winds from any storm system (tropical or otherwise) that are determined to have the potential to cause property damage or personal injury that would warrant a Condition IV alert.
- **Gale** – Non-tropical windstorm with winds 38 to 63 mph (33 to 55 knots).
- **Hurricane Watch** – An announcement for specific areas where a hurricane or an incipient hurricane poses a possible threat to a coastal area, generally within 36 hours.

- **Hurricane Warning** – A warning that sustained winds of 74 mph (64 knots) or higher, associated with a hurricane are expected in a specified coastal area in 24 hours or less.
- **Hurricane** – A tropical cyclone in which the maximum sustained surface wind is 74 mph (64 knots) or greater.
- **Missile Hazard** – Any object that may become airborne during high winds.
- **Severe Weather** – Any storm of tropical or non-tropical origin that has the capacity to produce destructive winds.
- **Small Area Storms** – Thunderstorms or tornadoes.
- **Small Area Storms Condition I** – Destructive winds, heavy rain, lightening, and hail are imminent within 1 hour.
- **Small Area Storms Condition II** – Destructive winds, heavy rain, lightening, and hail are expected within 6 hours.
- **Storm** – Non-tropical windstorm with winds 38 to 63 mph (33 to 55 knots).
- **Storm Surge** – An abnormal rise in sea level accompanying a hurricane or other intense storm, and whose height is the difference between the observed level of the sea surface and the level that would have occurred in the absence of the storm.
- **Storm Tide** – The actual sea level resulting from the astronomical tide combined with the storm surge. This term is used interchangeably with "Hurricane Tide."
- **Tornado** – Violent rotating columns of air with winds 115 to 288 mph (100 to 250 knots).
- **Tropical Depression** – A tropical low pressure system in which the maximum sustained surface wind is 38 mph (33 knots) or less.
- **Tropical Storm** – A tropical low pressure system in which the maximum surface wind ranges from 39 to 73 mph (34 to 63 knots) inclusive. This is the strength at which the National Hurricane Center applies a name to the storm.
- **Tropical Storm Watch** – Tropical storm conditions pose a threat to a coastal area generally within 36 hours.
- **Tropical Storm Warning** – A warning for tropical storm conditions with sustained winds within the range of 39 to 73 mph (34 to 63 knots) that are expected in a specified coastal area within 24 hours or less.

3.0 Responsibilities

3.1 Project Manager

The Project Manager is responsible for ensuring that all adequate measures have been taken to prepare for hurricanes and to protect site personnel and property in the event of a hurricane. The Project Manager will ensure that ample resources are available to implement this plan and that all personnel are aware of this plan and their responsibilities.

3.2 Site Supervisor

The Site Supervisor will communicate all hurricane information to site personnel and keep the site personnel continually informed of the measures to be taken. The Site Supervisor is responsible for the coordination and direction of site equipment shut-down and will oversee the preparation of site facilities for any imminent storm. The Site Supervisor will oversee the coordination of both pre- and post-storm operations and will ensure that the proper material, equipment, and supplies are utilized to implement this procedure.

3.3 Site Safety Officer

The Site Safety Officer (SSO) will monitor weather information, including the National Weather Service probability values for landfall. The SSO will maintain the necessary emergency supplies, and will periodically tour the site to ensure that proper steps are being taken to protect site personnel and property. The SSO will develop the emergency contact list will be maintained in a site dedicated vehicle.

Note: When personnel identified in Section 3.0 leave the site, they are responsible for notifying the Site Supervisor or a designated back-up person. The back-up person will be instructed in their responsibilities in the event of a hurricane.

4.0 Emergency Operating Procedures

4.1 Condition V – Early Preparedness

The Site Supervisor will notify the Project Manager when a tropical storm has been named and/or any severe weather has the potential to produce destructive winds at the _____ within 96 hours. This will initiate COR Condition V. This phase will continue until:

- The storm or condition is downgraded
- The storm track poses no threat to the site
- Condition IV begins

During Condition V, the progress of the storm will be monitored and tracked. The Program Manager will be contacted at least twice daily for Condition Requirements updates and to inform him of completion of required actions for Condition V.

See Appendix A, "Hurricane Preparedness Responsibility Punch List," for the Hurricane Preparedness Responsibility Punch List – Condition V.

4.2 Condition IV – (Destructive Winds are Possible within 72 Hours)

This COR starts when severe weather is within 72 hours of posing a threat to the project location. The SSO will ensure that the following steps are taken:

- Monitor the storm and inform the Project Manager of its progress
- Check Personal Protective Equipment (PPE) supplies and equipment to determine if any shipments are required or if pending shipments should be advanced or postponed

During Condition IV, the progress of the storm will be continuously monitored and tracked. The Site Supervisor will instruct site personnel to begin general cleanup of all loose materials that may pose a hazard during high winds or rain. This will include removal of all debris, trash, and other items that may become missile hazards. All lumber will be stacked in neat piles less than 4 feet high. The Program Manager will be contacted at least twice daily for Condition Requirements updates and to inform him of completion of required actions for Condition IV.

The Site Supervisor will keep all site personnel advised of the status of the storm and site preparation activities. Due to the urgency and amount of work involved in preparing for a threatening storm, all construction operations that might interfere with securing operations, such as starting a major excavation, will cease.

The Site Supervisor will ensure that the following steps are taken:

- Fill fuel tanks in all equipment on-site
- Secure stockpiled material on-site
- Review requirements for Condition II with all site personnel
- Maintain condition IV requirements.

See Appendix A for the Hurricane Preparedness Responsibility Checklist – Condition IV.

4.3 Condition III – Tropical Storm Warning (Destructive Winds are Possible within 48 Hours)

This COR starts when severe weather places the project site under a tropical storm warning. Condition III activities will also start if a threatening tropical storm is upgraded to a hurricane, or a severe storm approaching the _____ area has generated destructive winds in other locations. The Project Manager, Site Supervisor, and SSO will determine when to cease all operations based upon current weather conditions. If the storm or Condition is downgraded, the Project Manager and Site Supervisor will meet with the Program Manager to decide if a downgrade of the COR is appropriate. Actions for Condition III will be maintained and the following shall also be completed:

- Machinery, tools, equipment, and materials will be secured or removed form the site
- Take actions to secure job-site necessary for Condition II that cannot be completed within 18 hours.

See Appendix A for the Hurricane Preparedness Responsibility Checklist – Condition III.

4.4 Condition II – Destructive Winds are Anticipated within 24 hours or a Small Area Storm is Anticipated within 6 hours

Condition II begins when destructive winds are anticipated within 24 hours or a small area storm within 6 hours. The Project Manager and Site Supervisor will determine when to demobilize from the site based upon weather conditions. During this phase the Site Supervisor will direct the following actions:

- Secure machinery, tools, equipment and materials or remove them from the job-site
- Conduct a roll call of personnel on-site and inform the SSO
- Notify personnel on leave of schedule changes
- Personnel needing to leave the project to attend to personal matters will notify their Site Supervisor immediately
- Heavy equipment will be secured according to the manufacturer's recommendations

- All small field equipment will be secured
- All visitors from the site are evacuated
- Make a final site walk-through to determine that the site is secure and clear all missile hazards from the job-site
- Inform the Project Manager that all personnel are being released from the site.

If the storm or Condition is downgraded, the Project Manager and Site Supervisor will meet to decide if a downgrade of the phase is necessary.

See Appendix A for the Hurricane Preparedness Responsibility Checklist – Condition II.

4.5 Condition I – Destructive Winds are Anticipated within 12 hours or a Small Area Storm is Imminent within 1 hour

Complete all remaining actions required for lower conditions of readiness. Secure job-site access and evacuate to safe refuge. See Appendix A for the Hurricane Preparedness Responsibility Checklist – Condition I.

4.6 Resume Site Operations

The Project Manager will contact the Program Manager to determine when site operations will resume. Although the hurricane/severe weather has passed, hazards may still exist because of water damage, other hazardous conditions, dangers from electric shock, poisonous snakes, etc.

The Site Supervisor and SSO will conduct a damage survey with the Project Manager. Photographs of the storm damage at the site will be taken by the Site Supervisor or SSO. They will develop a prioritized recovery plan from the survey findings. Subsequently, all site personnel will be notified when it is safe to return to work. Required personnel and subcontractor expertise will be mobilized to the site to repair any damaged equipment.

See Appendix D for the Hurricane Preparedness Responsibility Checklist – Resume Site Operations.

5.0 Debriefing

Following the return to work of site personnel, the Site Supervisor will conduct a debriefing with site personnel. The debriefing will accomplish the following objectives:

- Finalize a recovery plan
- Review the Hurricane Plan for effectiveness
- Suggest and agree on improvements to the plan
- Incorporate plan changes

When completed, the Project Manager and Site Supervisor will meet with site personnel to discuss any corrective actions or changes in this plan.

6.0 References

The list of emergency telephone numbers is included as Appendix B, "Emergency Telephone Numbers." In addition, an example of a Hurricane Tracking Chart is presented in Appendix C, "Hurricane Tracking Map."

The following references and sources of information may be consulted for additional guidance on hurricane preparedness and response.

- Disaster Planning Guide for Business and Industry, Federal Emergency Management Administration (FEMA)
- U.S. Department of Commerce; National Oceanic and Atmospheric Administration (NOAA)

Appendix A
Hurricane Preparedness Responsibility Checklists

HURRICANE PREPAREDNESS CHECKLIST

Condition V

Date/Time Entered Condition V: _____

Severe Weather/Tropical Storm: _____

Action Items

- ☐ Project Manager Notified
- ☐ Track of Storm Poses No Threat
- ☐ Storm or Condition is Downgraded
- ☐ Upgrade to Condition IV

Storm Location

Date/Time: _____ Date/Time: _____

Location/Coordinates: _____ Location/Coordinates: _____

Date/Time: _____ Date/Time: _____

Location/Coordinates: _____ Location/Coordinates: _____

Condition V Action Items Complete: _____ Date: _____

HURRICANE PREPAREDNESS CHECKLIST

Condition IV (Landfall within 72 hours)

Date/Time Entered Condition IV: _____

Action Items:

- ☐ Notify Project Manager
- ☐ Notify Project Supervisor
- ☐ Notify Site Personnel
- ☐ Assemble shift personnel to begin preparation
- ☐ Track storm on hurricane tracking map (Appendix C) (if applicable)
- ☐ Secure all heavy equipment located at the site in accordance with manufacturer's specifications. All equipment will be moved to a secured site location.
- ☐ All equipment fuel tanks will be filled.
- ☐ All subcontractors with equipment or supplies on-site will be notified to begin removal procedures

Condition IV Action Items Complete: _____ Date: _____

HURRICANE PREPAREDNESS CHECKLIST

Condition III (Landfall within 48 hours)

Date/Time Entered Condition III: _____

Action Items:

- ☐ Provide the status of the storm to site personnel on an hourly basis
- ☐ Take actions to secure job-site necessary for Condition I that cannot be accomplished in 18 hours
- ☐ Recheck all items on checklist IV to ensure they are complete (i.e., gas tanks are still filled)

See itemized equipment checklist (itemized list of equipment to be secured/removed and COR for action)

Condition III Action Items Complete: _____ Date: _____

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HURRICANE PREPAREDNESS CHECKLIST

Itemized Equipment Checklist, Condition III

Equipment	Secure in Place	Remove from Project Site

HURRICANE PREPAREDNESS CHECKLIST

Condition II

Date/Time Entered Condition II: _____

Action Items:

- ☐ Evacuate all visitors from the site
- ☐ Conduct a role call of site personnel and inform the Project Manager
- ☐ Check the status all incoming shipments of supplies and equipment
- ☐ Remove all unnecessary vehicles from the site
- ☐ Secure heavy equipment in accordance with manufacturer's specification
- ☐ Secure all valuable records and equipment
- ☐ Release personnel from the site
- ☐ Recheck all items on checklist IV and III to ensure they are complete (i.e., gas tanks are still filled)

Condition II Action Items Complete: _____ Date: _____

HURRICANE PREPAREDNESS CHECKLIST

Condition I

Date/Time Entered Condition I: _____

Action Items:

- ☐ Complete all action items for lower conditions of readiness
- ☐ Secure job-site access and evacuate to safe refuge

Condition I Action Items Complete: _____ Date: _____

Appendix B
Emergency Telephone Numbers

Appendix C
Hurricane Tracking Map

Appendix D
Resume Site Operations Checklist

HURRICANE PREPAREDNESS CHECKLIST

Resume Site Operations

Date/Time Resume Site Operations: _____

Action Items:

- ☐ Conduct a damage survey
- ☐ Notify all site personnel when to return to work
- ☐ Develop a prioritized recovery plan
- ☐ Inspect electrical equipment before re-energizing to detect and repair damage
- ☐ Provide bottled water for drinking until normal drinking water is deemed safe to drink
- ☐ Remove storm debris from site
- ☐ Notify Program Manager of the resumption of site activities

Resume Site Operations Action Items Complete: _____

Date: _____

1. PURPOSE

The purpose of this procedure is to establish the requirements for incident reporting, investigation, and review. This procedure is an integral part of the company's overall accident prevention program and aids in the identification of potential causal factors and corrective actions.

2. SCOPE

This procedure applies to all occupational injuries, illnesses, accidents, and near miss incidents having the potential for injury; all losses or damage to company property in excess of $2,500; and any third party property damage resulting from company activities.

2.1 Exception Provisions

Variances and exceptions may be requested pursuant to the provisions of Shaw E&I Procedure No. EIG-HS-013, "Health and Safety Procedure Variances."

3. REFERENCES

- CORPHR207, Employee Discipline
- EIG-HS-013, Health and Safety Procedure Variances
- EIG-HS-101, Drug and Alcohol Testing
- EIG-HS-800, Motor Vehicle Operations - General Requirements
- EIG-HS-810, Commercial Motor Vehicles
- EIG-HS-045, Job Safety Analysis

4. DEFINITIONS

- **Chargeable Vehicle Accident**—Any **at-fault** vehicle accident meeting any **one** of the following criteria:
  - An individual other than an employee of the company is a party in the accident
  - Property owned by a person or entity other than the company is damaged
  - When company owned, leased, or rented vehicles are involved and damage exceeds $2,500.00.
  - When an employee is driving a personal vehicle while on company business and damage exceeds $2,500.00.
- **Company**—All affiliates, indirect and wholly owned subsidiaries of Shaw E&I.
- **Days Away From Work**—Days away from work are the number of **calendar** days following the injury or illness, excluding the date of the injury.
- **Job Safety Analysis (JSA)**—The JSA is an effective management technique for identifying hazardous conditions and unsafe acts in the workplace. A JSA is intended to analyze the individual steps or activities, which together create a job or specific work duty, and to detect any actual or potential hazards that may be present (Shaw E&I Procedure No. EIG-HS-045, "Job Safety Analysis").

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- **Restricted Work**—Occurs when, as the result of a work-related injury or illness: A physician or other licensed health care professional recommends that the employee not perform one or more of the routine functions of his or her job, or not work the full workday that he or she would otherwise have been scheduled to work.
- **Near Miss Incident**—Any incident where no injury occurred, but where the potential for injury existed.
- **OSHA Recordable Case**—See Attachment 1, "Injury/Illness Classification Guidelines."
- **Vehicle**—Any passenger vehicle, including trucks, used upon the highway or in private facilities for transporting passengers and/or property. For the purpose of this procedure, off-road vehicles such as earthmoving equipment, forklifts, non-highway use trucks, *etc.*, are not considered vehicles (see Shaw E&I Procedure No. EIG-HS-800, "Motor Vehicle Operation: General Requirements").

5. RESPONSIBILITIES

5.1 Procedure Responsibility

The Executive Director of Health and Safety is responsible for the issuance, revision, and maintenance of this procedure.

5.2 Action/Approval Responsibilities

The Responsibility Matrix is Attachment 2, "Accident Prevention Program: Reporting, Investigation, and Review Responsibility Matrix."

6. PROCEDURE

Key elements of this procedure are as follows:

- All occupational injuries/illnesses, vehicle accidents, and near miss incidents must be promptly reported and investigated.
- All Occupational Safety and Health Administration (OSHA) recordable injuries/illnesses and chargeable vehicle accidents must be reviewed by an Accident Review Board. The Accident Review Board report is submitted to the Baton Rouge Shaw Environmental & Infrastructure, Inc. (Shaw E&I) Safety Department, for production to and retention on behalf of the Legal Department.
- All incidents involving a fatality, major injury/illness, or resulting in significant property damage will be immediately reported to the business line Health & Safety Manager, the Baton Rouge Shaw E&I Safety Department, Business Line Vice President, and the Legal Department.
- All investigations and associated materials obtained and/or produced, in association with OSHA recordable injuries/illnesses, chargeable vehicle accidents, fatalities, major injury/illness, or incidents resulting in significant property damage, are to be performed for and on behalf of the legal department and will be subject to being classified as Confidential Attorney-Client/Attorney Work Product.

6.1 Incident Reporting Process

Employees are required to immediately report to their direct supervisor all occupational injuries, illnesses, accidents, and near miss incidents having the potential for injury. Site Business Line Managers or Supervisors (supervisor directly responsible for the employee involved in the incident) with first-hand knowledge of an incident are required to:

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- Immediately arrange for appropriate medical attention and notify the responsible health and safety representative.
- **As soon as practical, but not longer than one hour after gaining knowledge of the occurrence**, notify the Shaw E&I Notification Hotline/Helpdesk by calling 1-866-299-3445 (Attachment 3, "Help Desk / Hotline Notification Guidelines") of any injury requiring off-site medical treatment, all vehicle accidents, equipment incidents involving property damage exceeding $2,500 in value (Shaw E&I or third party), criminal activity, explosions or fires with property damage exceeding $2,500 in value, environmental spills/releases, fatalities, or any utility line strikes.
- Inform CORE Health Networks of all incidents requiring off-site medical attention by calling 1-877-347-7429. This call should be made **prior** to transporting the employee such that they can coordinate physicians services prior to the arrival of the employee to the clinic, and provide the following information:
  - Company name (Shaw E&I) and business line (*e.g.*, Federal, Commercial)
  - Employee name
  - Name of anticipated, treating medical facility and phone number
  - Brief description of incident

  CORE Health Network's role is to interface with the treating physician, to ensure that appropriate care is provided to the injured employee.
- Complete the Authorization for Treatment, Release of Medical Information, and Return to Work (Forms EIG-HS-020.01 through EIG-HS-020.03) and the Supervisor's Employee Injury Report (Form EIG-HS-020.04) for all cases requiring off-site medical attention. The Site Safety and Health Representative or responsible supervisor shall ensure that the forms are completed and faxed to CORE Health Networks at 225-295-4846 prior to leaving the medical facility or as soon as reasonably possible.
- Post accident drug and alcohol testing shall occur in accordance with Shaw E&I Procedure No. EIG-HS-101, "Drug and Alcohol Testing," immediately following an incident.
- Prior to an injured employee returning to his/her job duties, a follow-up call by CORE Health Networks will be made to the project site. The purpose of this call is to ensure work restrictions are clarified and planned work activities are consistent with medical recommendations.

The Supervisor shall initiate/complete the appropriate company documentation in accordance with the following incident classifications (note: if a Site Safety and Health Representative is on site, he/she should work in concert with the supervisor):

- OSHA Recordable Cases
  - Supervisor's Employee Injury/Illness Report (Form EIG-HS-020.04)
  - Incident Investigation Report (Form EIG-HS-020.05)
  - Witness Statement form (Form EIG-HS-020.06)
  - Accident Review Board (Form EIG-HS-020.07)
  - Injured Employee Statement (Form EIG-HS-020.10)
- First Aid Cases
  - Supervisor's Employee Injury/Illness Report (Form EIG-HS-020.04)

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  - Incident Investigation Report (Form EIG-HS-020.05)
  - Witness Statement form (Form EIG-HS-020.6)
- Chargeable Vehicle Accidents
  - Vehicle Accident Report (Form EIG-HS-020.8)
  - Incident Investigation Report (Form EIG-HS-020.5)
  - Witness Statement form (Form EIG-HS-020.6)
  - Accident Review Board (Form EIG-HS-020.7)
  - Driving Record Certification (Shaw E&I Procedure No. EIG-HS-800)
- Non-Chargeable Vehicle Accidents
  - Vehicle Accident Report (Form EIG-HS-020.08)
  - Incident Investigation Report (Form EIG-HS-020.05)
  - Witness Statement form (Form EIG-HS-020.06)
- Equipment, Property Damage and General Liability Incidents
  - Incident Investigation Report (Form EIG-HS-020.05)
  - Employee Witness Statement form (Form EIG-HS-020.06)
  - Equipment, Property Damage and General Liability Loss Report (Form EIG-HS-020.09).
- Near Miss
  - Incident Investigation Report (Form EIG-HS-020.05)

6.2 Supervisor's Employee Injury/Illness Report (Form EIG-HS-020.04)

The Supervisor's Employee Injury Report is to be completed for all incidents that result in an employee occupational injury or illness requiring off-site medical attention. It is to be initiated by the supervisor of the injured employee and forwarded to the respective Business Line Safety Manager for review/comments. Upon completion of review and comments the report should be forwarded, **within 24 Hours,** to the Shaw Corporate Claims department in Baton Rouge, via the corporate claims fax number (225-932-2636).

6.3 Vehicle Accident Report (Form EIG-HS-020.08)

The Vehicle Accident Report must be completed for any vehicle accident in which a company vehicle is involved. This includes company-owned or leased, rental, and personal vehicles being used for company business. This report is to be initiated by both the employee involved in the accident and his/her direct supervisor and forwarded to the respective Business Line Safety Manager for review/comments. Upon completion of review and comments the report should be forwarded to the Shaw Corporate Claims department in Baton Rouge (fax number 225-932-2636).

6.4 Equipment, General Liability, Property Damage, and Loss Report (Form EIG-HS-020.09)

The General Liability, Property Damage, and Loss Report is to be used for all losses or damage to company property in excess of $2,500.00. This form must be completed for all third party property, regardless of value, damaged as a result of company activities. The employee most familiar with the events that contributed to the loss or damage will complete the form, and then forward it to the project/location manager. The Corporate Claims Department and the respective

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Business Line Safety Manager must receive a copy of the report within one business day of the incident.

6.5 Incident Investigation Report (Form EIG-HS-020.05)

All injuries, illnesses, accidents, and near miss incidents will be investigated. Once arrangements for immediate medical care have been made, the employee's direct supervisor, with assistance from the health and safety representative and Business Line Health and Safety Manager, will:

- Collect the facts:
  - Describe and document (include sketch, photos, *etc.*) how the incident occurred
  - Collect support documentation (JSAs, Activity Hazard Analyses (AHA), Tailgate Safety Meetings, Work Orders, etc.)
  - List witnesses and collect written statements
- If applicable, contact the employee's Functional Manager in an effort to gain relevant information:
  - Identify the causative factors
  - Identify potentially unsafe acts or unsafe conditions that may have contributed to the incident
  - Identify potential curative action
  - List the corrective actions that are to be executed, appropriate curative action, the person(s) responsible for the corrective action, and the date by which action is to be completed

The investigation will be started as soon as possible following the incident, and the relevant reports and support documentation (JSAs, AHAs, Tailgate Safety Meetings, Work Orders, etc.) shall be submitted to the appropriate Business Line Health and Safety Manager within 72 hours. In addition to the previous information, reports from external sources (police, insurance carriers, testing laboratories, etc.) are to be obtained as soon as they become available and forwarded by the Business Line Safety Manager to the Corporate Claims department in Baton Rouge.

6.6 Injured Employee Statement and Witness Statement Forms (Forms EIG-HS-020.010 and EIG-HS-020.06, respectively)

The Injured Employee and Witness Statement Forms allow for consistency in the development of the investigation process. The Injured Employee Statement must be completed in all cases where an employee injury results in off-site medical treatment. If there are witnesses to the accident/incident, the Witness Statement form should be completed and signed by the subject witness. Both of these forms should be attached to the incident investigation report. It is essential that these statements are executed immediately following the incident to ensure an accurate account of the events. The completion of these forms shall be done independently by the injured employee and/or witnesses; any collaboration of efforts is prohibited.

6.7 Accident Review Board (Form EIG-HS-020.07)

The purpose of the Accident Review Board (ARB) is to collect and review the information gathered for each incident, report that information to the Legal Department, and take appropriate curative action. In all cases, the purpose of the entire investigative process, inclusive of conducting an ARB, is to identify curative actions as it relates to the incident/injury. Accordingly, a diligent and concerted effort to accomplish these tasks must be established at the onset of all of the subject incidents.

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In order to assist the Legal Department in evaluating the risk to, or liability of, the company associated with OSHA recordable injuries, chargeable vehicle accidents, fatalities or incidents resulting in significant property damage, the responsible Project/Location Manager is required to coordinate with all parties and set up the ARB such that it occurs **within 10 days of the accident**. The respective Business Line Health and Safety Manager whose project/location experienced the accident is then required to conduct the subject ARB.

The ARB shall be composed of the project/location manager, the employee's direct supervisor (at time of incident), a health and safety representative, and the employee(s) involved in the incident.

Additionally, there may be cases that involve an employee that has been assigned to a project and the Functional Manager of that employee may not have direct knowledge of an incident. In cases such as these, the Functional Manager shall be notified of the incident and requested to participate in the ARB. Also, as determined by the Business Line Health and Safety Manager, a representative of other internal sources of expertise should be involved where applicable.

All investigations and associated materials obtained and/or produced in association with injuries/illnesses resulting in OSHA recordable classification, chargeable vehicle accidents, fatalities or incidents resulting in significant property damage, are to be performed for and on behalf of the legal department and will be subject to being classified as Confidential Attorney-Client/Attorney Work Product. If the ARB is initiated under a Confidential Attorney-Client/Attorney Work Product status, all documents and other work product arising out of, or associated with, the investigation process, including the ARB, shall be prepared in anticipation of litigation. The ARB report, and associated documents, is submitted to the Baton Rouge Shaw E&I Safety Department for production to and retention on behalf of the Legal Department.

The ARB report, and all associated documents, shall be completed as soon as practicable, but not more than five business days following the ARB meeting, and forwarded by the Business Line Safety Manager to the Baton Rouge Shaw E&I Safety Department, via the Corporate Claims fax number. The original documents shall then be mailed to the Baton Rouge Shaw E&I Safety Department. These documents shall then be filed in a lockable cabinet, separate from files not meeting the subject criteria, by the Baton Rouge Shaw E&I Safety Department, for production to and retention on behalf of the Legal Department. In the event that copies of these files are maintained by Business Line Health and Safety Managers and/or the respective location in which the injury occurred, the same filing criteria shall be followed. The criteria shall be that these documents are filed in lockable cabinets, separate from files not meeting the subject Attorney-Client/Attorney Work Product criteria.

It is generally not acceptable to discipline an employee for having an accident. However, if in the opinion of the ARB it is determined that the accident resulted from an intentional unsafe act or intentional violation of company procedure on the employee's part, the employee may be subject to disciplinary action in accordance with the company's progressive disciplinary action system (see Human Resources Procedure CORPHR207-Employee Discipline).

7. ATTACHMENTS

- Attachment 1, Injury/Illness Classification Guidelines
- Attachment 2, Accident Prevention Program: Reporting, Investigation, And Review Responsibility Matrix
- Attachment 3, Help Desk / Hotline Notification Guidelines

8. FORMS

- Form EIG-HS-020.01, Authorization for Treatment of Occupational Injury/Illness

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- Form EIG-HS-020.02, Authorization for Release of Medical Information
- Form EIG-HS-020.03, Return to Work Examination Form
- Form EIG-HS-020.04, Supervisor's Employee Injury/Illness Report
- Form EIG-HS-020.05, Incident Investigation Report
- Form EIG-HS-020.06, Employee Witness Statement
- Form EIG-HS-020.07, Accident Review Board Report
- Form EIG-HS-020.08, Vehicle Accident Report
- Form EIG-HS-020.09, Equipment, Property Damage and General Liability Loss Report
- Form EIG-HS-020.10, Injured Employee Statement

9. RECORDS

- Form EIG-HS-020.01, Authorization for Treatment of Occupational Injury/Illness
- Form EIG-HS-020.02, Authorization for Release of Medical Information
- Form EIG-HS-020.03, Return to Work Examination Form
- Form EIG-HS-020.04, Supervisor's Employee Injury/Illness Report
- Form EIG-HS-020.05, Incident Investigation Report
- Form EIG-HS-020.06, Employee Witness Statement
- Form EIG-HS-020.07, Accident Review Board Report
- Form EIG-HS-020.08, Vehicle Accident Report
- Form EIG-HS-020.09, Equipment, Property Damage and General Liability Loss Report
- Form EIG-HS-020.10, Injured Employee Statement

10. REVISION HISTORY AND APPROVAL

Revision Level Revision Date	Revision Description	Responsible Manager
00-03 N/A	Initial issue- Rev 3: unavailable	N/A
04 5/20/2003	unavailable	Troy Allen
05 7/16/2003	Added content to Procedure, added Attachment 10; Helpdesk/Hotline notification guidelines.	Troy Allen
06 9/22/2010	Deleted requirement for Health & Safety Managers to prepare a monthly loss report. Changed all Health Resources references to CORE Health Networks. Revised attachment order and numbers to comply with the Standard Operating Procedure template requirements.	Troy Allen

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Revision Level Revision Date	Revision Description	Responsible Manager
	Added requirement for independent completion of employee/witness statements. Revised and updated forms.	
07 08/25/2011	Modified format only to align with Governance Management framework.	Andrew Johnson
08 12/13/2011	Added “Injured Employee Statement” Form EIG-HS-020.10 to Section 6.1; OSHA recordable cases. Updated CORE fax number and address in Form EIG-HS-020.01, EIG-HS-020.02, and EIG-HS-020.03. Updated footer information and changed social security number to employee id number in Form EIG-HS-020.04	Andrew Johnson

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Attachment 1
Injury/Illness Classification Guidelines

First Aid Treatment – If the incident requires only the following types of treatment, consider it first aid. **Do Not** record the case if it involves only:

- Using non-prescription medications at non-prescription strength
- Administering tetanus immunizations
- Cleaning, flushing, or soaking wounds on the skin surface
- Using wound coverings such as bandages, Band-Aids™, gauze pads, *etc.*, or using SteriStrips™ or butterfly bandages
- Using hot or cold therapy
- Using any totally non-rigid means of support, such as elastic bandages, wraps, non-rigid back belts, *etc.*
- Using temporary immobilization devices while transporting an accident victim (slings, neck collars, or back boards)
- Drilling a fingernail or toenail to relieve pressure, or draining fluids from blisters
- Using eye patches
- Using simple irrigation or a cotton swab to remove foreign bodies not embedded in or adhered to the eye
- Using irrigation, tweezers, cotton swab or other simple means to remove splinters or foreign material from areas other than the eye
- Using finger guards
- Using massages
- Drinking fluids to relieve heat stress

Medical Treatment – Includes managing and caring for a patient for the purpose of combating disease or disorder. The following are **not** considered medical treatments and are not recordable:

- Visits to a doctor or Licensed Health Care Professional solely for the purpose of observation or counseling
- Diagnostic procedures, including administering prescription medications that are used solely for diagnostic purposes
- Any procedure that can be labeled first aid (see above descriptions)

OSHA Recordable Injuries and Illnesses

Work related injuries and illnesses that result in the following should be recorded on the OSHA 300 Log:

- Death
- Loss of consciousness
- Days away from work
- Restricted work activity or job transfer

- Medical treatment beyond first aid.

You must also record any **work related** injury or illness that involves cancer, chronic irreversible disease, a fractured or cracked bone, or a punctured eardrum.

Additional Recordable Criteria

You must also record the following conditions when they are work related:

- Any needle stick injury or cut from a sharp object that is contaminated with another person's blood or other potentially infectious material
- Any case requiring an employee to be medically removed from a site under the requirements of an OSHA health standard
- Any Standard Threshold Shift in hearing (*i.e.*, cases involving an average hearing loss of 10dB or more in either ear)
- Tuberculosis infection as evidenced by a positive skin test or diagnosis by a physician or other licensed health care professional after exposure to a known case of active tuberculosis.

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Attachment 2
Accident Prevention Program: Reporting, Investigation, and Review
Responsibility Matrix

Action	Procedure Section	Employee	Supervisor	Project/ Location Manager	Site Health and Safety Rep/ Manager	Business Line Health and Safety Manager	Executive Director Health & Safety
Issue, Revise, and Maintain Procedure	5.1						X
Report All Incidents to Supervisor	6.1	X					
Notify Health and Safety Representative	6.1		X				
Arrange Medical Care	6.1		X		X		
Notify CORE Health Networks of Incident	6.1		X		X		
Initiate/Complete Company Forms	6.1		X		X		
Complete Investigation of incident	6.5		X	X	X	X	
Complete Equipment, Property Damage and General Liability Loss Report Incident	6.4	X		X			
Coordinate and Set up Accident Review Board	6.7			X			
Conduct Accident Review Board	6.7					X	
Participate in Accident Review Board	6.7	X	X	X	X	X	

Attachment 3
Help Desk/Hotline Notification Guidelines

Any incident, as defined in the bulleted items below, requires corporate notification **as soon as practical but not longer than one hour after occurrence**, via the Health and Safety Help Desk / Hotline. This requirement is a corporate wide directive and applies to all Shaw companies, not just Shaw E&I. As such, the responsibility for whom makes this notification has purposefully not been defined. This is due to the various types of projects in which Shaw performs activities. Some projects may only consist of three technicians at a site; others may involve multiple levels of site management and consist of 200+ employees. Therefore, the intent is for the supervisory/management person to communicate the notification requirements to his/her employees and make the appropriate determination as to how the notification takes place.

Immediate Corporate Notification via Help Desk: 1-866-299-3445

- Illness and/or injury (doctors cases and above)
- Property damage (dollar amount greater than $2,500)
- Automobile accidents (All)
- Criminal activity (*i.e.*, bomb threat, theft)
- Natural disaster (*i.e.*, earthquakes, flood, storm damage, hurricanes)
- Explosion and/or fires (that results in property damage greater than $2,500 or result in injury)
- Environmental spills/releases (incidents that requires regulatory notification or have an offsite impact)
- Regulatory visit (*i.e.*, OSHA, EPA, DEQ, MSHA, *etc.*)
- Fatalities
- Utility line strikes (All)

Note:

- Help Desk / Hotline notification is in addition to the requirement to inform CORE Health Networks of all incidents requiring off-site medical attention by calling 1-877-347-7429. This call should be made **prior** to transporting the employee such that they can coordinate physicians' services prior to arrival of the employee to the medical facility.
- As stated above, the notification requirements are a corporate directive and apply to all Shaw companies. Accordingly, Shaw E&I managers/supervisors should use sound judgment as it pertains to the two bulleted items that have been highlighted above. Although they may not be desired events, some Environmental spills/releases that occur may not be an uncommon situation at a particular site. In addition, there may be projects in which the EPA or some other regulatory agency visits on some normal frequency. Events such as these, which would typically be unusual at a construction or fabrication site, are not so unusual to some of our environmental projects. As such, a notification to the helpdesk would not be required.

Medical Forms
Authorization for Treatment of Occupational Injury/Illness

Employee Name: _____

Social Security #: _____ Injury: ☐ Illness: ☐

Job Title: _____ Incident Date: _____

Project/Location: _____ Location of Accident/Exposure: _____

Telephone Number: _____ H&S Representative: _____

Illness/Injury Description: _____

TO TREATING PHYSICIAN:

In the case of occupational injury/illness, please examine the employee and render necessary conservative treatment directly related to the occupational injury/illness.

Light Duty Work: It is the policy of our company to provide work assignments, whenever possible, for employees with physical activity restrictions resulting from an occupational injury/illness. If the employee will be subject to a restriction, please contact **CORE Health Networks** before releasing the employee, so that a light duty assignment may be arranged.

Medically Unfit to Return to Work: It is the policy of our company to assist employees unable to return to work, due to an injury/illness, in obtaining needed medical care and other available benefits. Medical findings are also used to help evaluate unsafe conditions that may have led to the incident. Please help us assist our employees by contacting **CORE Health Networks** with your findings as soon as possible, preferably before the employee leaves your office, but not later than the close of business on the day of initial treatment.

CORE Health Networks:	Telephone: 1-877-347-7429		Fax: 225-292-8986
Please Send Reports To	**CORE Health Networks**	***and***	**The Shaw Group, Inc. Corporate Claims Department**
Both of the Following:	10059 Reiger Road Baton Rouge, LA 70809		4171 Essen Lane Baton Rouge, LA 70809

Please Send Bills To: **The Shaw Group, Inc. Corporate Claims Department**
4171 Essen Lane
Baton Rouge, LA 70809

DOCTOR, Please provide:

Medical Diagnosis: _____

Treatment Provided: _____

Recommended Work Limitation/Restriction: _____

Return Visit Needed: No ☐ Yes ☐ Date if Yes _____ First Aid Only ☐

Physician Name: _____ Physician Telephone: _____

Physician Signature: _____ Date: _____

You must call CORE Health Networks for all occupational injuries/illnessesrequiring outside medical treatment: 1-877-347-7429.

Fax completed form to CORE Health Networks (225) 292-8986.

Send Bills to Shaw Corporate Claims Department

Medical Forms
Authorization for Release of Protected Medical Information

Printed Name: _____ Date of Birth: _____

Address: _____

Social Security #: _____ Home Telephone: _____

Authority to Release Protected Health Information
I hereby authorize the release of medical information, identified in this authorization form, and provide such information to:

CORE Health Networks
10059 North Reiger Road
Baton Rouge, LA 70809
Phone: (877) 347-7429
Fax: (225) 292-8986

AND

The Shaw Group Inc.
4171 Essen Lane
Baton Rouge, Louisiana 70809
Phone: 225-932-2500
Fax: 225-932-2636

The information to be released includes the following:

Complete health record	Discharge summary	Progress notes
History and physical exam	Consultation reports	X-ray films / images
Laboratory test results	X-ray & Image reports	Itemized bill
Diagnosis & treatment codes	Complete billing record	

Other (specify) _____

Purpose of the Requested Disclosure of Protected Health Information

I am authorizing the release of my protected health information.

Drug and/or Alcohol Abuse, and/or Psychiatric, and/or HIV/AIDS Records Release

I understand if my medical or billing record contains information in reference to, psychiatric care, sexually transmitted disease, hepatitis B or C testing, previous drug and/or alcohol abuse and/or other sensitive information, I agree to its release.

Check One: ☐ **Yes** ☐ **No**

I understand if my medical or billing record contains information in reference to HIV/AIDS (Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome) testing and/or treatment I agree to its release.

Check One: ☐ **Yes** ☐ **No**

Right to Revoke Authorization

Except to the extent that action has already been taken in reliance on this authorization, the authorization may be revoked at any time by submitting a written notice to ***The Corporate Claims Dept.*** **at** ***The Shaw Group Inc., 4171 Essen Lane, Baton Rouge, Louisiana, 70809***. Unless revoked, this authorization will expire at which time completion of treatment for the injury or illness has been accomplished.

Re-disclosure

I understand the information disclosed by this authorization may be subject to re-disclosure by the recipient and no longer be protected by the Health Insurance Portability and Accountability Act of 1996.

Signature of Patient or Personal Representative Who May Request Disclosure

I understand that I do not have to sign this authorization. However, if health care services are being provided to me for the purpose of providing information to a third-party (*e.g.,* fitness-for-work test), I understand that services may be denied if I do not authorize the release of information related to such health care services to the third-party. I can inspect or copy the protected health information to be used or disclosed. **I hereby release and discharge.** ***The Shaw Group Inc.*** **of any liability and the undersigned will hold** ***The Shaw Group Inc.*** **harmless for complying with this Authorization.**

Signature: _____ Date: _____

Description of relationship if not patient: _____

Medical Forms
Return-to-Work Examination Form

Exam Date: _____ / _____ / _____ **Employee Name:** _____

Birth Date: _____ / _____ / _____ **Social Security #:** _____ - _____ - _____

Job Title: _____ **Sex:** ☐ Male ☐ Female

Examining Provider: **Please complete this form and fax to CORE Health Networks at (225) 292-8986. Please contact CORE Health Networks at (877) 347-7429 to report status of employee post-treatment.**

Diagnosis: _____

Treatment Plan: _____

Medications: _____

Physical Therapy: _____

Other: _____

☐ May return to full duty work effective ___/___/

☐ May return to limited duty from ___/___/___ to ___/___/

☐ Unable to return to work from ___/___/___ to ___/___/

WORK LIMITATIONS:

☐ Restricted lifting/pushing/pulling: maximum weight in lbs: _____ (Company limits all lifting to ≤ 60 lbs).

☐ Work only with right/left hand.

☐ Restricted repetitive motion right/left hand.

☐ Sitting job only.

☐ Restricted operation of moving equipment.

☐ Other: _____

FOLLOW-UP PLAN:

☐ Release from care.

☐ Schedule for follow-up appointment on ___/___/___.

Time _____ AM/PM

☐ Referral to _____

Appointment date ___/___/___ Time _____ AM/PM

Comments: _____

_____ _____ _____

Examiner's Name (*print)* Examiner's Signature Date

Supervisor's Employee Injury/Illness Report Form

EMPLOYEE INFORMATION		
Employee Number	Claim Number	
Employee's Name:	Home Phone Number:	
Home Address:		Business Line Code:
Male ☐ Female ☐	Date of Birth:	Hire Date:
Dependents:	Dependents under 18:	Marital Status:
Occupation:		Department Name:
State Hired:	Currently Weekly Wage:	Hourly Wage:
Hours/Days Worked Per Week:	Days Per Week:	Hours Worked Per Day:
Employment Status:	Employee Report No.: NA	Employee ID No.: NA
Salaried Continued:	Paid for Date of Injury:	Education No. of Years:
Ever injured on the Job:	Supervisors Name and Phone:	

EMPLOYER INFORMATION	
Employer Name: **The Shaw Group, Inc.**	Work Location:
Project Name:	Project Number:
Contract Name:	Contract Number:
Contact Name:	Telephone Number:
Employer SIC:	Employer Location Code:
Employer FED ID:	Employer Code: NA
Nature of Business:	
Policy Number:	

ACCIDENT INFORMATION	
Date and Time of Injury:	
Did the Accident Occur at the Work Location	If no, where did the accident occur? NA
Accident Address:	
Nature of Accident:	
Give a Full Description of the Accident (Be as factually complete as possible):	
Are Other WC Claims Involved" No	Date and Time Reported to Employer:
Person Reported To:	

Shaw a world of Solutions	Title: Supervisor's Employee Injury/Illness Report Form	Form No: EIG-HS-020.04_8

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WITNESS INFORMATION
Were There Any Witnesses?
If Yes, List Names and How to Contact Them:

INJURY INFORMATION		
Which Part of the Body Was Injured? (*e.g.*, Head, Neck, Arm, Leg)		
What was the Nature of the Injury? (*e.g.*, Fracture, Sprain, Laceration)		
Part of the Body Location? (*e.g.*, Left, Right, Upper, Lower)		
Injury Description:		
Source of Injury:		Is Employee Hospitalized?
Lost Time:	If Yes, What was First Full Day Out:	
Date Last Day Worked:	Date Disability Began: NA	
Date Returned to Work:	Estimated Return Date: NA	

MEDICAL INFORMATION		
ER Treated & Released:	Hospitalized:	Phy./Clinic:
Hospital – Name, Address, Phone Number: NA	Was Employee Transported via Ambulance: Yes No	
Clinic – Name, Address, Phone Number:		

ADDITIONAL COMMENTS AND INFORMATION

REPORT PREPARED BY	
Name:	Title:
Signature:	Phone Number:

REPORT ALL WORKER'S COMPENSATION INJURIES TO THE APPROPRIATE SAFETY MANAGER
REPORTS ARE DUE WITHIN 24 HOURS OF INCIDENT .
Phone all injuries/illnesses to **Shaw Notification Hotline/Helpdesk 1-866-299-3445**

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Incident Investigation Report

*** Must Be Completed Within 72 HOURS & Relevant Support Documentation Must Be Attached/ Submitted***

Investigation Date _____ Date of Incident _____

Employee Name _____ Supervisor Name _____

Project Number _____ Project Name _____

Contract Number _____ Contract Name _____

Location of Incident _____

Incident Classification

Injury	☐ First Aid	Vehicle	☐ Chargeable	DOT	☐ DOT Vehicle
	☐ OSHA Recordable		☐ Non-chargeable		☐ DOT Reportable
	☐ Lost Workday				
	☐ Restricted Workday	Near Miss	☐	General Liability	☐

Description (Provide facts, describe how incident occurred, provide diagram [on back] or photos)

_____

_____

_____

Analysis (What unsafe acts or conditions contributed to the incident?)

_____

_____

_____

Corrective Action(s) (List corrective action items, responsible person, scheduled completion date)

_____

_____

_____

Witness Names (Complete Attachment 6 – Employee Witness Statement)

_____

_____

_____

Investigated By: _____ _____ _____

Print Name Signature Date

Project/Location Mgr.: _____ _____ _____

Print Name Signature Date

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Employee Witness Statement

MUST BE COMPLETED WITHIN 24 HOURS OF THE INCIDENT

This form should be completed by every employee working in the crew of the injured employee and by every other employee with knowledge of events or circumstances involved in the incident.

This information is being solicited from you so that the company can accurately assess the reported incident to avoid similar occurrences in the future. Describe only the facts for which you have personal knowledge. If you have no knowledge of the incident, write "no knowledge."

Company: _____

Exact Location of Incident/Accident: _____

Name of Injured Employee: _____

Date of Incident/Accident: _____ Time _____ am pm

Date of this Statement: _____ Time _____ am pm

Time your shift begins? _____ am pm Ends _____ am pm

Witness Information:

Name: _____

Home Phone No.: _____

Home Address: _____

County: _____ Zip: _____

Witness' Supervisor Name: _____

If not employed by Shaw E&I, enter name of company: _____

Company Phone Number: _____

Did you see the Incident/Accident? _____

How far from you (approx., in feet) did the Incident/Accident occur? _____

Stating only factual information, describe in detail what happened and include any applicable events leading to the Incident/Accident:

_____

_____

_____

_____

I certify that, to the best of my knowledge, all of the above information is complete, accurate, and factual. I acknowledge that the intentional falsification or altering of facts or making misleading statements may be grounds for disciplinary action.

_____ _____

Witness Signature/Date Print Name

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Accident Review Board

DATE:	LOCATION:
BOARD MEMBERS:	
ACCIDENT DATE:	EMPLOYEE(S) INVOLVED IN INCIDENT:
INVESTIGATION COMPLETE: YES ☐ NO ☐	ACCIDENT CLASSIFICATION:

The following information must be provided by the Accident Review Board for this incident (print):

SUPERVISOR: _____ **PROJECT/LOCATION MGR.:** _____

POTENTIAL CAUSE OF ACCIDENT:

ACTION BY BOARD*:

* All actions by the Accident Review Board are subject to final review by the Human Resources and Legal Departments.

ACCEPTED:	
_____	_____
(Employee Signature)	(Supervisor Signature)
APPROVED:	REJECTED FOR:
_____	_____
(Project/Location Manager)	
APPROVED:	REJECTED FOR:
_____	_____
(Business Line Health and Safety Manager or Designee)	
APPROVED:	REJECTED FOR:
_____	_____
(Business Line Vice President)	

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Vehicle Accident Report

ACCIDENT DESCRIPTION

This report is to be initiated by the employee involved in the accident or his/her direct supervisor. Please answer all questions completely. This report must be forwarded to the appropriate health and safety representative within 24 HOURS of the accident. Attach police report.

ACCIDENT DATE _____ TIME _____ ☐ A.M. or ☐ P.M.
LOCATION OF ACCIDENT (CITY, STATE) _____
DESCRIPTION OF ACCIDENT _____
_____
_____
WITNESS _____ PHONE NO. _____
ADDRESS _____ CITY _____ STATE _____ ZIP _____
POLICE OFFICER'S NAME AND BADGE # _____ DEPARTMENT _____

COMPANY VEHICLE

DRIVER _____ DRIVERS LICENSE NO. _____ STATE _____
ADDRESS _____ CITY _____ STATE _____ ZIP _____
WORK PHONE NO. _(_____)_____ S.S. NO. _____ PROJECT NAME/NO. _____
VEHICLE NO. _____ YEAR _____ MAKE _____ MODEL _____ LICENSE PLATE NO. _____
STATE _____ VEHICLE OWNER: ☐ COMPANY ☐ LEASED/RENTED ☐ PRIVATE VEHICLE
VEHICLE TYPE: ☐ COMMERCIAL MOTOR VEHICLE ☐ NON-COMMERCIAL
IF NOT COMPANY-OWNED: OWNER _____ PHONE NO _(____)_____
ADDRESS _____ CITY _____ STATE _____ ZIP _____
VEHICLE DAMAGE _____
NO. OF VEHICLES TOWED FROM SCENE _____ NUMBER OF INJURIES _____ NUMBER OF FATALITIES _____
WERE HAZARDOUS MATERIALS RELEASED? ☐ NO ☐ YES IF YES, DESCRIBE MATERIALS _____
_____

OTHER VEHICLE

DRIVER _____ DRIVERS LICENSE NO. _____ STATE _____
ADDRESS _____ CITY _____ STATE _____ ZIP _____
PHONE NO. _(_____)_____ S.S. NO. _____
OWNER'S NAME (☐ CHECK IF SAME AS DRIVER) _____
ADDRESS _____ CITY _____ STATE _____ ZIP _____
INSURAMCE COMPANY _____ POLICY NO.: _____
AGENT'S NAME _____ PHONE NO.: _(_____)_____
ADDRESS _____ CITY _____ STATE _____ ZIP _____
VEHICLE YEAR. _____ MAKE _____ MODEL _____ PLATE NO. _____ STATE _____
VEHICLE I.D. NO. _____
VEHICLE DAMAGE _____
PASSENGERS ☐ NO ☐ YES INJURIES ☐ NO ☐ YES (If yes, list names and telephone numbers below)
_____
_____
_____

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Vehicle Accident Report

WEATHER: ❑ Clear ❑ Cloudy ❑Fog ❑Rain ❑Sleet ❑Snow Other ___
PAVEMENT: ❑Asphalt ❑Steel ❑Concrete ❑Wood ❑Gravel/Dirt
❑Brick/Stone Other _____
CONDITION: ❑Dry ❑Wet ❑Icy ❑Pot Holes Other _____
TRAFFIC CONTROL: ❑Traffic Light ❑Stop Sign ❑Railroad ❑No Intersection ❑No Control
ROADWAY: No. of Lanes Each Direction: _____ ❑Residential ❑Divided Highway ❑Undivided Highway

Draw and name roadways showing each vehicle, direction of travel, and point of impact. Indicate travel before the accident with a solid line, and post-accident movement with a broken line.

SYMBOLS:

Your Vehicle ①

Other Vehicle(s) ②③

Pedestrian

Stop Sign

Yield

Railroad ‡

- ADDITIONAL INFORMATION: _____
- _____
- _____

Employee _____ (Print) _____ (Signature) _____ (Date)

Supervisor _____ (Print) _____ (Signature) _____ (Date)

H&S Rep. _____ (Print) _____ (Signature) _____ (Date)

Attach police report to vehicle accident report

Report must be faxed to Corporate Claims Department (Fax: 225-932-2636) within 24 hours, or not later than next business day.

Report all vehicle accidents to Shaw Notification Hotline/Helpdesk (Phone: 1-866-299-3445)

Equipment, Property Damage, and General Liability and Loss Report

This report is to be completed for all losses or damage to company property in excess of $2,500.00 and all third party damage, regardless of value, resulting from company activities.

PROJECT/LOCATION: _____ PROJECT NO.: _____ DATE: _____

PROGRAM NAME: _____ TASK ORDER NUMBER: _____

ADDRESS: _____

HOW DID DAMAGE OR LOSS OCCUR: _____

_____

_____

DESCRIPTION AND VALUE ($) OF DAMAGED/LOST/STOLEN PROPERTY: _____

_____

LOCATION OF DAMAGED/LOST/STOLEN PROPERTY (Before Loss): _____

_____

DATE AND TIME OF DAMAGE, LOSS, OR THEFT: Date: _____ Time: _____ a.m./p.m.

OWNER OF DAMAGED/LOST/STOLEN PROPERTY:

Name _____ Phone No. (____) _____

Address _____ City _____

Employer and Address _____

INJURED PARTIES (Also complete a Supervisor's Employee Injury Report if a Company Employee):

Name _____ Phone No. (____) _____

Address _____ City _____

Employer and Address _____

Description of Injury _____

WITNESSES:

1. Name _____ Phone No. (____) _____

   Home Address _____ City _____

   Employer and Address _____

2. Name _____ Phone No. (____) _____

   Home Address _____ City _____

   Employer and Address _____

WERE PICTURES TAKEN? ☐ YES ☐ NO

WERE POLICE NOTIFIED? ☐ YES ☐ NO DEPT. _____ REPORT NO. _____

COMPLETED BY: _____ _____ _____
(Print) (Signature) (Date)

PROJECT/LOCATION MANAGER: _____ _____ _____
(Print) (Signature) (Date)

REPORT MUST BE FAXED TO:
CORPORATE CLAIMS DEPARTMENT (FAX: 225-932-2636)
WITHIN 24 HOURS, OR NOT LATER THAN NEXT BUSINESS DAY

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Injured Employee Statement

MUST BE COMPLETED WITHIN 24 HOURS OF THE INCIDENT

This form should be completed by the injured employee involved in the incident. Describe only the facts for which you have personal knowledge. If you have no knowledge of a particular question, write "no knowledge."

Company: _____

Exact Location of Incident/Accident: _____

Name of Injured Employee: _____

Date of Incident/Accident: _____ Time _____ am pm

Date of this Statement: _____ Time _____ am pm

Time your shift begins? _____ am pm Ends? _____ am pm

Name of Known Witnesses:

Name: _____

Name: _____

Name: _____

Name: _____

Your Immediate Supervisor's Name: _____

If not employed by Shaw E&I, enter name of company and phone number: _____

Have you had prior injury similar to this injury? _____

Was it while you were at work? _____

What date did the prior injury occur? _____

Stating only factual information, describe in detail what happened and include any applicable events leading to the Incident/Accident:

_____

_____

_____

_____

I certify that, to the best of my knowledge, all of the above information is complete, accurate and factual. I acknowledge that the intentional falsification or altering of facts or making misleading statements may be grounds for disciplinary action.

_____ _____

Signature/Date Print Name

1. PURPOSE

This procedure establishes the requirement for management safety inspections of project and office locations. These inspections are an integral part of the overall accident prevention program and help to demonstrate management's commitment to safety.

2. SCOPE

This procedure applies to project managers, office managers, laboratory managers, project supervisors, and health and safety representatives.

2.1 Exception Provisions

Variances and exceptions may be requested pursuant to the provisions of Shaw Environmental & Infrastructure, Group (Shaw E&I) Procedure No. EIG-HS-013, "Health and Safety Procedure Variances."

3. REFERENCES

- Procedure No. EIG-HS-013, Health and Safety Procedure Variances

4. DEFINITIONS

None

5. RESPONSIBILITIES

5.1 Procedure Responsibility

The Senior Director of Environmental Health and Safety (EH&S) is responsible for the issuance, revision, and maintenance of this procedure.

5.2 Action/Approval Responsibilities

The responsibility requirements are included in Attachment 1, "Accident Prevention Program: Management Safety Inspections Responsibility Matrix."

6. PROCEDURE

Inspections of project, laboratory, and office locations by managers, supervisors, and the health and safety staff are critical factors in a comprehensive accident prevention program. Management safety inspections help demonstrate management's commitment to safety and verify that proper work practices are in use. These inspections are also used to verify the existence of safe work conditions and regulatory compliance. All employees are afforded the opportunity to participate in the inspection via the safety interview process.

Key requirements of this procedure include:

- Project Managers are required to conduct one inspection per month and ensure that at least one other inspection is conducted during the month.
- Office Managers are required to conduct an office safety inspection once every six months.
- Laboratory Managers are required to conduct a laboratory safety inspection every six months or more frequent as new processes or chemicals are introduced to the laboratory.

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- Completed inspection reports are given to the Project/Office Health and Safety Representative for review. A copy of the completed report will then be forwarded to the respective business line Health and Safety Manager.

6.1 Safety Inspections and Documentation

Safety inspections are required by various tiers and functions within the management structure. The objective is for operation managers to visibly demonstrate their concern for safety by direct contact with employees while in the workplace. Each inspection is to be documented on the appropriate Safety Inspection Report (Forms EIG-HS-021c.01, EIG-HS-021c.02, or EIG-HS-021c.03).

The primary responsibilities of the inspector include but are not limited to the following:

- Interviewing employees with regard to health and safety issues and how they might be corrected
- Observing and correcting unsafe conditions and acts
- Verifying that corrective actions have been assigned to a responsible employee and implemented

Positive safety observations and safety issues not specifically addressed in the Safety Inspection Report can be documented on the last page of the report. A list of all corrective action items will be maintained showing the corrective action, responsible person, and the date the action is to be completed. Completed reports are to be given to the Project/Office Health and Safety Representative, and then forwarded to the respective business line health and safety manager. See Attachment 2, “Accident Prevention Program: Management Safety Inspections Requirement Matrix,” for more detail on the proper routing of each inspection report.

6.2 Best Practices

Observations of superior safety practices that may be benchmarked at other projects, offices, or laboratories should be documented on the last page of the appropriate safety inspection report.

6.3 Joint Inspections

Managers are encouraged to conduct safety inspections jointly with EH&S personnel.

6.4 Safety Improvement Log

Each project, office, and laboratory will maintain a Project/Office/Lab Safety Improvement Log (Form EIG-HS-021c.04). The Safety Improvement Log is the central repository for all observations for safety improvements identified through any type of safety inspection. Project, Office, and Laboratory Managers will **verify** that corrective actions listed in the Safety Improvement Log are completed in a timely manner and **validated** that the corrective action(s) taken is effective in preventing accidents.

6.5 Management Site Visits

Each senior manager is encouraged to make an informal safety inspection and review previously conducted inspection reports, during each site visit, to demonstrate their commitment to safety and reinforce the responsibilities of project management. Findings during this informal inspection are to be brought to the attention of the Project Manager so that corrective action can be initiated.

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6.5.1 Project Managers

All Project Managers are required to complete at least one safety inspection per month and ensure that at least one other safety inspection per month is conducted. In the event that the Project Manager is not present at the project site during the month, this responsibility may be delegated to the Project Supervisor.

6.5.2 Office Managers

Office Managers are required to conduct an office safety inspection once every 6 months. Managers are encouraged to conduct more frequent inspections if the office location is being remodeled or if new space is being occupied that was not previously inspected.

6.5.3 Laboratory Managers

Laboratory Managers are required to conduct a laboratory safety inspection once every 6 months, or more frequently if new test chemicals, sample types, equipment, or instrumentation have been introduced that pose a greater risk.

6.5.4 Project Supervisors

Project supervisors are expected to inspect their projects monthly and ensure that corrective actions are implemented. Dependent upon Project Manager participation, project supervisors may also be required to conduct an additional monthly inspection. The requirement to conduct these inspections cannot be delegated.

6.5.5 Health and Safety Representative

Health and safety representatives must continually observe activities and correct unsafe acts/conditions as soon as reasonably possible. They are also required to review each Safety Inspection Report completed at their location to ensure that corrective actions are implemented. Once this review is complete, they will forward the reports to the appropriate business line health and safety manager.

6.6 Workshops

Health and safety representatives will present workshops and/or conduct joint inspections to help managers and supervisors develop their inspection skills.

7. ATTACHMENTS

- Attachment 1, Accident Prevention Program: Management Safety Inspections Responsibility Matrix
- Attachment 2, Accident Prevention Program: Management Safety Inspections Requirement Matrix

8. FORMS

- EIG-HS-021c.01, Project Safety Inspection Report
- EIG-HS-021c.02, Office Safety Inspection Report
- EIG-HS-021c.03, Laboratory Inspection Report
- EIG-HS-021c.04, Project/Office/Lab Safety Improvement Log

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9. RECORDS

- EIG-HS-021c.01, Project Safety Inspection Report
- EIG-HS-021c.02, Office Safety Inspection Report
- EIG-HS-021c.03, Laboratory Inspection Report
- EIG-HS-021c.04, Project/Office/Lab Safety Improvement Log

10. REVISION HISTORY AND APPROVAL

Revision Level Revision Date	Revision Description	Responsible Manager
00 N/A	Initial unavailable. (In the version history, the very first document was incorrectly showing Rev 0. It was really Rev 1)	N/A
01 11/1/2007	HS021c was separated into 3 separate procedures: HS021a, HS021b , HS021c.	Troy Allen
02 9/9/2010	Updated position title references. A “Radioactive Materials/X-Ray Generating Equipment” section has been added to Project Safety Inspection Report.	Troy Allen
03 11/19/2010	Removed all space heater inspection items from the electrical section of the Office Safety Inspection Report.	Troy Allen
04 8/25/2011	Modified format only to align with Governance Management framework.	Andrew Johnson

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Attachment 1
Accident Prevention Program: Management Safety Inspections Responsibility Matrix

Action	Procedure Section	*Responsible Party*				
		Senior Managers	**Project/ Office Manager**	**Project Supervisors**	**Health and Safety Representative**	**Senior Director of EH&S**
Issue, Revise, and Maintain Procedure	5.1					X
Conduct Informal Safety Inspections and Review Previously Completed Reports	6.1.1	X				
Conduct Safety Inspections	6.1.2 6.1.3 5.1.4		X	X		
Give Completed Reports to Health and Safety Representative	6.1.2 6.1.3 6.1.4		X	X		
Review Reports and Forward to Health and Safety Manager	6.1.5				X	
Conduct Inspection Workshops	6.2				X	

Attachment 2
Accident Prevention Program: Management Safety Inspections Requirement Matrix

Tier Level	Management Level	Form Used	Frequency	Routing [1]
1	Tier 1 Senior Management	Leadership Safety Assessment Report EIG-HS-021A	One/quarter	EH&S Director
2	Tier 2 Senior Management	Leadership Safety Assessment Report EIG-HS-021B	Two/quarter	EH&S Director
3	Project Managers/ Site Managers	Project Manager/Site Manager Safety Inspection EIG-HS-021C	Two/Month	Direct Supervisor, Site Safety Officer (if applicable) and Health and Safety Manager
3	Office Managers	Office Safety Inspection Report EIG-HS-021C	Semi-annually	Direct Supervisor, Health and Safety Manager
3	Laboratory Managers	Laboratory Safety Inspection Report EIG-HS-021C	Semi-annually	Direct Supervisor, Health and Safety Manager
3	Project Supervisors	Project Safety Inspection Report EIG-HS-021C	Two/Month	Project Manager, Site Safety Officer (if applicable) and Health and Safety Manager
3	Health & Safety Managers/ Representatives	Joint Inspections (with Senior Managers, Project/Site Managers, Office Managers, Lab Managers or Project Supervisors) EIG-HS-021C	Three/quarter	As appropriate

[1] The H&S Director and I H&S Managers will forward a copy to the H&S Administrator for filing and metric tracking.

Project Safety Inspection Report

Project _____ **Date** _____

BUSINESS LINE: _____ PROJECT NAME/NUMBER: _____

PROGRAM MANAGER: _____ PROJECT MANAGER: _____

GENERAL PROJECT DESCRIPTION:

SITE ACTIVITIES AT TIME OF INSPECTION:

INTERVIEWED EMPLOYEE: _____

SAFETY ISSUE: _____

CORRECTIVE ACTION:

ASSIGNED TO: _____ FOLLOW-UP DATE: _____

CORRECTION VERIFIED BY: _____ DATE: _____

INTERVIEWED EMPLOYEE: _____

SAFETY ISSUE: _____

CORRECTIVE ACTION:

ASSIGNED TO: _____ FOLLOW-UP DATE: _____

CORRECTION VERIFIED BY: _____ DATE: _____

INSPECTION COMPLETED BY: _____ DATE: _____

HEALTH AND SAFETY REVIEW BY: _____ DATE: _____

Project Safety Inspection Report (continued)

Project _____ **Date** _____

	YES	NO	N/A
FIRST AID			
1. Are first aid kit locations identified and accessible?			
2. Are emergency eye wash/safety showers available and inspected monthly?			
3. Are first aid kits inspected weekly?			
4. Is a qualified first aid/CPR provider on site?			
PERSONAL PROTECTIVE EQUIPMENT			
1. Have levels of personnel protection been established?			
2. Are respirators decontaminated, inspected, and stored according to standard procedures?			
3. Have employees been fit-tested?			
4. Is defective personal protective equipment tagged and taken out of service?			
5. Does compressed breathing air meet CGA Grade "D" minimum?			
6. Are there sufficient sizes and quantities of protective equipment?			
7. At a minimum, are employees utilizing safety glasses, hard hats, and steel toe boots?			
FIRE PREVENTION			
1. Are employees smoking only in designated outdoor areas?			
2. Are fire lanes established and maintained?			
3. Are flammable liquid dispensing systems bonded?			
4. Are approved safety cans available for storage of flammable liquids?			
5. Has the local fire department been contacted?			
6. Are fire extinguishers available and inspected monthly?			
7. Are flammables and combustibles properly stored?			
8. Are flammable storage cabinets available and used when needed?			
AIR MONITORING			
1. Is required air monitoring being conducted?			
2. Are air monitoring instruments calibrated daily?			
3. Are air monitoring logs up to date?			
4. Are instrument user manuals available?			
5. Are instruments being maintained?			
6. Are employees notified of personal sampling results within 5 days of receipt?			
WELDING AND CUTTING			
1. Are fire extinguishers present at welding and cutting operations?			
2. Are confined spaces evaluated prior to and during cutting and welding operations?			
3. Have Hot Work Permits been completed?			
4. Are proper helmets, goggles, aprons, and gloves available for welding and cutting operations?			
5. Are welding machines properly grounded?			
6. Are oxygen and fuel gas cylinders stored a minimum of 20 feet apart?			
7. Are only trained personnel permitted to operate welding and cutting equipment?			
8. Are gas cylinders transported in a secured vertical position with caps in place?			

Project Safety Inspection Report (continued)

Project _____ **Date** _____

	YES	NO	N/A
HAND AND POWER TOOLS			
1. Are defective hand and power tools tagged and taken out of service?			
2. Is eye protection available and used when operating power tools?			
3. Are guards and safety devices in place on power tools?			
4. Are power tools inspected before each use?			
5. Are nonsparking tools available when necessary?			
6. Is the correct tool being used for the job?			
MOTOR VEHICLES			
1. Are vehicles regularly inspected?			
2. Are personnel licensed for the vehicles they operate?			
3. Are unsafe vehicles tagged and reported to supervision?			
4. Is vehicles safety equipment operating properly?			
5. Are loads secure?			
6. Are vehicle occupants using safety belts?			
7. Are current insurance cards and blank accident report forms located in vehicles?			
EMERGENCY PLANS			
1. Are emergency telephone numbers posted?			
2. Have emergency escape routes been designated?			
3. Are employees familiar with the emergency signal?			
4. Has the emergency route to the hospital been established and posted?			
5. Is a vehicle on site that can transport injured employees to the hospital?			
MATERIALS HANDLING			
1. Are materials stacked and stored to prevent sliding or collapsing?			
2. Are tripping hazards identified?			
3. Are semi-trailers chocked?			
4. Are fixed jacks used under semi-trailers?			
5. Are riders prohibited on materials handling equipment?			
6. Are approved manlifts provided for the lifting of personnel?			
7. Are personnel in manlifts wearing approved fall protection devices?			
8. Are only qualified operators utilized *i.e.*, forklift trained?			
FIRE PROTECTION			
1. Has a fire alarm system been established?			
2. Do employees know the location and use of all fire extinguishers?			
3. Are fire extinguisher locations posted?			
4. Are combustible materials segregated from open flames?			
5. Have fire extinguishers been professionally inspected during the last year?			
6. Are fire extinguishers visually inspected monthly?			
7. Has a fire drill occurred within the last 12 months?			

Project Safety Inspection Report (continued)

Project _____ **Date** _____

	YES	NO	N/A
ELECTRICAL			
1. Is electrical equipment and wiring properly guarded and maintained in good condition?			
2. Are extension cords kept out of wet areas?			
3. Is damaged electrical equipment tagged and taken out of service?			
4. Have underground electrical lines been identified by proper authorities?			
5. Has a lockout/tagout system been established?			
6. Are GFCIs being used on all temporary electrical systems and as needed?			
7. Are extension cords being inspected daily (*i.e.*, group pin in place, no unapproved splices)?			
8. Are warning signs exhibited on high voltage equipment (250V or greater)?			
. Is adequate distance maintained from overhead electrical lines?			
10. Are switches, circuit breakers, and switchboards installed in wet locations enclosed in weatherproof enclosures?			
11. Are restricted or limited approach boundaries identified on electrical panels?			
12. Are authorized electricians trained in NFPA 70?			
13. Are only electrically rated tools being used for electrical work?			
CRANES AND RIGGING			
1. Are cranes inspected daily prior to use?			
2. Are crane swing areas barricaded or demarked?			
3. Is all rigging equipment tagged with an identification number and rated capacity?			
4. Is rigging equipment inspection documented?			
5. Are slings, chains, and rigging inspected before each use?			
6. Are damaged slings, chains, and rigging tagged and taken out of service?			
7. Are slings padded or protected from sharp corners?			
8. Do employees keep clear of suspended loads?			
9. Are rated load capacities and special hazard warnings posted on crane?			
10. Are the records of annual crane inspection available?			
11. Has accessible areas within the swing radius of the rear of the crane been barricaded?			
12. Do crane operators have required training/certification?			
COMPRESSED GAS CYLINDERS			
1. Are breathing air cylinders charged only to prescribed pressures?			
2. Are like cylinders segregated and stored in well ventilated areas?			
3. Is smoking prohibited in cylinder storage areas?			
4. Are cylinders stored secure and upright?			
5. Are cylinders protected from snow, rain, *etc.*?			
6. Are cylinder caps in place before cylinders are moved?			
7. Are fuel gas and oxygen cylinders stored a minimum of 20 feet apart?			
8. Are propane cylinders stored and used only outside of buildings?			
SCAFFOLDING			
1. Is scaffolding placed on a flat, firm surface?			
2. Are scaffold planks free of mud, ice, grease, *etc.*?			

Project Safety Inspection Report (continued)

Project _____ **Date** _____

		YES	NO	N/A
3.	Is scaffolding inspected before each use?			
4.	Are defective scaffold parts taken out of service?			
5.	Have employees completed scaffold user training?			
6.	On scaffolds where platforms are overlapped, is planking overlapped a minimum of 12 inches?			
7.	Does scaffold planking extend over end supports between 6 to 18 inches (dependent upon platform length)?			
8.	Are employees restricted from working on scaffolds during storms and high winds?			
9.	Are all pins in place and wheels locked?			
10.	Is required perimeter guarding (top rail, mid rail, and toe board) present?			
11.	Has a competent person been designated to oversee scaffold construction?			
12.	Are employees prohibited from moving mobile scaffold horizontally while employees are on them?			
13.	Are all scaffold components manufactured by the same company?			

WALKING AND WORKING SURFACES

1.	Are ladders regularly inspected?			
2.	Are access ways, stairways, ramps, and ladders clean of ice, mud, snow, or debris?			
3.	Are ladders being used in a safe manner?			
4.	Are ladders kept out of passageways, doors, or driveways?			
5.	Are broken or damaged ladders tagged and taken out of service?			
6.	Are metal ladders prohibited in electrical service?			
7.	Are stairways and floor openings guarded?			
8.	Are safety feet installed on straight and extension ladders?			
9.	Is general housekeeping being maintained?			
10.	Are ladders tied off?			
11.	Are handrails and side rails installed along the unprotected sides of stairways having 4 or more risers or rising more than 30 inches?			

SITE SAFETY PLAN

1.	Is a site safety plan available on site or accessible to all employees?			
2.	Does the safety plan accurately reflect site conditions and tasks?			
3.	Have potential hazards been described to employees on site?			
4.	Is there a designated safety official on site?			
5.	Have all employees signed the safety plan acknowledgment form?			

SITE POSTERS

1. Are the following posters displayed in a prominent and accessible area?

A.	Minimum Wage		
B.	OSHA Job Protection		
C.	Equal Employment Opportunity		
D.	Family and Medical Leave		
E.	Employee Polygraph Protection		
F.	Uninformed Services Employment and Reemployment Rights Act		
G.	Shaw Speak Up		
H.	Shaw HR203 Harassment Policy		

Project Safety Inspection Report (continued)

Project _____ **Date** _____

	YES	NO	N/A
I. Shaw Equal Employment Opportunity and Affirmative Action			
2. Are all required state-specific posters displayed?			
SITE CONTROL			
1. Are work zones clearly marked?			
2. Are support trailers located to minimize exposure from a potential release?			
3. Are support trailers accessible for approach by emergency vehicles?			
4. Is the site properly secured during and after work hours?			
5. Is an exclusion zone sign-in/sign-out log maintained?			
6. Are only personnel with current training and physicals permitted in exclusion or contamination reduction zone?			
HEAVY EQUIPMENT			
1. Is heavy equipment inspected as prescribed by the manufacturer?			
2. Is defective heavy equipment tagged and taken out of service?			
3. Are project roads and structures inspected for load capacities and proper clearances?			
4. Is heavy equipment shut down for fueling and maintenance?			
5. Are backup alarms installed and working on mobile equipment?			
6. Have qualified equipment operators been designated?			
7. Are riders prohibited on heavy equipment?			
8. Are guards and safety appliances in place and used?			
9. Are operators using the "three point" system when mounting/dismounting equipment?			
EXCAVATION			
1. Has a "competent person" been designated to oversee excavation activities?			
2. Prior to opening excavations, are utilities located and marked?			
3. Has a professional engineer evaluated all excavations greater than 20 feet deep?			
4. Is there rescue equipment on site and accessible to the excavation area?			
5. Is excavated material placed a minimum of 24 inches from the excavation?			
6. Are the sides of excavations sloped or shored to prevent cave ins?			
7. Have excavations greater than 4 feet deep been monitored for hazardous atmospheres (*i.e.*, LEL/O_2 deficiency)?			
8. Are ladders or ramps used in excavations over 4 feet deep?			
9. Are means of egress available so as to require no more than 25 feet of lateral travel?			
10. Are barriers, *i.e.*, guardrails or fences, placed around excavations near pedestrian or vehicle thoroughfares?			
11. Is excavation inspected daily by competent persons and documented?			
CONFINED SPACES			
1. Have employees been trained in the hazards of confined spaces?			
2. Are confined space permits posted at entrance to confined space?			
3. Is a copy of the confined space entry procedure available?			
4. Has a rescue plan been established?			
5. Is an entry supervisor present at each permit-required entry?			

Project Safety Inspection Report (continued)

Project _____ **Date** _____

	YES	NO	N/A
6. Are required extraction/fall protection devices being used?			
DECONTAMINATION			
1. Are decontamination stations set up on site?			
2. Is decontamination water properly contained and disposed of?			
3. Are all pieces of equipment inspected for proper decontamination before leaving the site?			
4. Are shin/metatarsal guards being used during power washing activities?			
HAZARD COMMUNICATION			
1. Is there a copy of the HAZCOM procedure on site?			
2. Are there MSDSs for required materials/chemicals present on site?			
3. Are all containers properly labeled, as to content, hazard?			
4. Have employees been trained in accordance with the HAZCOM procedure?			
5. Do employees (including subcontractors) know and understand the effects of exposure from the chemicals on site?			
6. Have all personnel signed the HAZCOM acknowledgment form?			
7. Is there an updated list of chemicals maintained on site?			
TRAINING			
1. Are tailgate safety meetings being conducted daily or before each shift?			
2. Are current training/medical records maintained on site?			
DOCUMENTATION			
1. Is an OSHA 300 Log maintained and the 300A posted during February 1 to April 30?			
2. Are accident report forms available?			
3. Is a copy of health and safety policy and procedures available on site?			
RADIOACTIVE MATERIALS/ X-RAY GENERATING EQUIPMENT			
1. Is there a Shaw license or registration? (examples: Troxler gauge or XRF device)			
2. Is there a current audit (within 12 mo.) of the Shaw radiation protection program on file? **If no, notify Corporate Radiation Safety.**			
3. Is radioactive material stored on site?			
4. Is the radioactive material storage area posted with a sign stating "Caution Radioactive Materials"?			

Project Safety Inspection Report (continued)

Project _____ **Date** _____

All Negative Responses	Corrective Action	Assigned To	Date Assigned	Date Completed	Verified By

DESCRIBE POSITIVE SAFETY OBSERVATIONS

Office Safety Inspection Report

Office _____ **Date** _____

DATE: _____ OFFICE NAME: _____

OFFICE MANAGER: _____

AREAS OF OFFICE INSPECTED:

INTERVIEWED EMPLOYEE: _____

SAFETY ISSUE: _____

CORRECTIVE ACTION:

ASSIGNED TO: _____ FOLLOW-UP DATE: _____

CORRECTION VERIFIED BY: _____ DATE: _____

INTERVIEWED EMPLOYEE: _____

SAFETY ISSUE: _____

CORRECTIVE ACTION:

ASSIGNED TO: _____ FOLLOW-UP DATE: _____

CORRECTION VERIFIED BY: _____ DATE: _____

INSPECTION COMPLETED BY: _____ DATE: _____

HEALTH AND SAFETY REVIEW BY: _____ DATE: _____

Office Safety Inspection Report (continued)

Project _____ **Date** _____

	YES	NO	N/A
FIRST AID			
1. Are first aid kits accessible and identified?			
2. Are emergency eye wash/safety showers available where needed and inspected?			
3. Are first aid kits inspected weekly?			
FIRE PREVENTION			
1. Are employees smoking only in designated outdoor areas?			
2. Are fire lanes/evacuation routes established and maintained?			
3. Are approved safety cans/cabinets available for storage of flammable liquids?			
4. Are fire exits clearly identified and unobstructed?			
5. Are sprinkler heads unobstructed?			
FURNITURE AND EQUIPMENT			
1. Are desks, file cabinets, *etc.* arranged so that drawers do not open into aisles or walkways?			
2. Are desk and file drawers closed after use?			
3. Is weight distributed in file cabinets so that upper drawer contents does not create a top-heavy condition?			
4. Are cabinets, bookcases, and shelves secured to prevent their falling over?			
5. Are faulty desks, chairs, or other office equipment repaired or taken out of service?			
6. Is adequate and sufficient lighting provided in all work areas?			
7. Are paper cutter blades in fully down and locked position when not in use?			
8. Are work stations arranged to be comfortable without unnecessary strains on backs, arms, necks, *etc.*?			
9. Do machines with exposed moving parts have appropriate guards?			
AISLES AND FLOORS			
1. Is aisle clearance adequate for two-way traffic and for unobstructed access to all parts of the office and building?			
2. Does office arrangement allow easy egress under emergency conditions?			
3. Are wastebaskets, briefcases, or other objects placed where they are not a tripping hazard?			
4. Are floors clear of pencils, bottles, and other loose objects?			
5. Are tripping hazards from electrical cords, phone outlets, or other protrusions on the floor prevented by arrangement of furniture or other means?			
6. Are floors free of loose tiles and projections that can create a tripping hazard?			
7. Is carpeting in good condition and not badly worn or torn?			
HAND AND POWER TOOLS			
1. Are defective hand and power tools tagged and taken out of service?			
2. Is eye protection available and used when operating power tools?			
3. Are guards and safety devices in place on power tools?			
4. Are power tools inspected before each use?			
5. Is the correct tool being used for the job?			
6. Do knife blades have guards when not in use?			

Office Safety Inspection Report (continued)

Project _____ **Date** _____

	YES	NO	N/A
MOTOR VEHICLES			
1. Are vehicles regularly inspected?			
2. Are personnel licensed for the vehicles they operate?			
3. Are unsafe vehicles reported to supervision?			
4. Is safety equipment on vehicles?			
5. Are loads secure on vehicles?			
6. Are vehicle occupants using safety belts?			
7. Are current insurance cards and blank accident report forms located in vehicles?			
EMERGENCY PLANS			
1. Are emergency telephone numbers posted?			
2. Have emergency escape routes been designated?			
3. Are employees familiar with the emergency signal?			
4. Has an emergency route to the hospital been established and posted?			
5. Has a fire drill occurred within the last 12 months?			
MATERIALS HANDLING			
1. Are materials stacked and stored to prevent sliding or collapsing?			
2. Are flammables and combustibles stored in approved containers?			
3. Are tripping hazards identified?			
4. Are riders prohibited on material handling equipment?			
5. Are only qualified operators utilized *i.e.*, forklift trained?			
FIRE PROTECTION			
1. Has a fire alarm system been established?			
2. Do employees know the location and use of all fire extinguishers?			
3. Are fire extinguisher locations marked?			
4. Have fire extinguishers been professionally inspected during the last year?			
5. Are fire extinguishers visually inspected monthly?			
6. Is there an operating fire detection system?			
ELECTRICAL			
1. Are extension cords kept out of wet areas?			
2. Are certified electricians used for electrical work?			
3. Are GFCIs being used as needed?			
4. Are extension cords not being used in lieu of permanent wiring?			
5. Are warning signs exhibited on high voltage equipment (250V or greater)?			
6. Are switches, circuit breakers, and switchboards installed in wet locations enclosed in weatherproof enclosures?			
7. Are electric fans protected with guards of not over one-half inch mesh, which prevents fingers getting inside guard?			
8. Are cords, panels, receptacles, and plugs in good condition?			
9. Are multi-outlet strips not plugged into other multi-outlet strips?			
10. Are extension cords not plugged into other extension cords?			
11. Are circuit breakers or fuse panels properly labeled, kept closed, and accessible?			

Office Safety Inspection Report (continued)

Project _____ **Date** _____

	YES	NO	N/A
12. Are extension cords arranged so that they are not placed over radiators, steam pipes, through doorways, or under carpets?			
13. Are restricted and limited approach boundaries identified on electrical panels?			
14. Are authorized electricians trained in NFPA 70?			
15. Are only electrically rated tools being used for electrical work?			

WALKING AND WORKING SURFACES

1. Are cords, cables, and other items not placed in walkways?			
2. Are ladders regularly inspected?			
3. Are access ways, stairways, ramps, and ladders clean of ice, mud, snow, or debris?			
4. Are ladders being used in a safe manner?			
5. Are ladders kept out of passageways, doors, or driveways?			
6. Are broken or damaged ladders tagged and taken out of service?			
7. Are metal ladders prohibited in electrical service?			
8. Are stairways and floor openings guarded?			
9. Are safety feet installed on straight and extension ladders?			
10. Are employees walking instead of running?			
11. Are handrails and side rails installed along the unprotected sides of stairways having 4 or more risers or rising more than 30 inches?			
12. Are there torn, loose, or curled carpets?			

HOUSEKEEPING

1. Is good housekeeping maintained?			
2. Are paper and materials stored properly?			
3. Are cleaning fluids used only in small quantities and stored in closed containers that are kept in well-ventilated areas?			
4. If cleaning fluids are flammable, are they not used near a flame or an open heating element?			
5. Are wastebaskets emptied on a daily basis?			

SITE POSTERS

1. Are the following posters displayed in a prominent and accessible area?			
A. Minimum Wage			
B. OSHA Job Protection			
C. Equal Employment Opportunity			
D. Family and Medical Leave			
E. Employee Polygraph Protection			
F. Uninformed Services Employment and Reemployment Rights Act			
G. Shaw Speak Up			
H. Shaw HR203 Harassment Policy			
I. Shaw Equal Employment Opportunity and Affirmative Action			
2. Are all required state-specific posters displayed?			

HAZARD COMMUNICATION

1. Is the written HAZCOM program available?			
2. Is there a MSDS FOR EACH HAZARDOUS CHEMICAL present in the office?			
3. Are all containers properly labeled, as to content, hazard?			
4. Have employees been trained on chemical hazards?			

Office Safety Inspection Report (continued)

Project _____ **Date** _____

	YES	NO	N/A
5. Have all employees signed the HAZCOM acknowledgment form?			
6. Is there a list of chemicals maintained on site?			

DOCUMENTATION

1. Is an OSHA 300 Log maintained and a 300A posted during February1, to April 30?			
2. Are accident report forms available?			
3. Is a copy of health and safety policy and procedures available?			

Office Safety Inspection Report (continued)

Project _____ **Date** _____

All Negative Responses	Corrective Action	Assigned To	Date Assigned	Date Completed	Verified By

DESCRIBE POSITIVE SAFETY OBSERVATIONS

Laboratory Safety Inspection Report

Location _____ **Date** _____

	YES	NO	N/A
I. FIRST AID			
1. Are first aid kit locations identified and accessible?			
2. Are emergency eye wash/safety showers available and inspected monthly?			
3. Is access to eye wash units and safety showers unimpeded?			
II. PERSONAL PROTECTIVE EQUIPMENT			
1. Are employees wearing safety glasses in the laboratory?			
2. Are laboratory coats worn by all employees and visitors when working with chemicals and/or samples?			
3. Are gloves worn when chemicals and samples are handled?			
III. FIRE PREVENTION/FIRE PROTECTION			
1. Are employees smoking only in designated outdoor areas?			
2. Are flammable storage cabinets available and used when needed?			
3. Has a fire alarm system been established?			
4. Are fire extinguishers available and inspected monthly?			
5. Do employees know the location and use of fire extinguishers?			
6. Are fire extinguisher locations posted?			
7. Have fire extinguishers been professionally inspected during the last year?			
IV. EMERGENCY PLANS			
1. Are emergency telephone numbers posted?			
2. Have emergency escape routes been designated?			
3. Are employees familiar with the emergency signal?			
4. Are appropriate spill kit supplies available?			
5. Are emergency exits marked?			
6. Are sprinkler heads unobstructed?			
7. Has a fire drill occurred within the last 12 months?			
V. ELECTRICAL			
1. Are extension cords kept out of wet areas?			
2. Are extension cords arranged so that they are not placed over radiators, steam pipes, through doorways, or under carpets?			
3. Are cords, panels, receptacles, and plugs in good condition?			
4. Are extension cords not being used in lieu of permanent wiring?			
5. Are extension cords not plugged into other extension cords?			
6. Are multi-outlet strips not plugged into other multi-outlet strips?			
7. Has a lockout/tagout system been established?			
8. Are GFCIs being used on all temporary electrical systems and as needed?			
9. Are warning signs exhibited on high voltage equipment (250V or greater)?			
10. Are circuit breakers or fuse panels properly labeled, kept closed, and accessible?			
11. Are restricted and limited approach boundaries identified on electrical panels?			
12. Are authorized electricians trained to NFPA 70?			
13. Are only electrically rated tools being used for electrical work?			

Laboratory Safety Inspection Report (continued)

Location _____ **Date** _____

	YES	NO	N/A
VI. COMPRESSED GAS CYLINDERS			
1. Are like cylinders segregated and stored in well ventilated areas?			
2. Is smoking prohibited in cylinder storage areas?			
3. Are cylinders stored secure and upright?			
4. Are cylinders protected from snow, rain, *etc.*?			
5. Are cylinder caps in place for storage and movement?			
VIII. WALKING AND WORKING SURFACES			
1. Are access ways, stairways, and ramps clean of ice, mud, snow, or debris?			
2. Are stairways and floor openings guarded?			
3. Are handrails and side rails installed along the unprotected sides of stairways having 4 or more risers or rising more than 30 inches?			
4. Are tripping hazards from electrical cords, phone outlets, or other protrusions on the floor prevented by arrangement of furniture or equipment?			
5. Are floors free of loose tiles and projections that can create a tripping hazard?			
VIII. HAZARD COMMUNICATION			
1. Is there a copy of the Chemical Hygiene Plan (CHP) on site?			
2. Have employees been trained in accordance with the CHP?			
3. Are all containers properly labeled as to content, hazard, *etc.*?			
4. Is there an updated list of chemicals maintained at the laboratory?			
5. Are there MSDSs for the chemicals present in the laboratory?			
6. Do employees know and understand the effects of exposure from the chemicals they work with?			
IX. DOCUMENTATION			
1. Is an OSHA 300A Log maintained on site and posted between February 1 and May 1?			
2. Are accident report forms available?			
X. FURNITURE AND EQUIPMENT			
1. Are desks, file cabinets, *etc.* arranged so that drawers do not open into aisles or walkways?			
2. Are desk and file drawers closed after use?			
3. Are cabinets, bookcases, and shelves secured to prevent their falling over?			
4. Is adequate and sufficient lighting provided in all work areas?			
5. Are work stations arranged to be comfortable without unnecessary strains on backs, arms, necks, *etc.*?			
6. Do machines with exposed moving parts have guards?			
XI. LABORATORY FUME HOODS			
1. Are face velocities posted on each hood?			
2. Is the average face velocity at least 100 ft/min.?			
3. Is the sash position marked or otherwise indicated to show the acceptable position for achieving the desired airflow rate?			

Laboratory Safety Inspection Report (continued)

Location _____ **Date** _____

		YES	NO	N/A
4.	Has the hood face velocity been measured with a calibrated instrument in the last 6 months?			
5.	Are signs posted on hoods that are not working correctly?			
6.	Does the hood contain visual indicators that it is working properly (*e.g.*, manometer, magneheilic gauge, *etc.*)?			
XII.	GENERAL LABORATORY RULES			
1.	Are open-toed shoes and sandals prohibited in the laboratory?			
2.	Are eating, drinking, chewing gum or tobacco products prohibited in the laboratory?			
3.	Are food refrigerators labeled such as to prevent chemical storage or vice versa?			
XIII.	HOUSEKEEPING			
1.	Are lab benches orderly?			
2.	Are laboratories free of liquid spills?			
3.	Are sinks free of accumulated glassware?			
4.	Are waste disposal containers available and labeled?			

Uncontrolled when printed: Verify latest version on ShawNet/Governance

Project/Office/Lab Safety Improvement Log

Date Identified	Source (1)	Observation Description	Severity Level (2)	Corrective Action	Person Responsible	Projected Resolution Date	Date Corrected	Verified By (Initials)	Validation By (Initials)

(1) Source:
- Safety Observation (SO)
- Project Safety Inspection Report (PSIR)
- Project/Site Manager Safety Audit (PMSA)
- Office Safety Inspection Report (OSIR)
- Laboratory Safety Inspection Report (LSIR)
- Leadership Safety Assessment (LSA)

(2) Severity Level:
- 1 OSHA / Regulatory Violation
- 2 Internal / Client Violation
- 3 Recommended / Best Practice

1. PURPOSE

This procedure establishes the guidelines for developing and implementing company safety incentive award programs and recognizing group accomplishments through team safety award programs. This procedure is designed to recognize group safety performance and reward the individual only when the project/location team has achieved its established goals. It is intended to encourage all employees to be concerned not only for their own safety, but for the safety of co-workers as well. Key elements of this procedure include:

- Eligibility
- Program development
- Award value
- Program funding
- Minimum goals
- Award request
- Goal verification

2. SCOPE

This procedure applies to all Company safety incentive award programs.

2.1 Exception Provisions

Variances and exceptions may be requested pursuant to the provisions of Shaw Environmental & Infrastructure, Inc. (Shaw E&I) Procedure No. EIG-HS-013, "Health and Safety Procedure Variances."

3. REFERENCES

- EIG-HS-013, Health and Safety Procedure Variances

4. DEFINITIONS

- **Company**—All wholly-owned subsidiaries of Shaw E&I.
- **Occupational Safety and Health Administration Recordable Injury/Illness**—All work-related deaths and illnesses, and those work-related injuries which result in loss of consciousness, restriction of work or motion, transfers to another job, or require medical treatment beyond first aid.
- **Lost/Restricted Workday Injury/Illness**—Cases which involve days away from work and/or days of restricted work activity. Days away from work are the number of calendar days (consecutive or not), excluding the date of injury, the employee would have worked, but could not because of occupational injury or illness; and/or the number of workdays (consecutive or not), excluding the date of injury, on which, because of injury or illness:
  - The employee was assigned to another job on a temporary basis

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  - The employee worked at a permanent job less than full time
  - The employee worked at a permanently-assigned job, but could not perform all duties normally connected with it.

- **Chargeable Vehicle Accident**—Any at-fault vehicle accident meeting any one of the following criteria:
  - An individual other than an employee of the company is a party in the accident.
  - Property owned by a person or entity other than the company is damaged.
  - When only company employees, company owned or leased (not rented) vehicles and property is involved and damage exceeds $2,500.00.
- **Safety Incentive Award**—Monetary or nonmonetary award granted to each member of a team that achieves its documented safety goals as defined in project/office-specific plans.
- **Safety Team Award**—Commemorative plaque/trophy/certificate given to a project or office team that achieves company-wide safety goals or otherwise demonstrates outstanding safety performance.

5. RESPONSIBILITY

5.1 Procedure Responsibility

The Senior Director of Health and Safety is responsible for the issuance, revision, and maintenance of this procedure.

5.2 Action/Approval Responsibilities

The responsibility requirements are included in Attachment 1, “Accident Prevention Program: Safety Incentive Award Program Responsibility Matrix.”

6. PROCEDURE

6.1 Project/Location Safety Incentive Awards

6.1.1 Eligibility

All company employees are eligible to participate in a safety incentive award program. In certain instances, subcontractors, teaming partners, and/or clients may also be eligible for participation. Each project/location manager must determine who will be eligible to participate prior to the initiation of a program. Only those employees physically present at one project/location for five days or more during a calendar month period will be eligible for an award. No employee will be permitted to participate in more than one program at any one time.

6.1.2 Program Development

The project/office (hereafter referenced as location) manager is responsible for developing a safety incentive award program tailored to their specific location needs. This program must comply with the guidelines contained in this procedure and be approved by the appropriate business line lead and the respective business line Environmental Health and Safety (EH&S) Director. The Location Manager is responsible for obtaining all required approvals prior to implementing a program (Form EI-HS023.1, “Safety Incentive Award Program Approval”).

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6.1.3 Award Value

For every calendar month in which a location achieves its goals, all approved participants will receive an award valued at a maximum value of $10.00 per calendar month. The Location Manager will be responsible for determining the value and type of award. It is also recommended that awards be nonmonetary in nature, such as Shaw logo merchandise (jackets, hats, ice chests) or safety related merchandise (first aid kits, fire extinguishers, etc). Gift certificates and gift cards are considered the equivalent to cash and therefore must go through payroll for tax withholding purposes. Location Managers are encouraged to follow the requirements set forth by the Transactional Processing department to ensure compliance with the applicable payroll procedures.

Awards may not be accumulated for a period of greater than five months unless approved by the Business Line Lead.

6.1.4 Program Funding

All costs associated with the awards must be approved by the Location Manager. Project awards will be funded by the project budget and will apply to project personnel, regardless of home business unit (HBU). Location awards for offices, facilities, etc. that otherwise include employees from various HBUs will be charged to either the location's designated budget for the award, or through prior approval for funding through the employee's HBU. In all cases whereby the office or location is not funding the program and the location is comprised of employees from various HBUs, the "Requesting Manager" who is establishing the program and completing EIG-HS-023.01 shall ensure that employees have received concurrence from their Supervisor to participate in the program.

In some cases, clients may establish safety incentive programs that differ from the guidelines established in this Standard Operating Procedure. Client-sponsored incentive programs, while in effect, will be used in lieu of this safety incentive award program.

6.1.5 Minimum Goals

The safety incentive award program is designed to recognize and reward exemplary team safety performance. At a minimum, the participating team must achieve the following goals:

- Zero recordable injury/illness cases
- Zero lost/restricted workday injury/illness cases
- Zero chargeable vehicle accidents

Other health and safety related goals, such as timely completion of Safety Inspection Reports, safety meeting participation, etc., may be established at the discretion of the Project/Location Manager.

6.1.6 Award Request

A representative from each location must submit a list of employees eligible for an award to the Location Manager. The Location Manager is then responsible for submitting the eligibility list and the Safety Incentive Award Request Form (EIG-HS-023.02) to the awareness and recognition subcommittee of a local safety council for approval. Approval by the subcommittee is required prior to award distribution.

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6.1.7 Goal Verification

Determining when a safety award goal has been achieved is the ultimate responsibility of the local safety council administering the program. If the awareness and recognition subcommittee of the council determines that accidents are not being reported or that accident reports are modified for the purpose of maintaining the goals, the program will be discontinued. Reinstatement of the program may only be achieved if the Location Manager submits a letter to the awareness and recognition subcommittee detailing the corrective actions that will be taken to prevent further deficiencies. The subcommittee must then obtain approval from the Senior Director of Health and Safety prior to reinstating the program.

6.2 Corporate Level/Business Line Level/ Project and Office Location Safety Team Awards

6.2.1 Eligibility/Minimum Goals/Award Request Requirements

The preceding Safety Incentive sections of this procedure recognize individual employees; however, it is also important to reward group recognition through the Team Award program. As demonstrated in Attachment 2, “Shaw Environmental & Infrastructure, Inc. Team Awards,” the Team Awards have been established in an effort to recognize exemplary performance throughout the organization, regardless of size or the complexity of the operation.

The eligibility, minimum goals, and award request requirements for these awards are outlined in Attachment 2.

6.2.2 Award Funding

These awards will be funded at the Shaw E&I/Business Line Level. Additional funding for celebrations related to these awards will be determined at the Business Line level for the project/location that receives any Shaw E&I Corporate or Business Line Level Award.

6.2.3 Verification

Verification will be conducted by either the Shaw E&I Senior Director of EH&S, the respective Business Line EH&S Director, or his/her designee.

6.2.4 Project Quarterly Safety Excellence Award and Safe Project of the Year Award

A project whose demonstrated commitment to safety goes beyond what was expected will be recognized for their effort. Project Managers may nominate their respective teams for the award by submitting Form EIG-HS-023.03 up through their respective business line with the intent to be selected by the Business Line’s Senior Leadership. The Business Line’s Senior Leadership Safety Councils will select quarterly and annual winners. The annual award recipients will be selected by the Shaw E&I Executive Leadership Safety Council. The criteria for nominations may include the following:

- Minimal incidents (first aid, Occupational Safety and Health Administration-recordable, lost time, chargeable vehicle)
- Robust Safety Observer Program
- Robust near miss reporting program
- Current Safety Improvement Log
- Completion of required safety assessments
- Safety communication bulletin board

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- Productive, employee owned Safety Council
- Root cause analysis of incidents, with proven and actionable results

7. ATTACHMENTS

- Attachment 1, Accident Prevention Program: Safety Incentive Award Program, Responsibility Matrix
- Attachment 2, Shaw Environmental & Infrastructure, Inc. Safety Awards

8. FORMS

- EIG-HS-023.01, Safety Incentive Award Program Approval
- EIG-HS-023.02, Safety Incentive Award Request Form
- EIG-HS-023.03, Health and Safety Team Award Nomination Form

9. RECORDS

- EIG-HS-023.01, Safety Incentive Award Program Approval
- EIG-HS-023.02, Safety Incentive Award Request Form
- EIG-HS-023.03, Health and Safety Team Award Nomination Form

10. REVISION HISTORY AND APPROVAL

Revision Level / Revision Date	Revision Description	Responsible Manager
00 4/24/2002	Initial issue	Warren Houseman
01 9/1/2007	Updated Purpose and Summary. Added definitions for Safety Incentive Award, and Safety Team Award. Major edits and additions to procedure: separated awards into two categories- Project/Location Safety Incentive Awards, and Corporate/Business Line Level Project & Office Location Safety Team Awards. Made a couple of the attachments forms instead.	Mike Zustra
02 7/20/2010	Changed position titles to reflect current organization. Revised Safety Wards in Attachment 2	Troy Allen
03 08/25/2011	Modified format only to align with Governance Management framework.	Andrew Johnson

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Attachment 1
Accident Prevention Program: Safety Incentive Award Program
Responsibility Matrix

Action	Procedure Section	*Responsible Party*					
		Project/ Location Representative	Business Line EH&S Director	Project/Office Manager(Location Manager)	Local Safety Council	Business Line Lead	Sr. Director of Health and Safety
Issuance, Revision, and Maintenance of Procedure	5.1						X
Determine Who is Eligible for Participation	6.1.1	X	X	X			
Develop Project/Location Specific Incentive Award Program	61.2		X	X		X	
Approve Programs	6.1.2		X	X			
Determine Value and Type of Award	6.1.3			X		X	
Establish Goals Beyond Minimum Requirement	6.1.5			X			
Program Funding	6.1.4			X			
Submit List of Award Eligible Employees to Project/Location Manager	6.1.6	X			X		
Complete Form 2 and Forward to Local Safety Council	6.1.6			X	X		
Determine When Goals are Achieved	6.1.7			X	X		X

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Attachment 2
Shaw Environmental & Infrastructure, Inc. Safety Awards

Safety Award Name	Criteria	Awarded From	Request Requirement
Million Man-hour Award	Project that achieves 1,000,000 without a lost time injury	President of Shaw E&I	Intended for projects. Project management requests the award through Business Line EH&S Organization.
Shaw E&I -President's Award	Awarded to projects or offices at increments of 1,000 calendar days without a lost time injury.	President of Shaw E&I	Intended for projects. Project management requests the award through Business Line EH&S Organization.
Targeting Zero Award	Awarded to projects or offices that achieve triple zeros over a twelve month period	President of Shaw E&I	Intended for projects and office locations. Operations Management requests the award through Business Line EH&S Organization.
Safety Excellence Award	Awarded to projects/offices with: • >50 people -one year without a lost time • <50 people – 100,000 hours without a lost time	President of Shaw E&I	Intended for projects and office locations. Operations Management requests the award through Business Line EH&S Organization.
Project Quarterly Safety Excellence Award	Triple zeros within any fiscal quarter (min). Awarded to one project at each of three levels: • Small < 5,000 man-hours in the quarter • Medium > 5,000 < 25,000 man-hours in the quarter • Large > 25,000 man-hours in the quarter.	Shaw E&I Business Line Presidents	Intended for projects. Project management requests recognition for the award by submission through Business Line Safety Council Network. Project winners selected at the Business Line Leadership Safety Council.
Safe Project of the Year Award	Selected at the small, medium, and large levels from the Quarterly Safety Excellence Award winners. Winners selected under same man-hour criteria listed above: • Small < 5,000 man-hours in the quarter • Medium > 5,000 < 25,000 man-hours in the quarter • Large > 25,000 man-hours in the quarter.	Shaw E&I Corporate	Intended for projects. Business Line Leadership Safety Council submits annual request of recognition for the award by submission of Quarterly Safety Excellence Award winners to Shaw E&I Executive Leadership Safety Council.

Safety Incentive Award Program Approval

I HAVE REVIEWED THE ATTACHED SAFETY INCENTIVE AWARD PROGRAM FOR

_____ AND APPROVE OF ITS USE.

Project/Location

Requesting Manager (Printed)	Requesting Manager (Signature)	Date

Business Line EH&S Manager (Printed)	Business Line EH&S Manager (Signature)	Date

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Safety Incentive Award Request Form

I AM REQUESTING THAT THE ATTACHED LIST OF EMPLOYEES AT THE _____

Project/Location

PROJECT/LOCATION IS PRESENTED A SAFETY INCENTIVE AWARD. THESE INDIVIDUALS WILL BE

GIVEN _____ (MAXIMUM VALUE OF $10.00 PER MONTH)

Type of Award

ON _____ FOR ACHIEVING ESTABLISHED GOALS FOR THE

Date of Award

MONTH(S) _____.

Month(s)/Year

SAFETY COUNCIL SUBCOMMITTEE, OPERATIONS MANAGER & EH&S MANAGER SIGNATURES REQUIRED

Project/Location Manager (Printed)	Project/Location Manager (Signature)	Date
Chairperson (Printed)	Chairperson (Signature)	Date
Business Line EH&S Manager (Printed)	Business Line EH&S Manager (Signature)	Date

Health and Safety Team Award Nomination Form

Project Name:	**Project Number:**	**Award Name:**	**Project / Office Address:**
Client's Name:	**Project or Office Manager:**		**Site Contact Number:**
Business Line:	**Regional Operations Manager:**		**Regional Operations Mgr Contact Number:**
Small, Med or Large Award Category:	**Criteria Information: (<50 employees or >50 employees)**		**Time Period of Achievement:**
Name of Safety Award Nomination :			
Project / Office Description:			
Significant or Unique Safety Challenges/Accomplishments:			
Any Client Recognition of Project / Office Performance (Safety or Otherwise):			
Other Justification for Nomination (attach additional sheets if needed):			

Nomination Authorizations	
Project / Office Manager's Name:	**Signature:**
Program / District Manager's Name:	**Signature:**
Regional Business Line Leader's Name:	**Signature:**
Business Line EH&S Director's Name:	**Signature:**
Sr. Director EH&S, Shaw E&I Name:	**Signature:**

1. PURPOSE

This procedure provides the guidelines to perform a Job Safety Analysis (JSA).

2. SCOPE

This procedure applies to all Shaw E&I work activities.

3. REFERENCES

- Occupational Safety and Health Administration, 2002, *Job Hazard Analysis*, OSHA 3071, U.S. Department of Labor.

4. DEFINITIONS

- **Hazard**—A potential danger; oil on the floor is a hazard.
- **Accident**—An unintended happening that may result in injury, loss, or damage; slipping on oil is an accident.
- **Injury**—The result of an accident; a sprained wrist from a fall would be an injury.
- **Job Hazard Analysis**—A technique that focuses on job tasks as a way to identify hazards before they result in an accident.

5. RESPONSIBILITIES

5.1 Procedure Responsibility

The Manager/Supervisor is responsible for implementing and enforcing this procedure.

The Safety Representative is responsible for monitoring compliance with this procedure.

Each Employee is responsible for complying with the project safety program, along with the guidance provided in this procedure and the instructions issued by the employee's supervisor.

It is the responsibility of management and supervision to ensure that this procedure is followed. If the project/site requirements stipulate the use of another method of JSA, it is the responsibility of management and supervision to ensure that the proposed method either meets or exceeds the requirements of this JSA procedure and the accompanying JSA form. Any procedure or JSA form that does not cover the items contained herein shall not be used.

5.2 Action/Approval Responsibilities

The Responsibility Matrix is Attachment 1, “Employee and Subcontractor Training Requirements Responsibility Matrix.”

6. PROCEDURE

The JSA is an effective management technique for identifying hazardous conditions and unsafe acts in the workplace. A JSA is intended to analyze the individual steps or activities, which together create a job or specific work duty, and to detect any actual or potential hazards that may be present. This process can identify less obvious potential hazards that may go undetected during routine management observations or audits.

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It should be understood that changing conditions a work crew encounters during a work period (e.g., inclement weather, another contractor began work in area), require that the JSA be modified to address these new hazards. The revised JSA should reflect new conditions in the task being performed or new hazards not previously identified.

6.1 General

A new JSA must be completed daily prior to the commencement of any work activity (see Form EIG-HS-045.01, "Job Safety Analysis"). If work conditions change, the JSA should be modified to address any new hazards.

The first page of the JSA is a checklist that should be used for reference purposes and serves to assist the work crew and supervisor with completion of the second page of the JSA. The second page of the JSA form is used to list the various tasks involved, potential hazards, and the recommended actions.

The three basic steps to be performed while conducting a JSA include:

- **Job Task**—Break the job down into successive steps or activities and observe how these actions are performed.
- **Potential Hazards**—Identify the hazards and potential accidents. This is the critical step because only an identified problem can be corrected or eliminated.
- **Recommended Actions**—Develop safe job procedures to eliminate the hazards and prevent potential accidents.

Job Safety Analysis is a procedure used to review job methods and uncover the following hazards that may have:

- Been overlooked in a Hazard Analysis, project layout, or design of the equipment, tools processes, or work area
- Developed after production started
- Resulted from changes in work procedures or personnel

6.2 Methods of Conducting Job Safety Analyses

The following are the two basic methods for conducting the JSA:

- Direct observation
- Group discussion

A fast and efficient method of conducting a JSA is through direct observations of job performance. In many instances this method may not be practical. However, through direct observation, one can gain knowledge concerning an activity and use it on a future JSA.

New jobs and those that are done infrequently do not lend themselves to direct observation. When this is the case, the JSA can be completed through discussions with persons familiar with the job. Individuals often involved in the process include, but are not limited to, first line supervisors, safety specialists, engineers, experienced employees, and outside contractors.

6.3 Analyzing the Job

When analyzing the job, most people start with the worst first. You should be guided by the following factors:

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- **Frequency of Accidents (including "near misses")—**An element of a job that repeatedly produces accidents is a candidate for starting a JSA. The greater the number of incidents associated with a job element, the greater its priority claim for a JSA.
- **New or Revised Jobs**—Jobs created by changes in equipment or in processes obviously have no history of accidents, but their accident potential may not be fully appreciated. Analysis should not be delayed until accidents or near misses occur. Any changes from the original task/job shall be noted on the form as a revision. Once this has occurred the newly identified hazards must be reviewed with the crew.
- **Multiple Employee Exposure—**Jobs that expose more than one individual to potential hazards also should be analyzed.

6.4 Common Errors

Five common errors that are often made when performing a job analysis are as follows:

- Making the breakdown so detailed that an unnecessarily large number of steps are listed.
- Making the job so general that basic steps are not recorded.
- Failure to identify the education and experience level of the target audience.
- Failure to identify end use(s) (e.g., training, actual procedure, basis for procedure)
- Always relying on the Supervisor for completing the JSA. Supervisor should describe work scope to the crew. The crew should then assist in identifying hazards and controls at the job site with active involvement from the Supervisor. Ultimately, the supervisor is responsible; however, crew members and the Supervisor should be actively involved in each JSA.

6.5 Identifying the Hazards and Potential Accidents

The purpose is to identify all hazards, both **physical** and **environmental**. To accomplish this, address the following questions for each step:

- Is there a danger of striking against, being struck by, or otherwise making harmful contact with an object?
- Can the employee be caught in, on, by, or between objects?
- Is there a potential for a slip, trip, or fall? If so, will it be on the same elevation or to a different elevation?
- Can he strain himself by pushing, pulling, lifting, bending, or twisting?
- Is the environment hazardous to one's safety or health? Has the weather been considered as a factor? Has the work product of others, as it pertains to the environment, been considered?

6.6 Accident Types

The following are types of accidents:

- Struck by
  - Moving or flying object
  - Falling material
- Struck against

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  - Stationary or moving object
  - Protruding object
  - Sharp or jagged edge
- Contact with
  - Acid
  - Electricity
  - Heat
  - Caustic
  - Cold
  - Radiation
  - Toxic and noxious substances
- Overexertion /repetitive
  - Lifting
  - Pulling
  - Pushing
  - Reaching
  - Twisting
- Caught
  - In
  - On
  - Between
- Fall to
  - Same level
  - Lower level
- Bodily reaction from
  - Voluntary motion
  - Involuntary motion
- Rubbed or abraded by
  - Friction
  - Pressure
  - Vibration

6.7 Writing Instructions

When evaluating a given job task ask the following question:

- "What should the employee do – or not do – to eliminate this particular hazard or prevent this potential accident?"

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Answer must be specific and concrete to be beneficial. General precautions such as "be careful," "use caution," or "be alert" are useless. Answers should state what to do and how to do it.

This recommendation, "Make certain the wrench does not slip or cause loss of balance," is incomplete. It does not tell how to prevent the wrench from slipping. Here is a more complete recommendation. "Set the wrench properly and securely. Test its grip by exerting a slight pressure on it. Brace yourself against something immovable, or take a stance with feet wide apart before exerting full pressure. This prevents loss of balance if the wrench slips."

Job Safety Analyses can be very beneficial if they are performed correctly. They not only result in a safer job, but also increase productivity and eliminate waste. Take the time to do them correctly; **and more importantly, use them. Also, remember to:**

- Put any qualifying statements first, not last.
- Start each instruction with an action word.
- Each instruction should be observable.
- Each instruction should be measurable.

6.8 Develop Solutions

The final step in conducting a JSA is to develop a recommended safe job procedure to prevent the occurrence of potential accidents. The principle solutions are as follows:

- Find a new way to do the job.
- Change the physical conditions that create the hazard.
- Try to eliminate remaining hazards by changing work methods or procedures.
- Try to reduce the necessity of doing a job, or at least the frequency that it must be performed.

6.9 Job Safety Analysis Form Completion

Sections 6.9.1 through 6.9.3 provide specific guidance on the completion of the JSA form.

6.9.1 Sequence of Basic Job Steps

Break the job down into steps. Each of the steps of a job should accomplish some major task. The task will consist of a set of movements used to perform a task, and then determine the next logical set of movements.

For example, the job might be to move a box from a conveyor in the receiving area to a shelf in the storage area. How does that break down into job steps? Picking up the box from the conveyor and putting it onto a hand truck is one logical set of movements, so it is one job step.

Everything related to that one logical set of movements is part of that job step. The next logical set of movements might be pushing the loaded hand truck to the storeroom. Removing the boxes from the truck and placing them on the shelf is another logical set of movements. Finally, returning the hand truck to the receiving area might be the final step in this type of job.

Be sure to list all the steps in a job. Some steps might not be done each time – checking the casters on a hand truck, for example. However, that task is part of the job as a whole, and should be listed and analyzed.

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6.9.2 Potential Hazards

Identify the hazards associated with each step. Examine each step to find and identify hazards – actions, conditions, and possibilities that could lead to an accident. It is not enough to look at the obvious hazards. It is also important to look at the entire work environment and discover every conceivable hazard that might exist.

Be sure to list health hazards as well, even though the harmful effect may not be immediate. A good example is the harmful effect of inhaling a solvent or chemical dust over a long period of time.

Hazards contribute to accidents, injuries, and occupational illnesses. In order to do part three of a JSA effectively, you must identify potential and existing hazards. That's why it's important to distinguish between a hazard, an accident, and an injury. Each of these terms has a specific meaning.

Some people find it easier to identify possible accidents, illnesses, and work back from them to the hazards. If you do that, you can list the accident and illness types in parentheses following the hazard. However, be sure you focus on the hazard for developing recommended actions and safe work procedures.

6.9.3 Recommended Action Procedure

Decide what actions are necessary to eliminate or minimize the hazards that could lead to an accident, injury, or occupational illness. Among the actions that can be taken are as follows:

- Engineering the hazard out
- Establishing administrative controls
  - Job instruction training
  - Good housekeeping
  - Good ergonomics (positioning the person in relation to the machine or other elements in the environment in such a way as to eliminate stresses and strains)
- Providing personal protective equipment
- Listing recommended safe operating procedures on the form, and listing required or recommended personal protective equipment for each step of the job.
- Being specific. Say exactly what needs to be done to correct the hazard, such as "lift, using your leg muscles." Avoid general statements like "be careful."
- Giving a recommended action or procedure for every hazard.
- Correcting serious hazards immediately.
- Changing the JSA to reflect new conditions in the task being performed or new hazards not identified previously.

6.10 Job Safety Analysis Uses

Job Safety Analysis is an important accident prevention tool that works by finding hazards and eliminating or minimizing them before the job is performed, and before they have a chance to become accidents. They can be used for the following:

- Job clarification and hazard awareness
- A guide in new employee training

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- For periodic contacts and for retraining of senior employees
- A reference tool to be used prior to commencing a job which is performed infrequently
- An accident investigation tool
- To inform employees of specific job hazards and protective measures

7. ATTACHMENTS

- Attachment 1, Job Safety Analysis Responsibility Matrix

8. FORMS

- EIG-HS-045.01, Job Safety Analysis

9. RECORDS

- EIG-HS-045.01, Job Safety Analysis

10. REVISION HISTORY AND APPROVAL

Revision Level / Revision Date	Revision Description	Responsible Manager
00 1/7/2003	Initial issue	Troy Allen
01 1/25/2011	Procedure was reordered, edited and reformatted. The Job Safety Analysis form was revised.	Troy Allen
02 08/25/2011	Modified format only to align with Governance Management framework.	Andrew Johnson

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Attachment 1
Job Safety Analysis Responsibility Matrix

Action	Procedure Section	*Responsible Party*		
		Manager/ Supervisor	**H&S Representative**	**Employee**
Responsible for implementing and enforcing procedure	5.1	X		
Monitoring for compliance with the procedure.	5.1		X	
Complying with the project JSA program, along with the rules and regulations as stipulated in this procedure	5.1			X

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JOB SAFETY ANALYSIS CHECKLIST FORM

Date:
Job #:
Permit #:
Issued by:
Supervisor:

Job Analyzed: _____ **Project Name:** _____

Consider the following and check the items which apply to the job, then review with the work crew.

Permits

_____ Excavation Permit
_____ Hot Work Permit
_____ Confined Space Entry Permit
_____ All permit conditions met
_____ Signed-off when work completed
_____ Rescue services available
_____ Other: _____

PPE

_____ Hard hat, safety glasses, safety-toe boots
_____ Chemical protective gloves
_____ Leather or special gloves (e.g. Whizards)
_____ Chemical protective coveralls
_____ Chemical protective boots
_____ Splash goggles / face shield
_____ Respirator
_____ Hearing protection
_____ Fall protection
_____ Burning goggles/welder's helmet
_____ Leathers (slag and burn protection)
_____ Chainsaw protection
_____ Pressure washing protection
_____ Puncture resistant insoles
_____ Reflective vest
_____ Other: _____

Tools

_____ Current inspection
_____ Proper tools for the job
_____ Good tool condition
_____ Qualifications, e.g. explosive actuated tool
_____ Other: _____

Emergency Equipment

_____ Fire extinguishers
_____ Safety shower/eyewash station
_____ First aid kit
_____ Evacuation route(s)
_____ Other: _____

Access

_____ Scaffold training and inspection
_____ Ladders (HS 302 followed)
_____ Man-lift inspected
_____ Personnel basket (inspected/approved)
_____ Operator training
_____ Fall protection provided
_____ Other: _____

Welding and Cutting

_____ Flash, slag, and other burns
_____ Combustibles & flammables
_____ Spark containment
_____ Shields
_____ Grounding
_____ Water hose
_____ Fire extinguisher
_____ Fire watch
_____ Proper cylinder procedures
_____ Flashback arrestors
_____ Other: _____

Overhead Utilities

_____ Survey area for utilities
_____ Check for clearance issues
_____ De-energize or reroute
_____ Barricade area
_____ Post hazard warning signs
_____ Provide spotters

Electrical (Shock and Arc Flash)

_____ De-energized
_____ Lockout tagout tryout
_____ NFPA 70 E PPE
_____ GFCI
_____ Assured grounding
_____ Extension cord inspected
_____ Other: _____

Lifting

_____ Forklift
_____ Forklift operator licensed
_____ Crane inspected
_____ Crane operator licensed
_____ Lift plan completed
_____ Rigging Competent Person
_____ Rigging inspected and safe
_____ Rigging properly stored
_____ Manual Lifting (60 pound limit)
_____ Proper manual lifting procedure

Drilling / Direct Push

_____ Underground / overhead utilities
_____ CPDO (HS308)
_____ Rig inspected
_____ Air monitoring performed
_____ Emergency procedures
_____ Other: _____

Hazards (Environmental)

_____ Cold stress
_____ Heat stress / Phys. monitoring
_____ Sunburn
_____ Hot/cold surfaces or materials
_____ Inadequate lighting
_____ Irritating plants
_____ Noise
_____ Severe weather
_____ Insects/Animals
_____ Other: _____

Hazards (Chemicals)

_____ Chemical – skin or eye contact
_____ Ingestion
_____ Inhalation
_____ Flammable
_____ Chemical reaction
_____ Hazard Communication Standard

Hazards (Body)

_____ Fall protection
_____ Pinch points
_____ Slips & trips
_____ Struck-by
_____ Other: _____

Monitoring Required

_____ Air
_____ Noise
_____ Radiological
_____ Other: _____

Overhead Work

_____ Barricades
_____ Signs
_____ Hole covers
_____ Guardrails

Excavation

_____ Permit completed
_____ Excavation Competent Person
_____ Underground utilities (HS308)
_____ Overhead utilities and hazards
_____ Soils tested
_____ Heavy equipment inspected
_____ Perimeter protection
_____ Daily inspections
_____ Protective systems in place
_____ Air monitoring / Dust control

Supervisor/Foreman Recommendations:
HARP Performed

JOB SAFETY ANALYSIS WORKSHEET FORM

DATE:
JOB#:
PERMIT#:
ISSUED BY:
SUPERVISOR:

Location of Job (Unit/Location on Project):		**Job Task Analyzed**
Required PPE:	**Safety Access/ Location**	Supervisor of Work:
	Safe Haven:	JSA Prepared By:
	Wind Direction:	Are other crews in area?
Pre-Job Preparation	Evacuation Route:	
1. Fill out JSA 2. Review JSA (EVERYONE) 3. Sign JSA (EVERYONE)	Assembly Point::	New: / Revised:

JOB TASK (What you are doing)	**Audit the Job:** Audit Time:

Potential Hazards	**Supervisor's Comments:**

RECOMMENDED ACTION OR PROCEDURE	**Supervisor's Initials:**

Crew Name Signatures:		

1. PURPOSE

This procedure sets forth minimum Health and Safety (H&S) training requirements for employees and subcontractors. Training requirements are established for tasks or types of work to be executed. Functional leads and project managers are responsible for ensuring that adequate numbers of employees are trained for the types of work applicable to their business areas or projects.

2. SCOPE

This procedure applies to all employee and subcontractor health and safety training.

2.1 Exception Provisions

Variances to this procedure shall be requested in accordance with Shaw Environmental & Infrastructure, Inc. (Shaw E&I) Procedure No. EIG-HS-013, "Health and Safety Procedure Variance." For a variance relative to this procedure, approval of the H&S Training Manager is required in addition to those listed in Shaw E&I Procedure No. EIG-HS-013.

3. REFERENCES

3.1 Internal References

- Shaw E&I Procedure No. EIG-HS-013, "Health and Safety Procedure Variance"
- Shaw E&I Procedure No. EIG-HS-300, "Confined Spaces"
- Shaw E&I Procedure No. EIG-HS-307, "Excavation and Trenching"
- Shaw E&I Procedure No. EIG-HS-308, "Underground/Overhead Utility Contact Prevention"
- Shaw E&I Procedure No. EIG-HS-314, "Hot Work"
- Shaw E&I Procedure No. EIG-HS-500, "OSHA Regulated Toxic and Hazardous Substances"
- Shaw E&I Procedure No. EIG-HS-512, "Handling of Blood or Other Potentially Infectious Material"
- Shaw E&I Procedure No. EIG-HS-601, "Respiratory Protection Program"
- Shaw E&I Procedure No. EIG-HS-700, "Policy & Guidance for Developing Radiation Protection Plans"
- Shaw E&I Procedure No. EIG-HS-800, "Motor Vehicle Operation: General Requirements"
- Shaw E&I Procedure No. EID-FL-002, "Designated Qualified Operator Training"

3.2 External References

- Code of Federal Regulations (CFR), U.S. Government Printing Office, Washington, D.C., <http://www.gpoaccess.gov/cfr/index.html> (July 2008).
  - 10 CFR 20
  - 10 CFR 835

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- 29 CFR 1910.120
- 29 CFR 1910.1096
- 29 CFR 1926.65
- 40 CFR 264.16
- 40 CFR 265.16
- 49 CFR 172.704
- 49 CFR 177.816

4. DEFINITIONS

Annual Refresher – Training on a subject which requires refresher training annually.

Attendant – One who monitors those who enter a permit-required confined space.

Company Vehicle – Any vehicle (Shaw E&I rental, lease, or personal) used on Shaw E&I business.

Emergency Response – A response effort by employees from outside the immediate release area or by other designated responders to an occurrence which results, or is likely to result, in an uncontrolled release of a hazardous substance.

Entrant – One who enters a permit-required confined space. This occurs as soon as any part of the entrant's body breaks the plane of an opening into the space.

Entry Supervisor – The person responsible for authorizing and overseeing entry into a permit-required confined space.

Hazardous Materials – Anything defined by the U.S. Department of Transportation (DOT) or U.S. Environmental Protection Agency as hazardous materials. This term includes hazardous materials, substances, and wastes.

Probationary Driver – Person in probationary driving status based on accumulation of points as provided in Shaw E&I Procedure No. EIG-HS-800, "Motor Vehicle Operation: General Requirements."

Rescue Personnel – Personnel designated to rescue entrants from a permit-required confined space. Personnel shall have trained together as a team prior to being designated.

Trainer – A company employee or subcontractor who has been approved by the H&S Training Manager to conduct a specific H&S-related training course.

5. RESPONSIBILITIES

5.1 Procedure Responsibility

The Training Manager and the Senior Director of Health and Safety are jointly responsible for the issuance, revision, and maintenance of this procedure. Functional leads and project managers shall ensure compliance with this procedure.

5.2 Action/Approval Responsibilities

The responsibility requirements are included in Attachment 1, "Employee and Subcontractor Training Requirements: General Requirements, Responsibility Matrix."

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6. PROCEDURE

6.1 Minimum Training Requirements

This procedure establishes the minimum employee **(including temporary personnel)** training requirements for work involving potential exposures to hazards greater than those found in the normal office environment. Additional training requirements may be established by state, local, or site authorities, as well as by Occupational Safety and Health Administration (OSHA) regulations that are not routinely applicable to company operations.

6.2 State and Local Training Requirements

This procedure focuses on national-level requirements. Local managers and Health and Safety representatives shall also identify and comply with applicable state, local, and client requirements. Documentation of these requirements shall be included in the project-specific Health and Safety Plan.

6.3 Prior Outside Training

Documentation of prior outside training may be accepted by the H&S Training Manager as equivalent to some company sessions. Documentation of training shall be provided to the Knoxville, Tennessee Health and Safety Training Records Center for inclusion in Shaw Talent Connection (STC). This documentation should be provided by the employee, Project Manager, or functional lead and should include all relevant information including manuals, syllabi, and telephone numbers.

6.4 Prior Approval for Outside Training

Use of training resources external to the corporation, except as specifically provided herein, requires prior approval of the Training Manager:

- **OSHA 8-Hour Refreshers**—Non-company delivered 8-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) Refresher courses must be approved by the training department. Employees will either attend a company provided classroom refresher session or will access the company computer delivered online refresher session. Unapproved sessions will not be entered into STC.

- **OSHA HAZWOPER Training**—Where possible, Shaw E&I employees should attend a company sponsored 40-hour HAZWOPER training session. Where numbers of employees needing a 40-hour session are too few to be cost effective to hold a company sponsored session, local outside training program providers will be evaluated by the Training Manager for meeting OSHA's and Shaw E&I 's training requirements. Unapproved sessions will not be entered into STC.

The intent of OSHA is for the 8-Hour HAZWOPER Supervisor Training to cover the employer's procedures and policies as they relate to work at 29 Code of Federal Regulation (CFR) 1910.120 sites. Employees who have received Supervisor training from outside providers are expected to become familiar with Shaw E&I Health and Safety Policies as they relate to work on Shaw E&I project sites.

6.5 Site-Specific Training

Site-specific training shall cover site-specific, client-specific, and job-specific elements that necessarily cannot be covered in standardized formal training sessions. The project management team is responsible for coordinating this training and forwarding documentation to the Health and Safety department.

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6.6 Exposure to Physical or Health Hazards

Anyone with potential exposure to physical or health hazards beyond those normal to the office environment, but not subject to training under 29 CFR 1910.120 or 29 CFR 1926.65 may be subject to other OSHA training requirements. Supervisors are encouraged to contact the Training Manager to help them develop and/or provide training support for those needs. Examples of such training would be ergonomic injury prevention, biologic hazards, unexploded ordinance safety, and fire safety. Documentation of training shall be provided to the Knoxville Health and Safety Training Records Center for inclusion in STC..

6.7 Hazardous Waste Supervisor Training Requirement for Managers/Supervisors

Persons who supervise or manage (on *or* off site) jobs regulated by 29 CFR 1910.120 or 29 CFR 1926.65 should complete the **company version** of Hazardous Waste Supervisor. For those who have taken this training prior to joining Shaw E&I, they must become familiar with Shaw E&I Health and Safety Policies as they relate to 29 CFR 1910.120 sites and projects.

6.8 Lab Safety Training Requirement for Laboratory Personnel

Persons who perform laboratory operations or work in a laboratory must complete Lab Safety Training prior to job assignment with a biennial refresher and Chemical Hygiene Plan training with an annual review. Documentation of training shall be provided to the Knoxville Health and Safety Training Records Center for inclusion in STC.

6.9 40-Hour or 8-Hour HAZWOPER Training Requirements

Employees with duties on 29 CFR 1910.120 or 29 CFR 1926.65-regulated sites in other than the support zone must complete initial 40-hour and annual 8-hour refresher training commonly referred to as 40-hour "HAZWOPER" or 8-hour "HAZWOPER" refresher. Refer to Attachment 2, "Shaw Environmental & Infrastructure, Inc. OSHA HAZWOPER Refresher Training Requirements," for a complete explanation of the company's annual refresher requirements and Attachment 3, "HAZWOPER Recertification Requirements" and Attachment 4, "HAZWOPER Recertification Documentation Form," for the requirements to recertify an employee whose refresher has lapsed for a period of 25 months or greater. Persons who clearly meet the criteria of 29 CFR 1910.120/1926.65 (e)(3)(ii) or (iii) may be approved by the Health and Safety Manager responsible for the site following provisions documented in the Health and Safety Plan.

6.10 Requirements for Resource Conservation and Recovery Act-Permitted Sites

Employees with duties on Resource Conservation and Recovery Act-permitted sites shall comply with applicable training requirements. In addition to 40-hour or 24-hour training in compliance with 29 CFR 1910.120/1926.65 (p), other general and site-specific requirements are listed in 40 CFR 264.16/265.16 and in permits and contingency plans. Annual 8-hour refresher training is required. Documentation of training shall be provided to the Knoxville Health and Safety Training Records Center for inclusion in STC..

6.11 Emergency Response

The company continues to contract with individual clients for whom the company provides spill clean-up services and other environmental services. Risks and potential exposures of personnel are well known for these clients. Project and business managers will coordinate training needs with the H&S Training Manager and will assure that personnel assigned to these response groups have adequate OSHA-specified initial and annual refresher training. The Internal Training Group will provide specialized training and refreshers as requested.

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6.12 Confined Space Entry

Persons doing work involving confined space entry shall have completed training as listed below:

- Entrants or attendants must have completed approved Confined Space Entrant/Attendant training.
- Entry supervisors must have completed Confined Space Entry Supervisor training.
- Persons conducting atmospheric testing for confined space entry must have instrument specific training and experience with the testing equipment.
- Rescue personnel must have completed Rescue Service Training with a qualified and approved outside training source unless all entrants are lowered into the confined space with a tripod and nonentry rescue is anticipated. Designated personnel shall have trained together as a team and shall have conducted an annual drill in the space being entered by company personnel or one with a similar configuration. The Training Manager shall review qualifications of rescue services contracted by the company. Evaluation of this training shall be documented on Form EIG-HS-300.04 and provided to the Knoxville Health and Safety Training Records Center for inclusion in STC. Refer to Shaw E&I Procedure No. EIG-HS-300, “Confined Spaces,” for additional confined space requirements.

6.13 Issue of Hot Work Permits

Persons issuing Hot Work permits shall be trained by their supervisor on the requirements of Shaw E&I Procedure No. EIG-HS-314, “Hot Work.” Documentation of training shall be provided to the Knoxville Health and Safety Training Records Center for inclusion in STC.

6.14 Health Hazards

6.14.1 Health Hazard Training

Health hazard training is required for work involving the potential for exposure to the specific materials listed below in accordance with Shaw E&I Procedure No. EIG-HS-500, “OSHA Regulated Toxic and Hazardous Substances.” With the exception of asbestos, this training shall be conducted or arranged by local/regional Health and Safety representatives in accordance with the listed OSHA regulation, company procedure, and applicable state regulation. The training must be conducted prior to work or immediately following receipt of industrial hygiene sample results demonstrating exposure above applicable action levels to the below listed materials:

- 4-Nitrobiphenyl
- alpha-Naphthylamine
- Methyl chloromethyl ether
- 3,3'-Dichlorobenzidine (and its salts)
- bis-Chloromethyl ether
- beta-Naphthylamine
- Benzidine
- 4-Aminodiphenyl
- Ethyleneimine
- beta-Propiolactone

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- 2-Acetylaminofluorene
- 4-Dimethylaminoazobenzene
- N-Nitrosodimethylamine
- Vinyl chloride
- Lead
- Benzene
- Coke oven emissions
- Cotton dust
- 1,2-dibromo-3-chloropropane (DBCP)
- Acrylonitrile
- Ethylene oxide
- Formaldehyde
- Polychlorinated biphenyls
- Arsenic
- Beryllium
- Dioxin
- Bloodborne pathogens and other potentially infectious materials

Documentation of training shall be provided to the Knoxville Health and Safety Training Records Center for inclusion in personnel training records.

6.14.2 Asbestos

Asbestos workers regulated under AHERA (Asbestos Hazard Emergency Response Act) shall have satisfactorily completed Asbestos Abatement Worker training and annual refresher training. If there is a 2-year gap without any refresher training, then the initial training must be repeated.

Supervisors of AHERA-regulated asbestos workers shall have satisfactorily completed an Asbestos Abatement Supervisor course and annual refresher training thereafter. Successful completion of these courses is required to be eligible for project-level designation as a competent person.

Certificates from AHERA/U.S. Environmental Protection Agency-approved training providers will be accepted for asbestos training and documentation of training shall be provided to the Knoxville Health and Safety Training Records Center for inclusion in STC.

6.14.3 Ionizing Radiation (10 CFR Parts 20 and 835, 29 CFR 1910.1096)

Persons with occupational exposure to ionizing radiation must be trained in radiation protection as follows:

- **General Employee Training in Radiation Protection (GET):** Persons who may encounter radiological hazards as a result of their job description or work location, but who are not considered to be radiation workers, must complete an awareness level course such as GET,

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Authorized User Training, and/or special briefings. Other site-specific (*e.g.*, U.S. Department of Energy) or license-specific (*e.g.*, United States Nuclear Regulatory Commission or individual state) training delivered on a project-specific basis may be substituted for this training requirement. For training content, see Shaw E&I Procedure No. EIG-HS-700, "Policy & Guidance for Developing Radiation Protection Plans."

- **Radiation Worker Training:** Those with potential to receive in excess of 100 millirem in one calendar year must complete the comprehensive 8-hour course titled Radiation Worker Training. This course is designed for radiological workers whose job assignments require unescorted access to radiation areas, contamination areas, or airborne radioactivity areas. See Shaw E&I Procedure No. EIG-HS-700 for information on content of training.

- **Authorized User Training:** In addition to Radiation Worker Training, advanced training in radiation protection shall be provided to Authorized Users who are not otherwise qualified by previous training and experience. Authorized User training consists of 40 hours of formal classroom, site-specific, and on-the-job training, as well as a detailed briefing on the contents of location-specific hazard control plans and Standard Operating Procedures for Radiation Protection.

- **All forms of radiation training must be updated annually:** Documentation of such training, except for location-specific Authorized User Training, shall be provided to the Knoxville Health and Safety Training Records Center for inclusion in STC.

6.14.4 Embryo-Fetus Protection

Embryo-Fetus Protection training will be included periodically in the annual 8-hour HAZWOPER refresher training.

6.15 Use of Respirators

Persons using respiratory protection shall have completed a respirator training session within the last year in accordance with Shaw E&I Procedure No. EIG-HS-601, "Respiratory Protection Program." Fit testing will be provided by identified individuals within the local office or job site. Documentation of fit testing shall be provided to the Knoxville Health and Safety Training Records Center for inclusion in STC.

6.16 Operation of Company Vehicles

Persons who operate company-owned, leased, or rented pickups, vans, trucks, four-wheel drives, and other vision-impaired vehicles, and persons in "probationary driver" status, shall have completed Safe Driver Training within the preceding year and refresher training at least every two years thereafter. An annual Safe Driver overview training session will be covered in the annual 8-hour HAZWOPER refresher, but this does not replace the more detailed bi-annual training requirement found in Shaw E&I Procedure No. EIG-HS-800. Documentation of training shall be provided to the Knoxville Health and Safety Training Records Center for inclusion in STC.

6.17 Department of Transportation HazMat Employees

6.17.1 General Awareness and Safety

Persons who may affect hazardous material transportation safety shall have DOT General Awareness and Safety training within the past **3 years**. This topic is included in the classroom 8-hour HAZWOPER refresher on a three-year cycle and in the on-line HAZWOPER refresher. Course completion records are automatically generated and maintained for all courses successfully completed within STC. This category includes anyone who is engaged in the following:

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- Packing hazardous materials
- Loading hazardous materials
- Driving hazardous materials
- Classifying hazardous materials
- Shipping hazardous materials
- Selecting packaging
- Preparing shipping papers
- Supervising any of the above tasks

6.17.2 Shippers

Any person who classifies hazardous or nonhazardous materials; prepares or signs shipping papers (including hazardous waste manifests [except for the driver portion thereof]); selects a DOT Proper Shipping Name; or plans or supervises the packaging, marking, or labeling of hazardous materials for shipment by ground transportation, shall complete the Shaw E&I Ground Shipment of Hazardous Materials course or an equivalent DOT shipping course. Also, Shaw E&I's Air Shipment of Hazardous Materials training is required for those who ship hazardous materials by air. Alternatively, persons who ship by air may attend another company-approved IATA course. Course completion records are automatically generated and maintained for all courses successfully completed within STC.

6.17.3 Local, Site-Specific, and Function-Specific Requirements

All persons potentially affecting the safety of hazardous materials transportation shall be trained in accordance with Sections 6.17.1 and 6.17.2 above. In addition, local training shall be conducted to address any local, site-specific, and function-specific needs as required by 49 CFR 172.704 and 49 CFR 177.816. The impact that each person could potentially have on the safety of hazardous materials transportation must be reviewed in the context of the above requirements. The intent of the regulation is that each person involved must be trained in the proper handling of hazardous materials as required by their job at that location. Completion of DOT General Awareness and Safety training will satisfy most, but not necessarily all, requirements. A local determination must be made based on the daily activities of the person concerned. Documentation of training shall be provided to the Knoxville Health and Safety Training Records Center for inclusion in STC.

6.18 Equipment Operation

While training is necessary for operation of various pieces of heavy equipment, there is not an OSHA-specified training requirement except for forklift trucks. The H&S Training Manager will recognize training from the equipment manufacturers, specialized heavy equipment schools and union training certificates. An additional alternative to the company training listed above is documented attendance of equivalent training, such as that provided by the National Safety Council, or an appropriate manufacturer or trade association, followed by a documented demonstration of competency using a performance checklist and an evaluation provided by a local experienced professional.

All Shaw employees that may be required to operate heavy equipment are required to comply with the requirements of Shaw E&I Procedure No. EID-FL-002, “Designated Qualified Operator Program,” and its testing and medical qualification requirements. Heavy equipment operators often receive training from classes supplied by equipment manufacturers or trade association

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groups. In addition, the Knoxville Health and Safety Training Center maintains a Heavy Equipment Training Kit for use by designated heavy equipment operator competent persons These competent persons present the purchased equipment-specific training programs; provide additional background materials; proctor a written examination; and then evaluate each operator's skills. The skills of new equipment operators need to be evaluated by experienced and safe operators and evaluations documented in project files and in STC.

6.19 Excavations

Each site where personnel are required to enter into an excavation must have an excavation competent person present to evaluate the construction and safety of the excavation as specified in Shaw E&I Procedure No. EIG-HS-307, "Excavation and Trenching." This individual must have completed the company Excavation Competent Person course or an equivalent outside training course. The H&S Training Manager will review and approve outside training courses for equivalency. Employees who enter excavations require Excavation Awareness Training or similar documented local site-specific training of approximately 1 to 2 hours to enable them to recognize unsafe conditions in and around the excavation. Excavation Awareness Training is given once every three years in the classroom version of the 8-hour HAZWOPER refresher and is available at all times within the on-line 8-hour HAZWOPER. Project health and safety personnel may also provide site-specific Excavation Awareness Training. Site-specific training records should be sent to the Knoxville Health and Safety Training Records Center for inclusion into STC.

6.20 Competent Person Drilling Oversight Training

When drilling activity is to take place, the Shaw's Field Team Leader must have successfully completed Shaw's in-house training pertinent to Competent Person Drilling Oversight (CPDO) Training. The Field Team Leader is required not only to have successfully completed CPDO training but to have an appropriate educational background, coupled with field experience and, the authority to make changes to correct deficiencies, or to stop the job if need be. The specific procedure that addresses CPDO training and utility contact prevention is Shaw E&I Procedure No. EIG-HS-308, "Underground/Overhead Utility Contact Prevention." The CPDO training module is available through online training. Requests for sign up and assignment of the CPDO training can be accomplished by contacting the Knoxville Health and Safety Training Records Center in Knoxville..

6.21 Work at Client Locations

Managers of work at client locations shall identify and comply with client requirements including the facility safety rules, the facility emergency action plan, and if applicable, any Process Safety Management requirements. In the event of conflict between company and client requirements the requirement, which is more protective of company employees shall be followed.

6.22 First-Aid or Cardiopulmonary Resuscitation Providers/Bloodborne Pathogens

Those who perform first aid or cardiopulmonary resuscitation (CPR) must have a current certification card. Additionally, those who are trained providers, as defined in Shaw E&I Procedure No. EIG-HS-512, "Handling of Blood or Other Potentially Infectious Material," must have completed Bloodborne Pathogen training. In order to comply with the U.S. Army Corps of Engineers and other client requirements, each project shall have at least two personnel on site at all times who are currently certified in first aid or CPR. It is recommended that each office also have, as a minimum, two personnel currently certified in first aid and CPR on duty during office hours. Documentation of training shall be provided to the Knoxville Health and Safety Training Records Center for inclusion in STC.

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6.23 Subcontractors

Subcontractors shall comply with all applicable OSHA and DOT regulatory training requirements, Shaw E&I Health and Safety policies and procedures, requirements established in the project-specific Health and Safety Plan., and client requirements. Proof of OSHA-required and Shaw E&I project-required training shall be presented to the Project Manager. Acceptable proof includes copies of certificates or signed statements on Subcontractor's letterhead. The H&S Training Manager will assist the Project Manager, as requested, in evaluating the adequacy of required training of Subcontractors. Particular attention should be given to expiration dates.

6.24 Recordkeeping

The official training records for the Corporation are maintained within the Shaw Talent Connection Learning Management System by the Knoxville Health and Safety Training Records Center. Documentation for training listed below shall be forwarded to the Training Records Center for inclusion with company records:

- Training conducted by the Training Department
- Training conducted by other authorized internal trainers
- Training conducted by approved outside training sources
- For newly hired employees, records for training received prior to joining the company

All training records will be available through the Health and Safety Training Records Center. This will eliminate the need for maintaining training files at each office location.

7. ATTACHMENTS

- Attachment 1, Employee and Subcontractor Training Requirements: General Requirements, Responsibility Matrix
- Attachment 2, Shaw Environmental & Infrastructure, Inc. OSHA HAZWOPER Refresher Training Requirements
- Attachment 3, HAZWOPER Recertification Requirements
- Attachment 4, HAZWOPER Recertification Documentation Form

8. FORMS

- None

9. RECORDS

HAZWOPER Recertification Documentation Form

10. REVISION HISTORY AND APPROVAL

Revision Level Revision Date	Revision Description	Responsible Manager
00 4/24/2002	Initial issue	Warren Houseman
01	Added section for: Competent Drilling Oversight (CPDO) Training.	Troy Allen

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Revision Level Revision Date	Revision Description	Responsible Manager
2/19/2007	Added Attachment 3: Hazwoper Recertification Requirements Added Attachment 4: Hazwoper Recertification Documentation Form	
02	Section 5.18 has been updated to reflect the new Heavy Equipment Training Kit that is maintained by the Knoxville Health & Safety Training Center. Embryo-Fetus training will be provided periodically instead of every two years during the annual 8-hour HAZWOPER refresher training. This Standard Operating Procedure title has been modified to include Health & Safety. All references to the Health and Safety Training Records Center database have been modified to reflect Shaw Talent Connection	Troy Allen
03 5/19/2010	Annual recertifications no longer required for Designated Heavy Equipment Operator Competent Persons and Equipment Operators.	Troy Allen
04 8/25/2011	Modified format only to align with Governance Management framework.	Andrew Johnson

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Attachment 1
Employee and Subcontractor Training Requirements
Responsibility Matrix

Action	Procedure Section	Responsible Party					
		Project Manager	Functional Lead	Employee	Supervisor or Manager	Training	H&S
Maintaining current training status for adequate numbers of employees in the types of work applicable for their business.	1.0	X	X				
Comply with applicable state, local, and client training requirements.	6.2	X	X		X		X
Documentation of state, local and client requirements in the project-specific Health and Safety Plan.	6.2	X	X				X
Provision of all relevant information (manuals, schedules, syllabi, telephone numbers), to the Training Department, for outside training courses.	6.3	X	X	X			
Prior approval of outside training resources, except as specifically provided herein.	6.4			X		X	
Provide and document site-specific training.	6.5	X	X				X
Evaluation of subcontractor compliance.	6.23	X	X			X	X
Forwarding of documentation for training to the Knoxville Health and Safety Training Records Center for inclusion with company records	6.24	X	X			X	X
Maintenance of corporate training database.	6.23					X	
Review employee's work experience and training for recertification requirements (if applicable).	Attachment 3			X	X	X	X
Complete and approve HAZWOPER Recertification Documentation Form (if applicable).	Attachment 4			X	X	X	X

Attachment 2
Shaw Environmental & Infrastructure, Inc. HAZWOPER Refresher Training Requirements

All employees who work at project sites that require compliance with the Hazardous Waste Operation and Emergency Response (HAZWOPER) standard, 29 Code of Federal Regulation (CFR) 1910.120, must have completed either the initial 40 or 24 hour training and have kept their certification active by completing the annual 8 hour refresher classes. The company requires the following to maintain certification to work at HAZWOPER sites:

1. Annual training is to be completed as close to the one-year anniversary date as possible.

2. For those employees who are not working on sites requiring compliance with 29 CFR 1910.120 and allow their refresher training to lapse from 13 to 24 months since their last refresher training, attendance at an 8-hour refresher training is necessary to restore their certification. The employee cannot work on a jobsite requiring a current certificate until the 8-hour refresher has been completed.

3. For those employees who have not had a refresher course for 25 or more months, they will be required to either attend a 40-hour HAZWOPER course or to satisfy the HAZWOPER recertification requirements described in Attachment 3 before they will be qualified to resume work on sites requiring compliance with the HAZWOPER standard.

Each employee is responsible for keeping his/her training status current and for completing either the company on-line HAZWOPER refresher or attending a company classroom version of the refresher.

Attachment 3
HAZWOPER Recertification Requirements

Employees who have had a 25 month or greater lapse of formal 8 hour classroom or internet refresher training may be considered for recertification by Shaw Environmental & Infrastructure, Inc., provided that they meet each of the following requirements:

1. The employee's manager or supervisor must review the employee's work experience during this 25 month or greater lapse period to determine if the employee had been actively engaged in job categories or projects which present hazards similar to those associated with Hazardous Waste Operations and Emergency Response (HAZWOPER) covered operations and if the employee had retained the necessary safety skills. For example, this could include work involving chemical manufacturing, usage, or application or work for other environmentally-related industries that would indicate that the employee had retained key safety skills.

2. The employee must provide a list of all documented safety and health related training attended during the lapse period. Documentation to support this training could include registration materials, certificates of completion, time cards and expense reports. In order to be considered for recertification, the employee's manager or supervisor must review the documentation and verify that at least 8 hours of safety and health related course work had been accumulated during the lapse period.

3. If the employee's manager or supervisor believes that the employee meets the requirement identified in items 1 and 2, the manager or supervisor will submit the completed HAZWOPER Recertification Documentation Form (Attachment 4) to the appropriate Health and Safety Manager.

4. Approved HAZWOPER Recertification Health and Safety Documentation Forms will be forwarded to the Health and Safety Training Department by the Health and Safety Manager. The Training Department will then administer a 50 question test to the employee. If the employee completes the test with a score of 80 percent or higher, he/she will be scheduled to complete an 8-hour refresher either on the internet or in the classroom prior to resuming HAZWOPER field activities.

Note: If any of these requirements are not met, the employee must re-take the 40-hour course. Also, this recertification process is not valid for employees working at HAZWOPER sites in California or Washington.

Attachment 4
HAZWOPER Recertification Documentation Form

Date: _____

Name: _____ Home Dept: _____ Employee No. _____

Date: 40 Hour HAZWOPER Certification: _____
(Attach certificate of completion)

Date: 8 Hour Refresher (most recent): _____
(Attach certificate of completion)

Description of documented safety and health training during 25-month or greater lapse period:

- Shaw approved Training:
- Non-Shaw training:
- Courses related to chemical or hazardous waste:
- Seminars or symposiums related to chemical or hazardous waste:
- Description of work experience during 25-month or greater lapse period:
- Work experience related to chemicals or hazardous waste:
- Other activity related to chemicals or hazardous waste:

_____ _____
Applicant Signature Supervisor Signature, Emp #, and Date:

H&S Assessment and Approval:

I, _____, H&S Manager for _____ have approved the application for equivalency of training and clear the applicant to take the equivalency test.

_____ _____
Printed Name Date

Date Forwarded to Shaw's Training Department: _____

1. PURPOSE

This procedure has been developed to ensure that all affected company employees are provided with current information on the hazardous chemicals that they may encounter during their work. The basic principle of Hazard Communication (HAZCOM) is that anyone who works with hazardous chemicals has both a need and a right to know the identities and the hazards of any chemical to which they may be occupationally exposed. This principle has been propagated by the Occupational Safety and Health Administration (OSHA) in 29 Code of Federal Regulations (CFR) 1910.1200, "Hazard Communication."

Some company activities are likely to occur in states or localities that either have or will have requirements that differ from those contained within the federal standard. In such circumstances, the local health and safety representative will be responsible for ensuring that these requirements are included in either a Site Health and Safety Plan or a similar document and conveyed to all affected employees. If federal, state, or local regulations vary or conflict, the more protective requirements and practices will be followed.

2. SCOPE

This procedure applies to all employees who work with hazardous chemicals.

Variances and exceptions may be requested pursuant to the provisions of Shaw Environmental & Infrastructure, Inc. (Shaw E&I) Procedure No. EIG-HS-013, "Health and Safety Procedure Variances."

3. REFERENCES

3.1 Internal References

- Procedure No. EIG-HS-013, Health and Safety Procedure Variances
- Procedure No. EIG-HS-050, Training Requirements
- Procedure No. EIG-HS-051, Tailgate Safety Meetings
- Procedure No. EIG-HS-500, OSHA Regulated Toxic and Hazardous Chemicals

3.2 External References

- Code of Federal Regulations, Title 29, Chapter XVII, Part 1910, Subpart Z, Section 1200 (29CFR1910.1200), "Hazard Communication," U.S. Government Printing Office

4. DEFINITIONS

- **Article**—A manufactured item other than a fluid or particle which is formed to a specific shape or design during manufacture, has end use function dependent in whole or in part upon its shape or design during end use, which under normal conditions of use does not release more than trace amounts of a hazardous substance and does not pose a physical hazard or health risk to employees.
- **Affected Employee**—Any company employee who may be exposed to hazardous chemicals under normal operating conditions or in foreseeable emergencies.
- **Company**—All wholly-owned subsidiaries of Shaw E&I

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- **Hazardous Chemical**—Any chemical which poses a physical or health hazard.
- **Health Hazard**—A chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees. Health hazards include chemicals, which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic system, and agents which damage the lungs, skin, eyes, or mucous membranes.
- **Immediate Use**—When hazardous chemicals will be under the control of and used only by the person who transfers it from a labeled container and only within the work shift in which it is transferred.
- **Label**—Any written, printed, or graphic material displayed on or affixed to containers of hazardous chemicals.
- **Local Health and Safety Representative**—The person who is responsible for the management and/or oversight of health and safety activities at a particular workplace. He/she may be assigned as a Site Health and Safety Officer or act as a home office health and safety manager who is responsible for multiple workplaces. This person does not necessarily need to be physically located at a workplace in which they are responsible for ensuring that the requirements of this procedure are fulfilled. The local health and safety representative may designate another qualified individual to assume some or all of the responsibilities delineated in this procedure.
- **Physical Hazard**—A chemical for which there is scientifically valid evidence that it is a combustible liquid, compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable, or reactive.
- **Responsible Party**—The entity responsible for preparation or distribution of Material Safety Data Sheets (MSDS) that can provide additional information on the hazardous chemical and appropriate emergency procedures.
- **Trade Secret**—Any confidential formula, pattern, process, device, information, or compilation of information that is used in an employer's business, and that gives the employer an opportunity to obtain an advantage over competitors who do not currently know or use it.
- **Workplace**—An establishment, job site, laboratory, office, or project at one geographic location containing one or more work areas.

5. RESPONSIBILITY MATRIX

5.1 Procedure Responsibility

The Senior Director of Health and Safety is responsible for the issuance, revision, and maintenance of this procedure.

5.2 Action/Approval Responsibilities

The Responsibility Matrix is Attachment 1, "Hazard Communication Program Responsibility Matrix."

6. PROCEDURE

In accordance with the requirements established in 29 CFR 1910.1200, employers are required to develop, implement, and maintain at each workplace a HAZCOM program. The program contained herein is intended to ensure that the hazards of all chemicals used by employees are evaluated and that information concerning the hazards of each chemical are conveyed to affected employees. The company program generally consists of five provisions, including hazardous

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chemical inventories, procurement of hazardous chemicals, container labeling, MSDSs, and the development and implementation of employee training programs. Because the company does not typically produce, distribute, or import hazardous chemicals, the focus of this procedure is on establishing an effective consumer/handler type HAZCOM program and the communication of information to our affected employees.

There are some types of chemicals that are specifically exempt from this procedure. These materials include:

- Any hazardous waste as defined by the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1967, as amended (42 U.S. Code 6901 *et seq.*), when subject to regulations issued under that Act by the U.S. Environmental Protection Agency.
- Any hazardous chemical as defined by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) when the hazardous chemical is the focus of remedial or removal actions being conducted under CERCLA in accordance with U.S. Environmental Protection Agency regulations.
- Tobacco or tobacco products.
- Wood or wood products, including lumber, which will not be processed, where the manufacturer or importer can establish that the only hazard they pose to employees is the potential for flammability or combustibility. Wood or wood products that have been treated with a hazardous chemical are covered by this procedure, and wood which may be subsequently sawed or cut, generating dust.
- Articles.
- Food or alcoholic beverages which are sold, used, or prepared in a retail establishment, or foods intended for personal consumption by employees while in the workplace.
- Any drug, as defined by the Federal Food, Drug, and Cosmetic Act, when it is in solid, final form for direct administration to patient; drugs which are packaged by the manufacturer for sale to consumers in a retail establishment; and drugs intended for personal consumption by employees while in the workplace.
- Cosmetics which are packaged for sale to consumers in a retail establishment, and cosmetics intended for personal consumption by employees while in the workplace.
- Any consumer product or hazardous chemical, as defined by Consumer Product Safety Act and Federal Hazardous Chemicals Act, where the employer can show that it is used in the workplace for the purpose intended by the manufacturer or importer of the product, and the use results in a duration and frequency of exposure which is not greater than the range of exposures that could reasonably be experienced by consumers when used for the purpose intended.
- Nuisance particulates where the manufacturer, distributor, or importer can establish that they do not pose any physical or health hazard covered under this procedure.
- Ionizing and nonionizing radiation.
- Biological hazards.

6.1 Hazardous Chemical Inventories

A complete list of all hazardous chemicals known to be present in the workplace that may expose an employee to a physical or health hazard will be maintained at each office location and project site. This list will be placed in the front section of the MSDS binder discussed in Section 6.4. The

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local health and safety representative/site safety officer will be responsible for maintaining the list and revising it as new chemicals are procured or when chemicals are no longer used and have been removed from the workplace. The identity of the hazardous chemical maintained on the list will be consistent with that which appears on the MSDS. All affected employees will be made aware of the location of the MSDS binder.

6.2 Procurement of Hazardous Chemicals

Because the company does not typically manufacture, distribute, or import hazardous chemicals, procurement is the primary method of obtaining hazardous chemicals. The person initiating the procurement of a hazardous chemical will be responsible for requesting a MSDS from the manufacturer or distributor. This MSDS is to be provided either prior to or at the time of receipt of the chemical. Hazardous chemicals are strictly forbidden to be accepted without an accompanying MSDS. Upon receipt of a hazardous chemical, the person receiving the shipment will notify the local health and safety representative so that a review of the MSDS can be conducted. Also, note that the supplier is only required to submit a MSDS with the initial shipment of a hazardous chemical to a specific location.

In the unlikely event that a hazardous chemical is either manufactured, imported, or distributed by the company, the Senior Director Health and Safety will be notified so that required actions, as dictated by OSHA, can be implemented.

6.3 Container Labeling

Labeling on hazardous chemical containers is meant to provide immediate information to affected employees about the hazards of chemicals they will be expected to handle during the course of their job duties. It is the responsibility of the manufacturer, importer, or distributor of the chemical to ensure that each hazardous chemical leaving their place of business is labeled, tagged, or marked with the following information:

- Identity of the hazardous chemical (must be common to the label, the MSDS, and the chemical inventory list)
- Appropriate warnings of the hazardous effects of a chemical (words, pictures, symbols, or any combination that appears on the label and conveys the specific physical or health hazards including target organ effects)
- Name and address of the chemical manufacturer, importer, or other responsible party

The person receiving the shipment is responsible to ensure that each container of hazardous chemical(s) has been provided with this labeling information. Hazardous chemicals that do not contain adequate labeling will not be accepted by the receiving person. In the event that hazardous chemicals that do not contain adequate labeling are inadvertently received, they are not to be handled until the identity of the material and appropriate hazard warnings are provided. If the hazardous chemical is regulated by a chemical-specific health standard, then it must be labeled in accordance with the requirements of that standard.

As long as the hazardous chemicals are maintained in their original, properly labeled container and their composition is not altered, there is no need for additional labeling. In the event that the chemical is transferred from a labeled container to an unlabeled portable container, the user must label this secondary container unless the container is intended for immediate use of the employee who performs the transfer. In this case, the container must be labeled with the identity of the chemical and the appropriate hazard warnings, as described above.

Pipes and piping systems present on Shaw E&I site-constructed or fixed equipment processes carrying hazardous chemicals may or may not be labeled. Labeled pipes will conform to either the labeling convention identified in the engineering specifications or by the client. Workplace-specific

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training will inform affected employees of the hazards posed by chemicals contained in unlabeled pipes and piping systems.

In locations where employees are present who only communicate in languages other than English, all labeling information must be presented in their language as well as in English.

6.4 Material Safety Data Sheets

MSDSs are written documents that convey specific, detailed information about the hazards associated with a specific chemical. It is the responsibility of the manufacturer, importer, or distributor to either provide MSDSs prior to shipment or with the shipped materials. The employee receiving the shipment of materials is responsible to ensure that a MSDS has been supplied. As described in Section 6.2, the employee initiating the procurement is responsible for requesting a MSDS from the manufacturer or distributor. In the event that a MSDS has not been provided, it is the responsibility of the receiving person to obtain one from the manufacturer or distributor as soon as possible. The material will not be handled prior to the receipt of a MSDS.

Each MSDS will be forwarded to the local health and safety representative/site safety officer or a designee who will then place a copy into a MSDS binder. This binder will be maintained in the workplace and updated as new materials arrive. The local health and safety representative/site safety officer will ensure that this binder is reviewed with all affected employees and is readily accessible during each work shift. A designated area for the storage of the binder will be established and all employees are to be informed of its location. Employees can request a personal copy of a MSDS by completing the Employee Request for MSDS form provided as EI-HS060.1. Where employees travel between workplaces during a work shift, the MSDSs may be kept at the primary workplace. Affected employees must be able to immediately obtain information from the MSDSs in the event of an emergency.

MSDSs will be in English and other languages, as necessary, for the particular employees in which the MSDSs will be used. MSDSs are to include the following information:

- Name, address, and telephone number of the responsible party
- Identity of the chemical as it appears on the label
- Hazardous ingredients
- Physical and chemical characteristics
- Physical and health hazards
- Primary route(s) of entry
- OSHA permissible exposure limit (PEL) or other applicable exposure limits
- Carcinogen information
- Safe handling and use information
- Control measures
- Emergency and first aid procedures
- Date of preparation and latest revision date

6.5 Training

All affected employees will be provided with information and training on the hazardous chemicals in their work area at the time of their initial assignment, when new information about the hazards

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of a chemical is discovered, and whenever a new physical or health hazard that the employees have not previously been informed of is introduced into the workplace. The HAZCOM training record has been provided as form EIG-HS-060.02.

Information provided in this training will include:

- Requirements of the HAZCOM program
- Any operations in the work area where hazardous chemicals are present
- Location of written hazard communication program, listing of hazardous chemicals present, and MSDSs
- Methods and observations that may be used to detect the presence or release of hazardous chemicals by use of monitoring devices, visual appearance, or odor
- The physical and health hazards of chemicals in the work area
- Protection measures to be utilized to prevent exposure, appropriate work practices, emergency procedures, and proper personal protective equipment to be used
- Explanation of the labeling system and the MSDS and how employees can obtain and use the appropriate hazard information

Training on the HAZCOM program may be satisfied by the use of two different types of training sessions, which include:

- **Tailgate Safety Meetings**—These meetings will be used to convey the methods and observations that may be used to detect the presence or release of a hazardous chemical in the workplace, the physical and health hazards of the chemicals in the workplace, and the measures that can be taken to protect affected employees from these hazards. The guidelines for this meeting are described in Shaw E&I Procedure No. HS051, “Tailgate Safety Meetings.”
- **Workplace-Specific or Annual Refresher Training**—Either of these training sessions can be used to convey the details of the HAZCOM program. These details include an explanation of labeling systems, the use of MSDSs, and how employees can obtain and use the appropriate hazard information. These training sessions are discussed further in Shaw E&I Procedure No. EIG-HS-050, “Training Requirements.”

Workplace-specific and tailgate safety meetings will be facilitated by the local health and safety representative or another individual who is knowledgeable on the requirements of the HAZCOM program and the specific chemicals that are being discussed. Training for non-English speaking employees shall be conducted in a manner such that the employee is able to comprehend. Annual refresher training can only be conducted by personnel previously approved by the company Training Department.

6.6 Trade Secrets

Some hazardous chemical manufacturers, importers, and distributors may withhold proprietary information required to be present on a MSDS. In such instances, the name and telephone number of the manufacturer, importer, or distributor will be forwarded to the Senior Director of Health and Safety for further action. It will be the responsibility of the Senior Director of Health and Safety to either obtain the necessary information or to decide to reject the chemical for use in company workplaces.

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6.7 Contractors

During the execution of Shaw work there will be situations when the company will be at locations where employees of other entities may be exposed to chemicals being used by the company. It will be the responsibility of the local health and safety representative or designee to provide the other entities' site representative(s) with copies of all MSDSs in which their employees may be exposed, as well as the labeling system in place, the protective measures to be taken, safe handling procedures to be used, and the location and availability of the MSDS binder.

Periodically, company work areas will be located on or adjacent to a facility operated by another entity. In these situations, the local health and safety representative or designee will contact the other entity to obtain applicable MSDS(s) for hazardous chemicals that company employees may be exposed to.

7. ATTACHMENTS

- Attachment 1, Hazard Communication Program Responsibility Matrix

8. FORMS

- EIG-HS-060.01, Employee Request for Material Safety Data Sheet (MSDS)
- EIG-HS-060.02, Hazard Communication and Right-to-Know Standards Employee Training Record

9. RECORDS

- EIG-HS-060.01, Employee Request for Material Safety Data Sheet (MSDS)
- EIG-HS-060.02, Hazard Communication and Right-to-Know Standards Employee Training Record

10. REVISION HISTORY AND APPROVAL

Revision Level / Revision Date	Revision Description	Responsible Manager
00 N/A	Initial issue unavailable.	N/A
01 9/26/2002	Information on Rev. 1 unavailable.	Warren Houseman
02 10/27/2003	Update Attachment 1, Responsibility Matrix	Troy Allen
03 9/16/2010	Converted procedure format to a Standard Operating Procedure. Addressed labeling of pipes and piping systems in Section 6.3. Deleted Attachment 4, Chemical Listing	Troy Allen
04 8/25/2011	Modified format only to align with Governance Management framework.	Andrew Johnson

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Attachment 1
Hazard Communication Program
Responsibility Matrix

Action	Procedure Section	Responsible Party				
		Purchaser	Receiver	Affected Employee	Local Health and Safety Representative	Senior Director Health & Safety
Understand and Comply With State and/or Local Regulations	1.0				X	
Issuance, Revision, and Maintenance of Procedure	5.1					X
Review and Understand This Procedure	6.0	X	X	X	X	
Establish, Update, and Revise MSDS Binder	6.1				X	
Request MSDSs for Procured Chemicals	6.2	X				
Initial Review of MSDSs	6.2				X	
Implement Requirements For Company Manufactured, Imported, or Distributed Chemicals	6.2					X
Review Incoming Shipments for Hazard Labeling/MSDS	6.3		X			
Request Missing MSDSs From Manufacturer or Distributor	6.4		X			
Provide HAZCOM Training	6.5				X	
Receive HAZCOM Training	6.5			X		
Obtain Information on Proprietary Chemicals	6.6					X
Transmit MSDSs to Contractors	6.7				X	
Obtain MSDSs From Other Entities	6.7				X	

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Employee Request for Material Safety Data Sheet (MSDS)

Employee Name: (Please print) _____

Employee Number: _____

Job Title/Location: _____

Department/Work Area: _____

I am requesting a copy of the MSDS(s) for the following chemical(s):

(Chemical name, Common name, Trade name)

1. _____

2. _____

3. _____

_____ _____

Signature Date

I have received a copy of the above MSDS(s) I requested.

_____ _____

Signature Date

cc: Local Health and Safety Representative

Hazard Communication and Right-To-Know Standards
Employee Training Record

INITIAL:

1. I have been informed about the Hazard Communication Program, Material Safety Data Sheets (MSDS), their use and location, and the procedures to obtain copies. ☐

2. I have been informed that some of my work may involve exposure to toxic substances, the hazards of which will be reviewed with me in tailgate safety meetings or site-specific training. ☐

3. I have been informed about the right of employees to have access to relevant exposure and medical records, and the procedures for requesting access. ☐

4. I understand that the company must act upon a request in a reasonable amount of time so as to avoid interruption of normal work operations. ☐

5. I have been provided access to the applicable regulations governing hazard communication, and access to employee exposure and medical records. ☐

PRINT NAME: _____

SIGNATURE: _____

EMPLOYEE NUMBER: _____

DATE: _____

1. PURPOSE

An effective medical surveillance program is a key element in the company's overall program to protect the health and safety of all employees and personnel working with Shaw Environmental & Infrastructure, Inc. (Shaw E&I). Provisions are made for the following:

- Baseline exams
- Annual exams
- Biennial exams
- Exit exams
- Disability/medical limitation follow-up/not medically cleared
- Re-hiring former employees
- Temporary, contractor, and subcontractor personnel

2. SCOPE

This procedure applies to the management and implementation of the Shaw E&I medical surveillance program.

3. REFERENCES

3.1 Internal References

- Shaw E&I Procedure No. EIG-HS-101, Drug and Alcohol Testing

4. DEFINITIONS

- **Company**—Shaw E&I and all wholly-owned subsidiaries thereof.

5. RESPONSIBILITIES

5.1 Procedure Responsibility

The Executive Director of Health and Safety is responsible for the issuance, revision, and maintenance of this procedure.

5.2 Action/Approval Responsibilities

The Responsibility Matrix can be found as Attachment 1, "Medical Policies and Procedures Responsibility Matrix."

6. PROCEDURE

The purpose of a medical surveillance program is to protect the health of the employee, by working in conjunction with an effective hazard recognition and control program. A common misconception is that a medical surveillance examination should be the equivalent of an examination by one's private physician. This is incorrect. The medical surveillance exam focuses on health effects related to the workplace and applicable job requirements.

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CORE Health Networks (1-888-388-CORE[2673]) has been selected to manage the delivery of medical surveillance services. William Nassetta, M.D., M.P.H. has been designated as the company's consulting Medical Director.

6.1 Medical Protocols

The company's Medical Surveillance Program consists of various examination modules which differ based upon each employee's job duties and whether it is for baseline, annual update, biennial update, or exit examination purposes (Attachment 2, "CORE Health Networks Tabular Protocol").

The company's examination modules include Administrative, Pre-placement, Laboratory, Field Exposure, Field Exposure (Transportation) – for U.S. Department of Transportation Drivers, Field Exposure/Asbestos, Asbestos, Clean Construction-Fit for Duty, and Professional Non-Exposed. All employees are subject to the specified Baseline examination based on a provided job requirement of their duties. Baseline examinations are administered on a conditional post offer of employment/pre-placement basis. All incumbent employees whose duties involve potential exposure to safety or health hazards are subject to the specified Annual Update examination and to the specified Exit examination. (Note: The Exit exam may be waived if the most recent exam on file is less than 6 months old.) Medical exam clearances can be extended for one year pending CORE Health Networks review of the medical extension form. Incumbent Fit for Duty exam employees will have a Biennial Update examination.

All employees entering the asbestos-monitoring program must remain in the program while employed by the company or until such time as a Health and Safety professional has documented the employee was never exposed to asbestos in excess of the Permissible Exposure Limit during his/her employment with the company.

All employees are subject to drug/alcohol testing for pre-hire, whenever "reasonable suspicion" of substance abuse exists, when the employees consent to participate in client-specific programs, after an accident or near miss incident and wherever random testing is required either by client-specific programs, company policy, or federal programs, as applicable by federal, state, and local laws (see Shaw E&I Procedure No. EIG-HS-101, "Drug and Alcohol Testing," for more information.)

6.1.1 Temporary, Contractor and Subcontractor Personnel.

All employees in this category are subject to the same medical surveillance and drug/alcohol testing requirements that would be applicable if a company employee were doing the work.

6.2 Local Administration

The local management of the medical surveillance program is the responsibility of the Health and Safety Assistant. This person will work at the direction of the Health and Safety professional for purposes of medical surveillance administration. They are responsible for scheduling medical examinations requested by the Human Resource department and identified personnel on the CORE Health Networks notification lists, receiving medical clearances, communicating medical status information to management and obtaining management and employee signatures on each medical clearance which identifies restrictions. Generally, professional/salaried employees are coordinated through the Baton Rouge, Louisiana, office while hourly/craft employees are handled by the Findlay, Ohio, location.

6.3 Scheduling

6.3.1 Baseline

All baseline examinations are conducted strictly upon a post-offer of employment/pre-placement basis. In order to verify that the Human Resource department has made a formal offer of

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employment, the Health and Safety Assistant is to accept requests for baseline examinations only from the Human Resource department. (Note: The offer letter from Human Resources must be conditional upon a negative drug/alcohol test and being found medically fit to perform job requirements for the offered position.)

Baseline examinations done at the inception of employment with the company that result in a positive drug/alcohol test shall result in the immediate withdrawal of the conditional offer of employment.

Health and Safety Assistants are required to keep a supply of examination and job requirement forms appropriate for the type(s) of employee classifications at their location. CORE Health Networks can be contacted at 1- 888-388-CORE (2673) to replenish examination forms only.

6.3.2 Annual Updates

Each month, CORE Health Networks will provide each Health and Safety Assistant with a "notification" list of employees due for annual update exams during the coming month and those employees due from previous periods who have not yet completed their examination. Except to the extent otherwise required by law, continued employment will be conditional based upon employee's exam and their being found medically fit to perform job requirements.

6.3.3 Exit

Exit examinations are required for all employees leaving the company, except those classified "administrative" unless their most recent exam is less than six months old. An Exit Examination/Declination Form is provided as Form EI-HS100.1, "Exit Examination Acceptance/Declination Form."

6.3.4 Examinations Conducted Away from the Employees Home Base

CORE Health Networks Customer Service Department must be contacted to identify the nearest available clinic in their network to service our needs. If there is not a nearby clinic available, CORE Health Networks can be asked to locate and prepare a nearer clinic to serve the company (there may be an added charge for this service).

6.3.5 Biennial Updates

Biennial Fit for Duty Update examinations will be provided from CORE Health Networks to the Health and Safety Assistant with a "notification" list of employees due for Biennial Fit for Duty Update exams during the coming month, and those employees due from previous periods who have not yet completed their examinations. A Request for Extension of Medical Requirements Form is provided as Form EI-HS100.02, "Request for Extension of Medical Surveillance Requirements."

6.4 Medical Clearance

Fit for Duty clearances will be issued by CORE Health Networks within three business days following the examination. All other clearances will be issued by CORE Health Networks within approximately five business days post examination. The clearance will be sent directly to the local Health and Safety Assistant. The Health and Safety Assistant is responsible for coordinating requests for retesting or additional testing, for obtaining the signatures of the employee on the clearance and manager, and placing the document in the employee's Medical/Exposure Monitoring file.

It is important to note that medical clearances are not confidential medical records. They are designed and intended to communicate employee medical status to management.

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6.4.1 Medical Restrictions Issued

Whenever a restricted medical clearance is issued, the Health and Safety Assistant shall advise the location Health and Safety professional and Human Resources representative. The Health and Safety and Human Resources representatives will meet with the manager to determine if the medical restriction will have an impact on the employee's ability to perform the essential duties of the intended job.

6.4.1.1 No Impact on Job Duties

If the medical limitation is found not to have an impact on the ability to meet essential job functions, the procedures in Section 6.4.1 are followed.

6.4.1.2 Job Duties Impacted

If a preliminary review indicates that the individual's medical status, as reflected in prescribed medical limitations, will negatively impact their ability to perform the intended job, then the steps listed below must be taken:

1. Consult with Dr. William Nassetta (the company's Consulting Medical Director) regarding the individual's specific medical status and the essential functions of their job (reference the company's job description).

   If it appears initially that the individual is medically not fit to perform the essential functions of the job, an evaluation of whether the person can perform the essential functions with a reasonable accommodation, pursuant to step 2 shall be made.

   If after evaluation of reasonable accommodations/alternatives, the individual cannot perform the essential functions of the job, placement or continued work in that position is prohibited. Go to step 3.

2. Reasonable Accommodation Evaluation

   When an individual is qualified to perform the essential functions of the job, but requires an accommodation (e.g., job restructure, facility changes, provide special equipment, provision of interpreters) to safely enter the workplace and perform, the manager with the Health and Safety and Human Resource representatives will meet with the individual to discuss their specific physical and/or mental limitations and abilities. The purpose is to identify specific potential accommodations that could be made.

   Once potential accommodations have been identified, they must be evaluated to determine whether they enable the individual to perform essential job functions, without requiring the company to incur an undue hardship. Following this evaluation, the most promising accommodation(s) must be subjected to a safety review. **Before implementation of any accommodation it must be determined that it will not create a current specific threat of substantial harm to any employee or other work employee.** The safety review shall include reasonable medical judgment that relies on the most current medical knowledge and/or the best objective evidence.

3. Alternate Position Evaluation

   When an acceptable reasonable accommodation cannot be identified for the individual to perform the essential functions of their job, the Human Resources department will seek to identify alternate available positions for which the individual is qualified. The Health and Safety staff will be responsible for reviewing the essential functions of any new position with the company's Medical Director to verify that the individual is capable of performing them, and to verify that safety requirements can be met.

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6.4.1.3 Not Medically Cleared

In those cases whereby CORE Health Networks has provided documentation that an employee is reported as not medically cleared for their job duties, the company shall evaluate other alternatives in an effort to offer the employee placement in any open positions that the subject employee may qualify. Should the employee's qualifications not satisfy the job requirements of any available positions, the subject employee will be released from employment.

6.5 Disability Confirmation

When an individual claims to have a disability and requests accommodation, the company is entitled to have the individual examined by a physician to confirm the disability and to evaluate its impact on the ability to perform essential job functions. This examination shall be coordinated by the company's Medical Director to verify that authorized scope is not exceeded.

6.6 Re-Hiring Former Employee

When a former employee is being re-hired, if the most current company medical examination is less than six months old and the location Health & Safety professional can confirm that the individual was not subject to hazardous exposures during the non-company employment, the Health & Safety professional can choose to waive a new Baseline exam. Annual update will be based on the most recent exam date, not hire date.

All returning former employees shall be subject to drug and alcohol testing at the time of re-hire unless the break in service has been less than 30 days and the former employee has a negative drug screen on file that had occurred within one calendar year from the proposed rehire date.

7. ATTACHMENTS

- Attachment 1, Medical Policies and Procedures Responsibility Matrix
- Attachment 2, CORE Health Networks Tabular Protocol

8. FORMS

- Form EIG-HS-100.01, Exit Examination Acceptance/Declination Form
- Form EIG-HS-100.02, Request for Extension of Medical Surveillance Requirements

9. RECORDS

- Form EIG-HS-100.01, Exit Examination Acceptance/Declination Form
- Form EIG-HS-100.02, Request for Extension of Medical Surveillance Requirements

10. REVISION HISTORY AND APPROVAL

Revision Level Revision Date	Revision Description	Responsible Manager
00 4/24/2002	Initial issue	Warren Houseman
01 9/24/2004	Minor edits.	Troy Allen
02 1/20/2011	Reformatted entire procedure. Updated medical surveillance provider references to CORE Health Networks. Fixed technical errors from last posting of Attachment 1- Tabular Protocaol-	Troy Allen

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Revision Level Revision Date	Revision Description	Responsible Manager
	Exhibit A and Legend.	
03 8/25/2011	Modified format only to align with Governance Management framework.	Andrew Johnson

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Attachment 1
Medical Policies and Procedures Responsibility Matrix

Action	Procedure Section	Responsible Party						
		Employee	Health and Safety Professional	Health and Safety Assistant	Medical Director	CORE Health Networks	Human Resource	Manager
Submit to required medical evaluations	6.1	X						
Require temporary, contractor, subcontractor personnel to meet company's medical requirements	6.1.1							X
Local medical surveillance coordination/ Administration	6.2		X	X				
Schedule examinations	6.3 - 6.4			X				
Issue medical clearances	6.4					X		
Obtain management/associate signatures	6.4			X				
Investigate disability claims, medical restrictions, transfers, accommodations	6.4.2	X	X		X		X	X
Confirm disabilities (medically)	6.5		X		X			
Decide on exam waiver for re-hires	6.6		X					

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Attachment 1
Tabular Protocol – Exhibit A

Module	Hst. & Phys. w/dipstick UA, Vision, Vital Signs	Spiro	Audio	EKG	Chest X-Ray	Bio Chem	Bio Tox	Drug Screen
Baseline								
Administrative/ Executive								**DS 5**
Professional (nonexposed)	°	°	°	°	°	°		**DS 5**
Laboratory	°					°		**DS 5**
Laboratory (Neg. Pres. Respirator)	✎	✎				✎		
Field Exposure	°	°	°	*	°	°		**DS 5**
Field Exposure (Trans)	°	°	°	*	°	°		**N**
Field Exposure/Asbestos	°	°	°	*	°#	°		**DS 5**
Field Exposure/Asbestos/ Lead	°	°	°	*	°#	°	**6014**	**DS 5**
Asbestos	°	°	°	*	°#	°		**DS 5**
Six Months								
Blood Lead							**6014**	
Annual								
Laboratory	°		**2Y**	*	**5Y**	°		
Laboratory (Neg. Pres. Respirator)	✎	✎				✎		
Manufacturing (no respirator use)	°	°	°		**5Y**	°		
Field Exposure	°	°	°	*	**5Y**	°		
Field Exposure (Trans)	°	°	°	*	**5Y**	°		**N/R**
Field Exposure/Asbestos	°	°	°	*	**See #**	°		
Field Exposure/Asbestos/ Lead	°	°	°	*	**See #**	°	**6014**	
Asbestos	°	°	°	*	**See #**	°°		
Exit								
Professional (nonexposed)	°	°	°		**1Y**	°		
Laboratory	°	°			**1Y**	°		
Manufacturing	°	°	°		**1Y**	°		
Field Exposure	°	°	°		**1Y**	°		
Field Exposure (Trans)	°	°	°		**1Y**	°		
Field Exposure/Asbestos	°	°	°		**1Y#**	°		
Field Exposure/Asbestos/ Lead	°	°	°		**1Y#**	°	**6014**	
Asbestos	°	°	°		**1Y#**	°		

[1]Certain exam categories may be eligible for one year clearance extensions.

Tabular Protocol – Exhibit A-2

ASBESTOS CXR SCHEDULE				
Years of Exposure	Age 6	15-35	35-45	45+
	0-10	5Y	5Y	5Y
	10+	5Y	2Y	1Y

CALOSHA ASBESTOS CXR SCHEDULE			
Years of Exposure	Age 6	< 40	> 40
	0-10	3Y	1Y
	10+	1Y [X]	1Y [X]

NOTE: CALOSHA requires a three (3) view CXR for asbestos clearance

[X] Oblique view every three years

LEGEND

✎	At MD discretion
#	X-Ray film sent to CORE Health Networks for ILO reading
1Y-Y	Yearly frequency
N	NIDA drug screen
NL	NIDA-Like drug screen (5 drugs only)
N/R	NIDA Random drug screen
DS5	5 drugs

NOTE: All non-NIDA drug and alcohol tests shall follow the protocols in Shaw E & I procedure HS 101 (Exhibit E).

Tabular Protocol – Exhibit A-3
Drug Screens

SAMHSA 5 Panel DRUG SCREEN	
Marijuana	Cocaine
Amphetamines	Opiates
PCP	
Includes the NIDA chain of custody procedures and all of the guidelines of the Department of Health and Human Services. The Medical Review Officer (MRO) services are included.	

DS 10 DRUG SCREEN	
Amphetamines	Marijuana metabolites
Barbiturates	Methadone
Benzodiazepines	Methaqualone
Cocaine Metabolites	Opiates
	Phencyclidine
	Propoxyphene

REASONABLE CAUSE DRUG SCREEN	
Amphetamines	Marijuana metabolites
Barbiturates	Methadone
Benzodiazepines	Methaqualone
Cocaine Metabolites	Opiates
Propoxyphene	Phencyclidine
Ethanol	Propoxyphene

BIOTOX PANEL 6014	
Lead	Zinc Protoporphyrin

Exit Examination Acceptance/Declination Form

I, _____, am an employee of Shaw Environmental & Infrastructure.
(Print Name)

I understand that due to my occupational exposure, I may be at risk to exposure to hazardous materials and are required to submit to an exit examination before leaving the company, unless it has been less than six months since my last physical. I have been offered an Exit Examination, at no charge to myself.

(Please check appropriate box.)

☐ I accept to submit to the offered no charge Exit Examination.

However,

☐ I decline to submit to the required Exit Examination.

☐ I waive an Exit Examination because it has been less than six months since my last physical.

If I want to request a copy of my Exit Examination, I may contact CORE Health Networks @ 888-388-2673(CORE).

_____ _____

Employee Signature Date

_____ _____

Human Resource Representative (Print Name) Date

_____

Signature of Human Resource Representative

Uncontrolled when printed: Verify latest version on ShawNet/Governance

Request for Extension of Medical Requirements

Employee Name (print): _____ Date: _____

Social Security Number: _____ Date of Birth: _____

Date of Last Physical: _____ Site Code: _____

Health & Safety Assistant: _____ VISION Code: _____

Please answer each question below and obtain the indicated signatures. The completed form MUST be faxed to CORE Health Networks, Shaw E&I medical services provider, at (225) 292-8986 prior to your next scheduled annual physical exam.

		YES	NO	UNSURE
1.	I have spent 30 days or more in the field within the past year on hazardous waste contaminated sites or in a laboratory with exposure, with potential exposure above permissible exposure limits.			
2.	I expect to work 30 days or more in the field in the upcoming year on hazardous waste contaminated sites or in the laboratory.			
3.	As a result of work activities in the past twelve months, I was required to wear a respirator for 30 days or more.			
4.	As a result of scheduled work activities, I anticipate being required to wear a respirator for 30 days or more during the next twelve months.			
5.	I have worked on a project site during the last year where the health and safety plan required the use of hearing protection.			
6.	I have had a change in my medical status in the last year (e.g. surgery, medical treatment, medical diagnosis, etc.)			

If you answered YES to any of the above, please explain details below, or on back of page (i.e., chemical, physical, biological, or ergonomic exposures): _____

_____

_____

_____

_____ _____

Employee Signature Date

_____ _____

Health and Safety or Supervisor Signature Date

_____

Health and Safety or Supervisor Name (please print)

1. PURPOSE

Shaw Environmental & Infrastructure (hereinafter referred to as collectively as "Shaw E & I") has established this Drug and Alcohol procedure to maintain a work environment free from substance abuse; provide a safe and healthy environment for our Employees and the general public; maintain the quality and integrity of Shaw E & I's products and services; preserve Shaw E & I's reputation in the communities where Shaw E & I operates; and protect and secure our property and information.

The purpose of this procedure is to provide guidelines for all "Employees" (hereinafter referred to collectively as, and inclusive of: applicants, prospective employees, existing employees and employees working for Shaw E & I through temporary staffing agencies) regarding substance use and abuse and to provide supervisors with practical procedures for its administration. Subcontractors and lower tier subcontractors (a lower tier subcontractor is any subcontractor at any level working on any Company project whether directly with Shaw E & I or through a third party) are required to document that they maintain a substance abuse prevention program comparable to this program. Shaw E & I reserves the right to modify this procedure at any time consistent with changes in medical procedures, technologies, the law, or Shaw E & I's operational needs. This procedure shall not, in any event, alter the basic "at will" status of any Employee, nor shall it create any expressed or implied contractual rights relative to employment with Shaw E & I.

2. SCOPE

This procedure applies to all applicants applying for positions in the United States, all Employees working in the United States, and all international Employees testing in the United States prior to deployment including but not limited to officers, directors, and supervisors. Subcontractors and lower tier subcontractors are required to document that they maintain a substance abuse prevention program comparable to this program.

An applicant or prospective Employee of Shaw E & I who refuses a post-offer, pre-employment drug or alcohol test will not be considered for a position with Shaw E & I.

This procedure applies to all Company work locations except when state restrictions apply. For the purpose of this procedure, and as a result of the nature of work in which Shaw E & I performs for our customers, we often employ individuals that actually work at a location that is neither owned or otherwise leased / rented by Shaw E & I. Accordingly, we define these customer job site work locations as being "Host Employer" premises.

An existing Employee who refuses to submit to a drug/alcohol test is subject to disciplinary action, up to and including termination, pursuant to Shaw E & I's guidelines and applicable Federal and state laws. "Company or Host Employer's Premises" are defined as: all areas or locations in which work is performed, including but not limited to Employee's lockers, lunch boxes, personal bags and effects, clothing, furniture, desks, drawers, containers, tool boxes, storage facilities, work areas and personal vehicles parked on Company property or job site locations and equipment, either owned, borrowed, leased or operated by Shaw E & I or Host Employer.

This procedure has been developed to ensure that all affected company employees are provided with current information on the hazardous chemicals that they may encounter during their work. The basic principle of Hazard Communication (HAZCOM) is that anyone who works with hazardous chemicals has both a need and a right to know the identities and the hazards of any chemical to which they may be occupationally exposed. This principle has been propagated by the Occupational Safety and Health Administration (OSHA) in 29 Code of Federal Regulations (CFR) 1910.1200, "Hazard Communication."

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Some company activities are likely to occur in states or localities that either have or will have requirements that differ from those contained within the federal standard. In such circumstances, the local health and safety representative will be responsible for ensuring that these requirements are included in either a Site Health and Safety Plan or a similar document and conveyed to all affected employees. If federal, state, or local regulations vary or conflict, the more protective requirements and practices will be followed.

3. REFERENCES

3.1 Internal References

- EIG-HS-800 Motor Vehicle Operation and Maintenance
- EIG-HS-020 Accident Prevention Program: Reporting, Investigation, and Review

3.2 External References

- Title 10 Code of Federal Regulations (10 CFR) Part 707
- 49 CFR Part 40
- 49 CFR Part 40, Part 199

4. DEFINITIONS

None

5. RESPONSIBILITIES

5.1 Vice President of Health and Safety

The Vice President of Health & Safety is responsible for issuing, revising, and maintaining this procedure.

5.2 Director of Health and Safety

The Director of Health and Safety is responsible for the following:

- Contacting collection facilities, approved laboratories, and the medical review officer (MRO)
- Verifying that subcontractor programs meet the intent of this procedure

5.3 Project/Office Manager

The project/office manager is responsible for the following:

- Providing a copy of this procedure to covered non-DOT employees
- Contacting collection facilities, approved laboratories, and the MRO
- Handling positive (failed) test results
- Verifying that subcontractor programs meet the intent of this procedure
- Coordinating local testing program

5.4 Health and Safety Representative

The health and safety representative is responsible for the following:

- Providing a copy of this procedure to covered non-DOT employees

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- Contacting collection facilities, approved laboratories, and the MRO
- Verifying that subcontractor programs meet the intent of this procedure
- Coordinating local testing program

5.5 Substance Abuse Program Administrator

The substance abuse program administrator is responsible for the following:

- Issuing, revising, and maintaining this procedure
- Contacting collection facilities, approved laboratories, and the MRO
- Handling positive (failed) test results
- Verifying that subcontractor programs meet the intent of this procedure
- Coordinating local testing program

5.6 Medical Review Officer

The MRO is responsible for the following:

- Handling positive (failed) test results
- Evaluating test results

5.7 Employee

Employees are responsible for the following:

- Complying with Shaw E & I's Drug and Alcohol testing policy and this procedure
- Providing test specimens when requested.

6. PROCEDURE

All employees should read and sign Form EIG-HS101.01, The Shaw Drug and Alcohol Policy, prior to submitting to drug and alcohol testing. Additional provisions that consider non-DOT regulations and drug and alcohol laws of Puerto Rico are contained in Attachment 1. The following sections describe Shaw's drug and alcohol testing program.

6.1 Illegal Drugs

The use, possession, concealment, manufacturing, promotion, transportation, distribution or sale of illegal drugs by any Employee or any employee of any subcontractor or lower tier subcontractor of Shaw E & I is strictly prohibited on all Company and Host Employer Premises and during Company working hours at any location and is grounds for disciplinary action up to and including termination.

Illegal drugs are defined as any drug (or the synthetic or generic equivalents of such drugs) that is illegal under Federal, state, or local laws. This includes but is not limited to marijuana, heroin, hashish, opiates, cocaine, hallucinogens, methamphetamine, depressants, and stimulants not prescribed for current medical treatment by a licensed physician.

6.2 Alcohol

Possession or consumption of alcohol on Company or Host Employer's Premises or unauthorized consumption while on the job is a violation of this procedure and is grounds for disciplinary action up to and including termination. Alcohol or alcoholic beverages means any beverage that has an

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alcoholic content and that is subject to state regulatory control for distribution as an alcoholic beverage.

6.3 Prescribed Medications

Any Employee undergoing medical treatment by a physician, dentist or other medical professional that includes the use of any drug or medication capable of affecting the Employee's mental or physical abilities is required to communicate to his/her supervisor that he/she is taking the medication.

In any situation whereby an Employee's medications are capable of affecting the Employee physically or mentally and thus affecting his/her ability to work safely, the Employee is required to consult with their physician and explain their job requirements. The Employee must provide a release to work to their supervisor from the treating physician prior to returning to work.

It is the responsibility of an Employee to communicate to his/her supervisor if he/she is taking medication that is capable of affecting the Employee mentally or physically. If the Employee fails to do so it is a violation of this procedure and is grounds for disciplinary action up to and including termination.

Any questions concerning this section of the procedure should be directed to Shaw E & I's Human Resources Department or Shaw E & I's Substance Abuse Program Administrator.

6.4 Drug and Alcohol Testing

Shaw E & I may utilize any type of drug or alcohol test allowed by both Federal laws and the laws of the state in which an Employee is employed to help in the control of or in the detection of drug or alcohol usage that violates this procedure. Drug and alcohol tests will be conducted for job related purposes and be consistent with business necessity.

Drug and alcohol tests may be utilized in, but are not limited to, the following circumstances, as may be allowed under the laws of the jurisdiction in which the Employee is employed:

- Post-offer, pre-employment examinations
- Random/Unannounced sampling
- Post-accident
- Reasonable cause or suspicion
- Post rehabilitation
- When otherwise requested or required by the client or by contract and pursuant to applicable law.

Employees agree to comply with drug testing facilities and sign all consent forms needed by the drug testing facilities.

Employees assigned to U.S. Department of Energy (DOE) sites may be required to participate in facility-specific drug and alcohol screening pools meeting the requirements of Title 10 Code of Federal Regulations (10 CFR) Part 707.

6.4.1 Post offer Pre-Employment Drug Testing

This section applies to all states except Montana which has restrictions in place where certain additional requirements should be followed pursuant to state legislation. Call the Medical Services Department for additional guidance on drug testing in the state of Montana.

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Following an employment offer and prior to becoming an active Employee, the applicant/prospective Employee will be tested to determine use of illegal drugs. No Employee will begin work on any project or at any subcontractor location without submitting to and successfully passing an approved, pre-employment drug testing method pursuant to the requirements set forth in this procedure.

In circumstances where an Employee has been laid-off or terminated from Shaw E & I and subsequently re-hired by Shaw E & I within a 30 day period, the Employee will not be required to submit to a post-offer, pre-employment drug test before beginning work on a project as long as the Employee has submitted to a drug test with Shaw E & I within one calendar year. In cases where the Employee is re-hired within 30 days and has not been drug tested with Shaw E & I within one calendar year, the Employee will be required to submit to a post-offer, pre-employment drug test before beginning work on any project or at any location.

In circumstances where an Employee has been laid-off or terminated from Shaw E & I and subsequently re-hired with Shaw E & I after a 30 day time period, the Employee will be required to submit to a post-offer, pre-employment drug test before beginning work on any project or at any location.

In circumstances where an Employee was terminated for a positive drug test, including refusing to take a drug test (which is assumed positive by Shaw E & I) and that Employee is re-applying for employment, the prospective Employee will have to take a pre-employment, post-offer drug test, as well as fulfill all of the requirements of Section 6.6.3 of this procedure.

6.4.2 Random/Unannounced Drug Testing

This section applies in all states and/or cities, except; Rhode Island; Vermont; San Francisco, California; and Boulder, Colorado. There are restrictions in Massachusetts, New Jersey, New York, West Virginia, Connecticut, Maine, Minnesota, Montana, and California where certain additional requirements should be followed pursuant to state legislation. Call the Medical Services Department for guidance.

A random/unannounced drug testing program is in effect and all Employees are subject to a random/unannounced drug testing program unless prohibited by state or local law. Accordingly, due to certain state and local law exclusions, certain offices, sites, or project locations may not be included in the random/unannounced drug testing program. Employees at locations whereby random/unannounced drug testing is allowed will be included in the selection process for random/unannounced drug testing by using a computer based random number generator that is matched to an Employee's I.D. or reference number. These tests shall be random, unannounced, and conducted in the concurrent quarter with the quarterly random selection process. The goal of the program shall be to randomly test a minimum of ten percent of the affected work force not covered by DOT or different contract requirements, on a quarterly basis.

6.4.3 Post-Accident Drug/Alcohol Testing

This section applies in all states, except in San Francisco, California. There are restrictions in Boulder, Colorado; Connecticut; Iowa; Maine; Vermont; Rhode Island; Mississippi; and Oklahoma where certain additional requirements should be followed pursuant to state legislation. Call the Medical Services Department for additional guidance.

Subject to Federal and state laws, Shaw E & I will conduct post accident/injury drug and/or alcohol tests on any Employee receiving medical care for a work-related injury. This post-accident testing shall be performed as soon as practicable following work-related accidents or incidents. Additionally, Shaw E & I shall require a drug/alcohol test for any Employee Shaw E & I reasonably believes contributed or caused the accident or incident. A drug/alcohol test may be performed in the following situations:

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1. Any incident or accident that causes the Employee or third party affected by an Employee's actions to seek medical care for work-related injuries.

2. Any incident or accident resulting in serious personal injury or death.

3. Any property/equipment damage equal to or exceeding $2,500.00 or any property/equipment damage considered to be significant by Shaw E & I representative.

4. Any Chargeable Vehicle Accident (see EIG-HS-800).

6.4.4 Reasonable Cause Drug/Alcohol Testing

This section applies in all states, except in Vermont and Rhode Island.

Reasonable cause drug/alcohol testing will be performed when an Employee is observed by at least two trained Company representatives displaying symptoms or behavior that he/she is using drugs or alcohol or is under the influence of a substance prohibited by this procedure. The two Company representatives shall complete Form EIG-HS-101.02 of this procedure describing their observations. For training opportunities in reasonable suspicion drug testing, the Medical Services Department should be contacted. Such symptoms or behaviors include, but are not limited to, the following:

- Extreme drowsiness, respiratory depression, large pupils, constricted pupils, and slurred speech
- Disorientation
- Drunken behavior with or without the use of alcohol
- Admission by Employee of hallucinations or drug/alcohol use on the job
- Unexplained tremors, convulsions, or violent behavior
- Excessive absenteeism/tardiness, including established absentee patterns
- Significant decline in job performance
- Significant change in personality (misconduct, insubordination)
- Unexplained absences from workstation
- Information from credible source(s) indicating possible substance abuse
- Changes in personal hygiene
- Difficulty in motor coordination

A reasonable cause drug/alcohol test will also be performed on an Employee that is arrested during non-work hours for a drug/alcohol offense as soon as practical when he/she returns to the jobsite to the extent permitted by Federal, state, and local law.

The Employee suspected will not be allowed to operate any equipment. If an on-site collection is not available the Employee suspected will be driven by a Company representative for testing. The Employee suspected will not be allowed to return to work until receipt of a negative test.

6.4.5 Post-Rehabilitation Drug/Alcohol Testing

This section applies in all states. There are restrictions in Maine and Vermont where certain additional requirements should be followed pursuant to state legislation. Call the Medical Services Department for additional guidance.

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Subject to applicable Federal and state laws, any Employee who is eligible to return to work after receiving counseling/rehabilitation, as recommended by a state-certified substance abuse professional, will be required to sign a return to work agreement (Form EIG-HS-101.03), pass a drug/alcohol test before returning to duty, and is subject to periodic unannounced drug/alcohol tests for a period of 24 months after returning to duty.

6.5 DRUG/ALCOHOL TESTING PROCEDURES

Shaw E & I has in place specific written procedures for specimen collection, testing, storage and laboratory urinalysis. These procedures are available for review and can be requested from your supervisor, Shaw E & I's Human Resources Department or Shaw E & I's Substance Abuse Program Administrator.

6.5.1 Collection Sites/Laboratories

Shaw E & I will select collection sites and/or laboratories, certified by the U.S. Department of Health and Human Services and/or appropriate state agencies, to conduct drug/alcohol tests. The collection sites and/or laboratories will agree to conduct tests in accordance with applicable state and Federal laws and regulations.

6.5.2 Medical Review Officer

The MRO is a licensed physician with knowledge of substance abuse disorders. The MRO will receive all dilute specimen reports, all positive drug test results, and certain pre-employment tests from the laboratory and will verify the test result. Pre-employment test results that are reported as positive will not be reviewed by the MRO except in situations where it is required by local or state law.

6.5.3 Cost of Testing

All costs of drug/alcohol tests required by Shaw E & I are paid for by Shaw E & I.

6.5.4 Time of Testing

Employees are required to report to the drug/alcohol testing location designated by Shaw E & I immediately after notification from Shaw E & I. Generally, drug/alcohol tests are scheduled immediately before, during or immediately after an Employee's work hours, and Employees will be given a maximum of two hours after notification to report to the testing facility. If the Employee requires additional time, he/she is required to provide the reason for the request for the time extension immediately, which will be considered by Shaw E & I's Substance Abuse Program Administrator (by calling the EH&S department in Baton Rouge, LA at 225-932-2500). Requests should be presumed denied unless specifically granted by the Substance Abuse Prevention Administrator within the two hour time frame.

6.5.5 Inability to Provide Drug Screen Sample

Any Employee who is unable to provide a specimen sample within three hours of the first attempt to provide such specimen for a drug/alcohol test will be treated as refusing to cooperate with this procedure and will not be considered for employment or be subject to disciplinary action, up to and including termination. However, an applicant/prospective Employee or Employee who is unable or cannot provide a sample specimen within three hours due to a medical condition or illness must notify Shaw E & I's Substance Abuse Program Administrators immediately (by calling the EH&S department in Baton Rouge, LA at 225-932-2500.)

Employees will be required to make a first attempt at providing a specimen within 30 minutes of arrival at the collection facility/location.

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6.5.6 Pending Test

Any Employee whose test result is pending final analysis confirmation by the MRO may immediately be removed from the work site until final results are available.

6.5.7 Rapid Drug Testing Cups

This section applies in all states except for on-site purposes in Minnesota and Vermont. There are restrictions in Puerto Rico and New York where certain additional requirements should be followed pursuant to state legislation. Call the Medical Services Department for guidance.

Rapid drug testing cups/dipsticks should only be used when authorized by state law and/or local legislation and when proper written approval is received from the Substance Abuse Program Administrator.

If a rapid drug testing cup is used, the following will apply:

- A result from a rapid drug testing cup is never considered positive; if there is a presence of drugs detected the result is considered non-negative.
- Non-negative specimens must be sent to the lab for GC/MS confirmation and MRO evaluation (if confirmed positive).
- A third party specimen collector must be utilized unless written approval is obtained from the Substance Abuse Program Administrator.
- If a rapid drug testing cup is non-negative then an Employee may be suspended pending confirmation result from the lab. An Employee will not proceed in the hiring process with a non-negative rapid drug testing cup result until a confirmed negative result is received. An Employee can proceed in the hiring process if a negative rapid drug testing cup result is received.
- All specimens from a rapid drug testing cup, whether negative or non-negative, must be sent to the lab for analysis.

6.5.8 Procedure for Rebutting and/or Appealing a Positive Drug or Alcohol Test Result

If an Employee rebuts and/or appeals a positive drug or alcohol test result; Section 6.6.5 of this procedure will be followed.

6.5.9 Procedure for Post-Accident Drug Testing

To determine if a post accident drug test is required, see Section 6.4.3 of this procedure. If a post-accident drug test is required, the following will apply:

- The drug test must have a completed chain-of-custody.
- In the event of a non-negative drug test result, the Employee will be suspended pending the GC/MS confirmation and MRO evaluation (if needed).
- The specimen collection will be administered by a third party.
- In the event a medical provider does not provide drug testing services, the Substance Abuse Program Administrator should be called immediately.
- A refusal to submit to a post-accident drug test will be considered a positive drug test/refusal to comply with this procedure (refer to Section 6.5.5) and is grounds for disciplinary action up to and including termination.

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6.5.10 Procedure for Observed Specimen Collection

This section applies in all states except: Boulder, Colorado; Connecticut; Oklahoma; California; Maine; and Rhode Island.

An observed specimen collection will be allowed under the following circumstances:

- A person provides a specimen and the temperature is out-of-range.
- An Employee that leaves the testing area without the approval from Shaw E & I representative.
- There is clear and convincing evidence that a person is trying to substitute a specimen sample with another sample.
- A person gives a sample that is too dilute to test.
- A client requests that all drug test collections be witnessed.
- An adulterant is detected in a person's specimen.
- A third party observer of the same sex as the Employee must be utilized unless written approval is obtained from the Substance Abuse Program Administrator.

Specimens will be collected per the guidance in Attachment 2.

6.6 Results of Drug/Alcohol Screen

Compliance with the Drug and Alcohol Program is a condition of employment. Employees who violate any provision in this procedure will not be considered for employment or are subject to disciplinary action, up to and including termination, pursuant to Shaw E & I's guidelines and applicable Federal and state laws.

6.6.1 Positive Drug and Alcohol Tests

Any Employee who has a positive drug/alcohol test result (pursuant to the minimum cutoffs designated by Shaw E & I, client or otherwise provided by applicable state law) will be notified of a positive test result. The consequences of a positive test result and procedures for appealing the positive test result will be explained prior to any disciplinary or adverse action being taken. Every Employee has the right to inspect and/or obtain a copy of the positive drug/alcohol test. If, after a conditional offer of employment, an Employee tests positive, the offer of employment will be withdrawn.

6.6.2 Positive Drug Tests

Any existing Employee who tests positive is subject to disciplinary action, up to and including termination, pursuant to Shaw E & I's guidelines and applicable Federal and state laws. An Employee denied employment or an existing Employee whose employment has been terminated as a result of a positive drug test may re-apply for employment within Shaw E & I after:

- Waiting at least 90 days after the date that the initial positive drug test was reported.
- Waiting at least 180 days after the date that the second positive drug test was reported.
- Waiting at least 1 year after the date that the third or any subsequent positive drug test were reported.
- Successfully completing an evaluation by a state-certified substance abuse professional and successfully completing or in the process of completing all recommended courses of

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treatment established by the substance abuse professional and providing documentation from the substance abuse professional to Shaw E & I.

- Completing Form EIG-HS-101.03.

Shaw E & I will require any such individual to comply with the provisions of this procedure and to be subject to periodic unannounced drug testing for 24 months as is allowed under Federal and/or state laws.

6.6.3 Positive Alcohol Tests

Any existing Employee who has a breath alcohol level of 0.02 through 0.039 will be immediately suspended from any work duties with Shaw E & I unless he/she works in Montana where the breath alcohol level has to be greater than 0.04 to be recognized as positive. An Employee may return to work at his or her next scheduled shift as long as his or her breath alcohol level is below 0.02. All breath alcohol tests must be administered by a certified technician. Any existing Employee who has a breath alcohol level of 0.04 or higher will be subject to disciplinary action, up to and including termination, pursuant to Shaw E & I's guidelines and applicable Federal and state laws.

An Employee denied employment or an existing Employee of Shaw E & I whose employment has been terminated as a result of a positive breath alcohol test of 0.04 or higher may re-apply for employment within Shaw E & I after:

- Waiting at least 90 days after the date of the initial positive breath alcohol test.
- Waiting at least 180 days after the date that the second positive breath alcohol test is reported.
- Waiting at least 1 year after the date that the third or subsequent positive breath alcohol tests are reported.
- Successfully completing an evaluation by a state-certified substance abuse professional and successfully completing or in the process of completing all recommended courses of treatment established by the substance abuse professional and providing documentation from the substance abuse professional to Shaw E & I.
- Completing Form EIG-HS-101.03.

Shaw E & I will require any such individual to comply with the provisions of this procedure and to be subjected to periodic unannounced alcohol testing for 24 months as is allowed under Federal and/or state laws.

Employees that have been drinking alcohol on their personal time and are called in for "emergency" work must declare to their supervisors that they have been drinking alcohol; employees who declare to their supervisors that they have been dirking alcohol on their personal time will not be subject to disciplinary action. Any employee that arrives at work under the influence of alcohol will be subject to breath alcohol testing and the subsequent appropriate disciplinary action, up to and including termination.

Any employee that is scheduled "on-call" should not drink any alcohol during the timeframe they are "on-call." Any employee that drinks alcohol while scheduled "on-call", is called in for work, and is found to be under the influence of alcohol will be subject to disciplinary action up to and including termination.

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6.6.4 Rebutting and/or Appealing a Drug or Alcohol Test Result

Any Employee may rebut the drug or alcohol test results to the extent an opportunity to rebut is provided under applicable state or local law. The Employee should contact the MRO to discuss, explain or contest the test results within the appropriate time period under state or local law.

Any Employee that desires to appeal a drug or alcohol test result can have the original specimen re-tested. Employee must request re-test within 72 hours (or the specific time period pursuant to local or state law if different) of receiving initial notice of test result from the MRO. All requests for a re-test must be submitted to the MRO within the 72 hours after initial notification of result. The Employee will pay for the re-test of the original specimen unless prohibited by law. Payment for the re-test will be made to the appropriate clinic/MRO. The procedure of appealing a drug test result includes:

- The re-test will only be completed on the original specimen that yielded the positive result. A second specimen will not be collected.
- The cost of the re-test has to be paid by the Employee to the clinic/MRO before the specimen can be re-tested.
- The re-test will be completed at a SAMSHA certified lab of the Employee's choice. The Employee will send the name and address of the SAMSHA certified lab along with the payment to the clinic before the specimen can be re-tested.
- The result of the re-test will serve as the final determining result regarding the appeal process. No further retesting is allowed.

6.6.5 Adulterated, Unsuitable or Diluted Samples

Existing Employees:

Adulterated, unsuitable, or diluted urine samples in which the analytical laboratory cannot yield a result, as determined by the MRO and in accordance with state and Federal guidelines, will be treated as positive samples. Employees who furnish adulterated, unsuitable, or diluted urine samples may be required to submit to a second drug screen and/or are subject to disciplinary action, up to and including termination pursuant to Shaw E & I's guidelines and applicable Federal and state laws. Any re-testing of an Employee, because of an adulterated, unsuitable, or diluted urine sample submission shall be done in accordance with the time of submission requirements outlined in Section 6.5 and may require direct observation of collection. In the event that a specimen's temperature is out-of-range, an observed recollection will administered when allowed by Federal, state and local law. If the specimen's temperature is out-of-range after the observed recollection, it will be considered as a refusal to provide a valid specimen.

Dilute specimens at the lab will be tested at level of detection (LOD). Any employee who has a dilute/negative drug test result will be treated as negative; if the drug test result is dilute/positive then the employee will be treated as positive and subject to disciplinary action, up to and including termination.

Applicants / Prospective Employees:

If, after a conditional offer of employment, it is determined that an applicant/prospective Employee provided an adulterated or unsuitable urine sample, as determined by the MRO and in accordance with state and Federal guidelines, that individual will not be considered for a position with Shaw E & I. The applicant may re-apply for employment with Shaw E & I after waiting at least 90 days after the date of the adulterated or unsuitable urine sample.

If an applicant provides a diluted urine sample, as determined by the testing laboratory, the sample will be analyzed and measured to level of detection as to determine if the sample contains any trace amounts of illegal drugs (as described in Section 6.1). If it is then determined

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that the dilute sample contains any trace amounts of illegal drugs, the employment process will be terminated and the applicant will not be allowed to re-apply for employment until after 90 days following the date of the test and completing the provision in Section 6.6.5. However, if it is determined that the original dilute sample does not contain any trace amounts of illegal drugs, the specimen will be reported out as a negative drug test and the applicant will be eligible for employment.

6.7 Privacy and Confidentiality

Individual privacy and confidentiality will be carefully respected in maintaining a record retention program. Any information obtained through drug/alcohol testing unrelated to the use of drugs and/or alcohol will be held in strict confidence by the MRO and not released to Shaw E & I. With the exception of the testing laboratory, the MRO, and the Substance Abuse Program Administrator (or other individuals designated by Shaw E & I to receive and evaluate test results and resulting employment decisions), the results of individual drug tests will not be released to anyone without the express written authorization of the tested individual, except as ordered by a Court or governmental agency. Results that are reported to Shaw E & I by the MRO as positive will also be held in strict confidence with individual privacy and confidentiality being carefully respected.

Written records will be stored in locked containers or in a secured location. Such records will not be made a part of individual personnel files. Unless an Employee gives his or her written consent, the Employee's drug/alcohol test records will not be released to a subsequent employer absent a court order or unless required by Federal or state law.

6.8 Searches and Inspections

Shaw E & I may at any time conduct searches and inspections where there is reason to believe that an Employee may be in possession of substances which are prohibited under this Policy. Shaw E & I has the right to inspect an Employee's personal property on Company or Host Employer Premises. This search will be for the purpose of determining if such Employees are in possession, use, transportation or concealment of any prohibited items or substances. Searches and inspections may be conducted without prior announcement. Submission to a search or inspection is a condition of employment. Failure to cooperate and not signing the consent form (EIG-HS-101.01) shall result in immediate suspension and is grounds for disciplinary action up to and including termination. Employees acknowledge and agree that they have no expectation of privacy in any space, item, locker, property, or equipment located on Company or Host Employer Premises or equipment owned, operated, leased, provided, or controlled by Shaw E & I or a Host Employer.

If an illegal substance is found Company or Host Employer Premises, a phone call to the authorities, the Substance abuse program administrator or the Human Resource Business Unit Director should be made immediately. The person that discovered the illegal substance should document his/her findings thoroughly.

6.9 Criminal Drug Conviction

Any Employee who has had a criminal drug conviction for a drug offense must notify Shaw E & I within five (5) days of that conviction. When an Employee has been convicted (meaning a finding of guilt or imposition of sentence, including a plea of *nolo contendre*) of a drug offense fails to notify Shaw E & I of such conviction, Shaw E & I will either pose a sanction on the Employee, up to and including termination, or require the Employee to satisfactorily complete a drug-abuse rehabilitation program before returning to work.

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6.10 Drug and Alcohol Education/Employee Assistance Program (EAP)

Drug and alcohol use awareness education will assist Company representatives and Employees to recognize individuals who may be abusing drugs or alcohol. The purpose of drug and alcohol awareness education is to:

- Provide Employees with an awareness of alcohol and drug use problems concerning the health and safety aspects of such use.
- To help Employees recognize symptoms of abuse.
- To help Employees recognize drugs and drug paraphernalia.
- To help Employees understand this procedure and penalties for violating this procedure and to outline procedures for handling situations related to this procedure.
- To reinforce Employee awareness of Shaw E & I's work rules on this subject.
- To reinforce the dangers of drug and alcohol abuse in the workplace.
- Provide information on the availability of drug and alcohol counseling, rehabilitation and Employee assistance.

Any Employee desiring information on substance use and abuse or a list of Employee Assistance Programs available in your area should contact Shaw E & I's Human Resources Department or Shaw E & I's Substance Abuse Program Administrator.

7. ATTACHMENTS

- Attachment 1, The Shaw Group Inc. Drug and Alcohol Non-DOT Policy Puerto Rico Addendum
- Attachment 2, Specimen Collection Procedure

8. FORMS

- EIG-HS-101.01, The Shaw Drug and Alcohol Policy Acknowledgement
- EIG-HS-101.02, Reasonable Suspicion Documentation Form
- EIG-HS-101.03, Re-Hire Certification and Agreement Employees Returning from a Substance Abuse Counseling/Rehabilitation Program

9. RECORDS

- EIG-HS-101.01, The Shaw Drug and Alcohol Policy Acknowledgement
- EIG-HS-101.02, Reasonable Suspicion Documentation Form
- EIG-HS-101.03, Re-Hire Certification and Agreement Employees Returning from a Substance Abuse Counseling/Rehabilitation Program

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10. REVISION HISTORY AND APPROVAL

Revision Level Revision Date	Revision Description	Responsible Manager
00 4/24/2002	Initial issue	N/A
01-02 N/A	Information on Revision 1-2 is unavailable.	N/A
03 5/7/2006	Information on Revision 3 is unavailable.	Troy Allen
04 12/19/2008	Revised to reflect changes that Corporate made to their Drug and Alcohol Testing Procedure.	Troy Allen
05 3/15/2010	Changes were made to return to work timeframes after a positive result (90, 180, 1 year) as well as notification requirements surrounding off-duty alcohol consumption and the notification to supervisors before reporting for call-out.	Troy Allen
06 12/13/2011	Modified format only to align with Governance Management framework.	Andrew Johnson

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Attachment 1
The Shaw Group Inc. Drug and Alcohol Non-DOT Policy
Puerto Rico Addendum

I. Puerto Rico Law

A. Possession

Under Puerto Rico law, **24 L.P.R.A. § 2404,** it is unlawful for any person knowingly or intentionally, to possess any controlled substance, unless such substance was obtained directly or pursuant to a valid prescription or order from a practitioner, while acting in the course of his professional practice.

Any person who violates Puerto Rico law shall be guilty of a felony and upon conviction thereof, shall be punished by imprisonment for a fixed term of three (3) years. Should there be aggravating circumstances, the fixed penalty established may be increased to a maximum of five (5) years; if there should be extenuating circumstances, it may be reduced to a minimum of two (2) years. The court, in its discretion, in addition to imprisonment, may impose a fine that shall not exceed five thousand (5,000) dollars and an administrative fee.

If such person commits the said offense after one or more previous convictions under this subsection are final, he shall be guilty of a felony and, upon conviction thereof, shall be sentenced to imprisonment for a fixed term of six (6) years. Should there be aggravating circumstances, the fixed penalty established may be increased to a maximum of ten (10) years; if there should be extenuating circumstances, it may be reduced to a minimum of four (4) years.

If any person who has not been previously convicted of violating Puerto Rico law or any other law of the United States, related to narcotic drugs, marijuana or stimulant or depressant substances, is found guilty of violating subsection (a) of this section, be it after a trial or entering a plea of guilty, the court, without entering a verdict of guilty and with the consent of said person, may defer further proceedings and place said person on probation under such reasonable terms and conditions as it may require and for a fixed term of three (3) years. Should there be aggravating circumstances, the fixed penalty established may be increased to a maximum of five (5) years; should extenuating circumstances exist, it may be reduced to a minimum of two (2) years. The court shall advise the defendant that should he/she abandon the treatment and rehabilitation program, he/she shall be sanctioned pursuant to the provisions of § 4428 of Title 33.

B. Manufacture and Distribution

Under Puerto Rico law it is unlawful for any person knowingly or intentionally:

(1) To manufacture, distribute, dispense, transport or conceal or possess with the intent to manufacture, distribute, dispense, transport or conceal a controlled substance; or
(2) To produce, distribute or dispense, transport or conceal or possess with the intent to distribute or dispense, transport or conceal an adulterated substance.

Any person who violates this Puerto Rico law will be convicted of a felony and punished in accordance with the type of drug involved. Such punishment ranges from a sentence of a minimum of a fixed term of ten years to a maximum of a fixed term fifty years in prison. In addition, the court, in its discretion, may impose a fine, not to exceed fifty thousand (50,000) dollars and an administrative fee.

II. United States Law

Under the laws of the United States of America, it is unlawful for any person knowingly or intentionally:

(1) To manufacture, distribute or dispense or possess with intent to manufacture, distribute or dispense, a controlled substance; or
(2) To import or export a controlled substance.

Any person who violates this law will be sentenced to a term of imprisonment ranging from 5 years to 40 years and a fine of up to $20,000,000, depending on the type and quantity of the controlled substance or drug involved.

Attachment 2
Specimen Collection Procedures

Subject to laws and regulations of the jurisdiction in which the Employee may be employed, the specimen collection shall be conducted in the following manner. Specimens used in testing shall be collected by a certified laboratory or their agents in a manner in compliance with applicable state and Federal laws and regulations.

Drug Screen Specimen Collection

A. Scope

1. The drug testing custody and control form is to be used as a permanent record on which identifying data on the Employee and on the specimen collection and transfer process are retained. The drug-testing plan requires testing for at least marijuana, cocaine, opiates, amphetamines, and phencyclidine.

2. Urine Drug Screen specimens collected under this plan may be used only to test for controlled substances designated or approved for testing as described in this procedure and shall not be used to conduct any other analysis or test.

3. This plan does not prohibit procedures reasonably incident to the analysis of the specimen for controlled substances (e.g., determination of pH or tests for specific gravity, creatinine concentration, or presence of adulterants).

B. Procedures

1. The collection site person shall utilize the drug testing custody and control form provided by company; this form must address the requirements as contained in § 40.23. The custody and control form must comply with the provisions as contained in 49 CFR Part 40 with regard to the information that must be contained on the form. (Standard Form #DOT, 3900.0 or equivalent).

2. The drug testing custody and control form may include such additional information as may be required for billing or other legitimate purposes necessary to the collection.

3. A clean, single-use specimen bottle that is securely wrapped until filled with the specimen and use of a tamper proof sealing system, designed in a manner such to ensure against undetected opening shall be utilized.

4. Written procedures, instructions, and training shall be provided as follows:

   a. Shaw E & I may contract for and utilize when possible, an independent collection Site. The independent collection site shall abide by all procedures, techniques and methods outlined in 49 CFR Part 40, Part 199 and any DOT agency regulation, as well as those outlined in this document.

   b. Company collection procedures and training shall clearly emphasize that the collection site person is responsible for maintaining the integrity of the specimen collection and transfer process, carefully ensuring the modesty and privacy of the donor and is to avoid any conduct or remarks that might be construed as accusatorial or otherwise offensive or inappropriate.

   c. The collection site person shall have successfully completed training to carry out this function or shall be a licensed medical professional or a technician who has been provided instructions for collection and certifies completion as required.

d. Unless it is impracticable for any other individual to perform this function, a direct supervisor of an Employee shall not serve as the collection site person for a test of the Employee.

5. The collection individual shall use a shipping container in which the specimen and associated paper work may be transferred and which can be sealed and initialed to prevent undetected tampering.

C. Security

1. The purpose of this section is to prevent unauthorized access, which could compromise the integrity of the collection process of the specimen.

2. The designated collection site is to be secure. If a collection site facility is dedicated solely to urine collection, it shall be secure at all times. If a facility cannot be dedicated solely to drug testing, the portion of the facility used for testing shall be secure during drug testing.

3. A facility normally used for other purposes, such as a public rest room or hospital examining room, may be secured by visual inspection to ensure other persons are not present and undetected access (e.g., through a rear door not in the view of the collection site person) is not possible. Security during collection may be maintained by effective restriction of access to collection materials and specimens. In the case of a public rest room, the facility must post and secure against access during the entire screen collection procedure to avoid embarrassment to the Employee or distraction of the collection site person.

4. If it is impractical to maintain continuous physical security of a collection site from the time the specimen is presented until the sealed mailer is transferred for shipment, the following minimum procedures shall apply:

   a. The specimen shall remain under the direct control of the collection site person from delivery to its being sealed in the mailer.

   b. The mailer shall be immediately mailed, maintained in secure storage, or remain until mailed under the personal control of the collection site person.

D. Chain-of-Custody

1. The chain-of-custody block, of the drug testing custody and control form, shall be properly executed by authorized collection site personnel upon receipt of specimens.

2. Handling the transportation of urine specimens from one authorized individual or place to another shall always be accomplished through chain-of-custody procedures. Every effort shall be made to minimize the number of persons handling specimens.

E. Access to Authorized Personnel Only

1. No unauthorized personnel shall be permitted in any part of the designated collection site when urine specimens are collected or stored. Only the collection site person may handle specimens prior to their sealing in the mailing container or monitor or observe a specimen collection (under the conditions specified in this section).

2. To promote security of specimens, avoid distraction of the collection site person and ensure against any confusion in the identification of specimens, the collection site person shall have only one donor under supervision at anytime.

3. For this purpose, a collection procedure is complete when the urine bottle has been sealed and initialed, the drug testing custody and control form has been executed and the Employee has departed the site (or, in the case of an Employee who was unable to provide a complete specimen, has entered a waiting area).

F. Privacy

1. Procedures for collecting urine specimens shall allow individual privacy unless there is a reason to believe that a particular individual may alter or substitute the specimen to be provided, as further described in this section.

2. For purposes of this procedure, the following circumstances are the exclusive grounds constituting a reason to believe that the individual may alter or substitute the specimen:

   a. The Employee has presented a urine specimen that falls outside the normal temperature range (32.0_C/90_F – 38_C/100_F), &

      (1) The Employee declines to provide a measurement of oral body temperature, as provided in paragraph G.14. of this section; or

      (2) Oral body temperature varies by more than 1_C/1.8_F from the temperature of the specimen.

   b. The last urine specimen provided by the Employee (i.e., on a previous occasion) was determined by the laboratory to have a specific gravity of less than 1.003 and a creatinine concentration below 0.2g/L.

   c. The collection site person observes conduct clearly and unequivocally indicating an attempt to substitute or adulterate the sample (e.g., substitute urine in plain view, blue dye in specimen presented); or

   d. The Employee has previously been determined to use a controlled substance without medical authorization or the particular test was being conducted under a DOT regulation providing for follow-up testing upon or after return to service.

3. A higher-level supervisor of the collection site person or a designated employer representative shall review and concur in advance with any decision by a collection site person to obtain a specimen under the direct observation of a same gender collection site person based upon the circumstances described in paragraph 2 above.

G. Integrity and Identity of the Specimen

The collection site person shall take precautions to ensure that a urine specimen is not adulterated or diluted during the collection procedure and that information on the urine bottle and on the urine custody and control form can identify the individual from whom the specimen was collected. The following minimum precautions shall be taken to ensure that unadulterated specimens are obtained and correctly identified:

1. To deter the dilution of specimens at the collection site, toilet-bluing agents shall be placed in toilet tanks wherever possible, so that reservoir of water in the toilet bowl always remains blue. Where practicable, there shall be no other source of water (e.g., no shower or sink) in the enclosure where urination occurs. If there is another source of water in the enclosure, it shall be effectively secured or monitored to ensure it is not used as a source for diluting the specimen.

2. When an individual arrives at the collection site, the collection site person shall ensure that the individual is positively identified as the Employee selected for testing (e.g.,

through presentation of photo identification or identification by the employer's representative). If the individual's identity cannot be established, the collection site person shall not proceed with the collection. If the Employee requests, the collection site person shall show proper identification to the Employee. The Employee shall complete any required registration/consent form at collection site.

3. If the individual fails to arrive at the assigned time, the collection site person shall contact the appropriate authority to obtain guidance on the action to be taken.

4. The collection site person shall ask the individual to remove any unnecessary outer garments such as a coat or jacket that might conceal items or substances that could be used to tamper with or adulterate the individual's urine specimen. The collection site person shall ensure that all personal belongings such as a purse or briefcase remain with the outer garments. The individual may retain his or her wallet. If the Employee requests it, the collection site person shall provide the Employee a receipt for any personal belongings.

5. The individual shall be instructed to wash and dry his or her hands prior to urination.

6. After washing hands, the individual shall remain in the presence of the collection site person and shall not have access to any water fountain, faucet, soap dispenser, cleaning agent, or any other materials which could be used to adulterate the specimen.

7. The individual may provide their specimen in the privacy of a stall or otherwise partitioned area that allows for individual privacy. The collection site person shall provide the individual with a specimen bottle or collection container, if applicable, for this purpose.

8. The collection site person shall note any unusual behavior or appearance on the urine custody and control form.

9. In the exceptional event that an employer-designated collection site is not accessible and there is an immediate requirement for specimen collection (e.g., circumstances require a post-accident test), a public restroom may be used according to the following procedures: A collection site person of the same gender as the individual; shall accompany the individual into the public restroom this shall be secured during the collection procedure. If possible, a toilet bluing agent shall be placed in the bowl and any accessible toilet tank. The collection site person shall remain in the restroom, but outside the stall, until the specimen is collected. If no bluing agent is available to deter specimen dilutions the collection site person shall instruct the individual not to flush the toilet until the specimen is delivered to the collection site person. After the collection site person has possession of the specimen, the individual will be instructed to slush the toilet and to participate with the collection site person in completing the chain-of-custody procedures.

10. If Shaw E & I is using the single collection method then the following procedures shall be used:

    a. The collector may choose to direct the Employee to urinate either directly into a specimen bottle or into a separate collection container.

    b. If a separate collection container is used, the collection site person or the Employee shall pour at least 30 ml of the urine from the collection container into the specimen bottle in the presence of the Employee

11. Collection Methodology

    a. In either collection methodology, upon receiving the specimen from the individual the collection site person shall determine if it has at least 30 ml of urine for a single specimen collection or 45 ml of urine for a split specimen collection.

    b. If the individual has not provided the required quantity of urine, the specimen shall be discarded. The collection site person shall direct the individual to drink up to 40 ounces of fluid, distributed reasonably through a period of up to three hours or until the individual has provided a new urine specimen, whichever occurs first. If the Employee refuses to drink fluids as directed or to provide a new urine specimen, the collection site person shall terminate the collection and notify the employer that the Employee has refused to submit to testing. If the Employee has not provided a sufficient specimen within three hours of the first unsuccessful attempt to provide the specimen, the collection site person shall discontinue the collection and notify the employer.

12. After the specimen has been provided and submitted to the collection site person, the individual shall be allowed to wash his or her hands.

13. Immediately after the specimen is collected, the collection site person shall measure the temperature of the specimen. The temperature-measuring device used must accurately reflect the temperature of the specimen and not contaminate the specimen. The time from urination to temperature measure is critical and in no case shall exceed 4 minutes.

14. A specimen temperature outside the range of 32.0_C90_F - 38_C/100_F, constitutes a reason to believe that the individual has altered or substituted the specimen (See Section F.2.a.). In such cases, the individual supplying the specimen may volunteer to have their temperature taken to provide evidence to counter the reason to believe the individual may have altered or substituted the specimen.

15. Immediately after the specimen is collected, the collection site person shall also inspect the specimen to determine its color and look for any signs of contaminants. Any unusual findings shall be noted on the urine custody and control form.

16. All specimens suspected of being adulterated shall be forwarded to the laboratory for testing.

17. Whenever there is reason to believe that a particular individual has altered or substituted the specimen as described in Section F.2.a. and c., a second specimen shall be obtained as soon as possible under the direct observation of a same gender collection site person.

18. Both the individual being tested and the collection site person shall keep the specimen in view at all times prior to its being sealed and labeled. As provided below, the specimen shall be sealed by placement of a tamper-proof seal over the bottle cap and down the sides of the bottle and labeled in the presence of the Employee. If the specimen is transferred to a second bottle, the collection site person shall request the individual to observe the transfer of the specimen and the placement of the tamper-proof seal over the bottle cap and down the sides of the bottle.

19. The collection site person and the Employee shall be present at the same time during procedures outlined in items 20 through 24 of this section.

20. The collection site person or Employee shall place securely on the bottle an identification label, which contains the date, the individual's specimen number and any other identifying information provided or required by the employer. If separate from the label, the tamper-proof seal shall also be applied.

21. The specimen donor shall initial the identification label on the specimen bottle for the purpose of certifying that it is the specimen collection from the donor.

22. The collection site person shall enter on the drug testing custody and control form all information identifying the specimen. The collection site person shall sign the drug testing custody and control form, certifying that the collection was accomplished according to the applicable Federal requirements.

23. The individual shall be asked to read and sign a statement on the drug testing custody and control form that the specimen collected from him/her is in fact that specimen he/she provided.

24. The collection site person shall complete the chain-of-custody portion of the drug testing custody and control form to indicate receipt of the specimen from the Employee and shall certify proper completion of the collection.

25. The urine specimen and chain-of-custody form are now ready for shipment. If the specimen is not immediately prepared for shipment, the collection site person shall ensure that it is appropriately safeguarded during temporary storage.

26. Control of Specimen

    a. While any part of the above chain-of-custody procedures is being performed, it is essential that the urine specimen and custody documents be under the control of the involved collection site person.

    b. If the involved collection site person leaves their workstation momentarily, the collection site person shall take the specimen and drug testing custody and control form with them or shall secure them. After the collection site person returns to the workstation, the custody process will continue. If the collection site person is leaving for an extended period of time, they shall package the specimen for mailing before leaving the site.

    c. The collection site person shall not leave the collection site in the interval between presentation of the specimen by the Employee and secure the sample with an identifying label bearing the Employee's specimen identification number and seal initialed by the Employee. If it becomes necessary for the collection site person to leave the site during this interval, the collection shall be nullified and at the election of Shaw E & I a new collection may be begun.

27. Collection Control

    a. To the maximum extent possible, collection site personnel shall keep the individual's specimen bottle within sight both before and after the individual has urinated. After the specimen is collected, it shall be properly sealed and labeled.

28. Transportation to Laboratory

    a. Collection site personnel shall arrange to ship the collected specimens to the drug testing laboratory. The specimens shall be placed in shipping containers designed to minimize the possibility of damage during shipment (e.g., specimen boxes and/or padded mailers); and those containers shall be securely sealed to eliminate the possibility of undetected tampering. On the tape sealing the container, the collection site person shall sign and enter the date specimens were sealed in the containers for shipment. The collection site person shall ensure that the chain-of custody documentation is attached to each container sealed for shipment to the drug-testing laboratory.

29. Failure to Cooperate

    a. If the Employee refuses to cooperate with the collection process, the collection site person shall inform the designated company representative and shall document the non-cooperation on the drug testing custody and control form.

30. Employee Requiring Medical Attention

    a. If the sample is being collected from an Employee in need of medical attention part of a post-accident test given in an emergency medical facility, necessary medical attention shall not be delayed in order to collect the specimen.

31. Use of Chain-of-Custody Forms

    a. A chain-of-custody form shall be used for maintaining control and accountability of each specimen form the point of collection to final disposition of the specimen. The date and purpose shall be documented on the form each time a specimen is handled or transferred and every individual in the chain shall be identified. Every effort shall be made to minimize the number of persons handling specimens.

Evidential Breath Testing (EBT) for Alcohol

A. Scope

1. The evidential and non-evidential testing procedures set forth in this section was developed from utilizing, a guidance document, the requirements as set forth in 49 CFR Part 40 and specifies the required form and disposition of such testing forms.

B. Alcohol Testing Form

1. Shaw E & I may utilize a form similar to that of a DOT Breath Alcohol Testing form or a form that is directly generated by an EBT and may omit the space for affixing a separate printed result to the testing form. In all cases, the form shall provide triplicate or three consecutive identical copies with copy 1 being retained by Shaw E & I, copy 2 shall be provided to the Employee and copy 3 shall be retained by the BAT/STT.

2. The Breath Alcohol Testing form may include such additional information as may be required for billing or other legitimate purposes necessary to the testing, provided that personal identifying information on the individual (other than the social security number or Employee identification number) may not be provided.

C. Breath Testing Locations

1. Shaw E & I shall ensure that there are sufficient breath testing sites or the availability of BAT's/STT's located within a reasonable proximity to each of Shaw E & I's work locations.

2. Shaw E & I shall conduct the testing in a location that affords visual and aural privacy to the Employee being tested. All necessary equipment, personnel, and materials for conducting the alcohol testing shall be provided at the testing site.

3. A mobile collection facility, such as a van that is equipped for alcohol testing, that meets the requirements set forth in this procedure may be utilized.

4. No unauthorized persons shall be permitted access to the testing site when the EBT remains unsecured or to prevent such individuals from seeing or hearing a test result.

5. In some circumstances Shaw E & I may have to conduct such alcohol testing outdoors at the scene of an accident that does not meet the requirements as specified in post-accident provisions of the procedure. In these situations the BAT/STT shall provide the necessary visual and aural privacy to the Employee to the greatest extent practicable.

6. The BAT/STT shall supervise only one Employee's use of the EBT at a time. The BAT/STT shall not leave the alcohol testing site while the testing process is in progress.

D. Alcohol Testing Equipment

1. General

   a. Shaw E & I shall use only approved evidential breath testing (EBT) devices and non-evidential devices for conducting the alcohol testing provisions required in the program. These devices are listed on NHTSA's conforming products list (CPL).

2. Screening Devices

   a. Shaw E & I shall utilize either non-evidential devices or EBTs listed on the CPL for screening tests.

3. Confirmation Devices

   a. Shaw E & I shall utilize an EBT listed on the CPL for confirmation testing.

4. NHTSA Conforming Products List (CPL)

   a. All devices that will be used by Shaw E & I for alcohol testing are NHTSA approved evidential breath alcohol testing devices. NHTSA has model specifications for evidential breath testing devices. NHTSA periodically publishes an updated Conforming Products List, which states which devices have met NHTSA standards.

5. Quality Assurance Plans for Evidential Breath Testing Devices. Each EBT used shall have an approved quality assurance plan (QAP) to include the following:

   a. Methods for conducting external calibration.

   b. Minimum intervals for performing external calibrations.

   c. Tolerance on an external calibration check.

   d. Inspection, maintenance and calibration requirements. Each QAP is submitted to NHTSA for approval. Records demonstrating that the EBTs are subject to required external calibration checks will be maintained. An EBT will be taken out of service if any external calibration check results in a reading outside the tolerance for the EBT set forth in the QAP. The EBT will not be used again until it has been serviced and has had an external calibration check resulting in a reading within the tolerance for the EBT. This company will ensure that required inspections, maintenance and calibration checks are conducted. When the EBT is not being used it will be stored in a secure location.

6. Quality Assurance Plans for Non-Evidential Screening Devices. Each Non-Evidential Screening Device used shall have an approved quality assurance plan (QAP) to including the following:

   a. The plan shall designate the method or methods to be used to perform quality control checks; the temperatures at which the non-evidential screening device shall be stored and used, as well as other environmental conditions (e.g., altitude, humidity)

that may affect the performance of the device; and, where relevant, the shelf life of the device.

b. The QAP shall prohibit the use of any device that does not pass the specified quality control checks or that has passed its expiration date. The manufacturers' instructions on or included in the package for each saliva testing device shall include directions on the proper use of the device, the time frame within which the device must be read and the manner in which the reading is made. The employer and its agents shall comply with the QAP and manufacturer's instructions for each non-evidential screening device it uses for alcohol screening tests.

E. Breath Alcohol Testing Preparations

1. When an Employee arrives at the alcohol testing site, the BAT/STT shall ensure that the individual is positively identified as the Employee selected for alcohol testing (e.g., through presentation of photo identification or identification by Shaw E & I's representative). If the Employee's identity cannot be established, the BAT/STT shall not proceed with the alcohol test. If the Employee requests, the BAT/STT shall show proper identification to the Employee.

2. The BAT/STT shall explain the alcohol testing process to the Employee.

3. If the Employee fails to arrive at the assigned time, the BAT/STT should contact the appropriate company authority to obtain guidance on any action to be taken.

F. Screening Test Procedures for Evidential Breath Testing and Non-Evidential Breath Testing Devices.

1. The BAT shall begin the alcohol testing process by completing Step 1 on the Alcohol Breath Testing form. The Employee shall then complete Step 2 by signing the certification. Refusal by the Employee to sign the certification shall be regarded as a refusal to take the alcohol test.

2. The BAT shall select an individually sealed mouthpiece. It shall be opened in full view of the Employee and attached to the EBT in accordance with the manufacturer's instructions.

3. The BAT shall instruct the Employee to blow forcefully into the mouthpiece for at least 6 seconds or until the EBT instrument indicates that an adequate amount of breath has been obtained.

4. The BAT shall show the Employee the result displayed on the EBT. The BAT shall record the displayed result, testing device, serial number of the testing device, time and quantified result in Step 3 of the form.

5. If the EBT prints the test result directly onto the alcohol form, then the BAT shall show the Employee the result displayed on the EBT.

6. If the EBT does not provide a printed result, the BAT shall show the Employee the result displayed on the EBT. The BAT shall then record the test result onto the breath alcohol test form in the designated space and the Employee will sign the form as to acknowledge the results. The result shall be entered in such a manner that will provide clear evidence as to the results that were displayed by the EBT.

7. If the result of the screening alcohol test is a breath alcohol concentration of less than 0.04, the BAT shall date the form and sign the certification in Step 3 of the form. The Employee shall then sign the certification and fill in the date in Step 4 of the form. If the

Employee does not sign the certification in Step 4, it shall not be considered a refusal to be tested. In this event, the BAT shall note the Employee's failure to sign in the "Remarks" section of the form.

8. If the EBT has printing capabilities and the test result printed by the EBT does not match the displayed result, the BAT shall note the disparity in the "Remarks" section. Both the BAT and the Employee shall initial or sign the notation. The alcohol test is invalid and Shaw E & I representative and the Employee shall be so advised.

9. At this point, no further testing is authorized. The BAT shall transmit the result of less than 0.04 to the appropriate company representative in a confidential manner. Shaw E & I shall receive and store the information so as to ensure that confidentiality is maintained as required in the procedure.

10. If the result of the screening test is an alcohol concentration of 0.04 or greater, then the BAT shall perform a confirmation test. If a different BAT will conduct the confirmation test, then the BAT who conducts the screening test shall complete and sign the form and log entry. The BAT will upon completion of the alcohol test provide the Employee with Copy 2 of the Breath Alcohol Testing form.

G. Confirmation Test Procedures.

1. When a BAT other than the one who conducted the screening test is required to conduct the confirmation test, the new BAT will require the Employee to provide positive identification such as photo ID card or identification by a company representative. The BAT will, upon request of the Employee being tested, provide such identification.

2. The BAT shall instruct the Employee not to eat, drink, put any object or substance in his/she mouth and, to the extent possible, not belch during the waiting period just prior to the confirmation test being conducted. This waiting period shall begin with the completion of the screening test and shall not be less than 15 minutes, but must be within 30 minutes of the completion of the screening test. The time the Employee spends in transit between the screening test and confirmation test, the Employee is under direct observation, counts toward the mandatory 15 minute deprivation period. If the BAT conducts the confirmation test more than 30 minutes after the result of the screening test has been obtained the BAT shall note in the “Remarks” section of the form the time that elapsed between the screening and the confirmation test and the reason why the confirmation test could not be conducted within 30 minutes of the screening test. The BAT shall explain to the Employee that the reason for this is to prevent any accumulation of mouth alcohol leading to an artificially high reading and that it is for the benefit of the Employee to comply with these instructions. The BAT shall also explain that the test will be conducted at the end of the required waiting period, even if the Employee has disregarded the instructions. If the BAT becomes aware that the Employee has not complied with the provided instructions; the BAT shall note the observations in the "Remarks" section of the form.

3. When a BAT other than the one who conducted the screening test is required to conduct the confirmation test, the new BAT shall initiate a new breath alcohol testing form. The BAT shall then complete step 1 on the form and the Employee shall then complete Step 2 by signing the certification. If the Employee should choose not to sign the certification, the BAT shall then make an appropriate notation in the "Remarks" section indicating the Employee's refusal to take the alcohol test. The BAT shall note in the "Remarks" section that a different BAT conducted the screening test.

4. The BAT shall open, in the presence of the Employee, a new individually-sealed mouthpiece and attach the mouthpiece to the EBT in accordance with the manufacturer's

instructions. The BAT will then instruct the Employee to blow forcefully into the mouthpiece for at least 6 seconds or until the EBT indicates that an adequate amount of breath has been obtained.

5. In the event that the screening and confirmation test results are not identical, the confirmation test result shall be deemed to be the final result on which any action by Shaw E & I may be taken in order to comply with the requirements of the AMPP and any applicable Federal requirements.

6. If the EBT prints the test result directly onto the alcohol form, then the BAT shall show the Employee the result displayed on the EBT.

7. If the EBT does not provide a printed result, the BAT shall show the Employee the result displayed on the EBT. The BAT shall then record the test result onto the breath alcohol test form in the designated space and the Employee will sign the form as to acknowledge the results. The result shall be entered in such a manner that will provide clear evidence as to the results that were displayed by the EBT.

8. After the confirmation test is completed, the BAT shall date the form and sign the certification in Step 3 of the form. The Employee shall then be instructed to sign the certification and fill in the date in Step 4. If the Employee should elect to not sign the certification or to provide his/her initials in the log book entry for the test conducted, it shall not be considered as a refusal to be tested. The BAT shall then note the Employee's failure to sign or initial the log book entry in the "Remarks" section of the testing form.

9. The BAT shall transmit all alcohol testing results to the APM (Alcohol Program Manager) or other designated company representative in a confidential manner. All communications by BAT's shall be to the APM or designee only and may be provided in writing, in person or by telephone or electronic means. The BAT shall ensure that immediate transmission of test results to Shaw E & I is conducted in order for Shaw E & I to prevent the Employee from performing any covered functions.

10. Should the initial transmission not be accomplished in writing, but via telephone notification, Shaw E & I designee shall establish a mechanism to verify the identity of the BAT providing the information. The BAT shall follow the initial transmission by providing to Shaw E & I designee Shaw E & I's copy of the Breath Alcohol Testing form. The test results shall be stored in such a manner so as to protect the confidentiality of the results and to eliminate the disclosure of information to unauthorized persons.

H. Refusals to Test and Uncompleted Tests.

1. Refusal by an Employee to complete and sign Step 2 of the Breath Alcohol Testing form, to provide breath, to provide an adequate amount of breath or otherwise to cooperate with the testing process in a way that prevents the completion of the test shall be noted by the BAT in the "Remarks" section of the form. The testing process shall be terminated and the BAT shall immediately notify Shaw E & I representative/designee.

2. If a screening or confirmation test cannot be completed or if an event occurs to invalidate the test, the BAT/STT shall, if practicable, begin a new screening or confirmation test using a new Breath Alcohol Testing form with a new sequential test number.

I. Inadequate Amount of Breath for EBT Devices

1. If the Employee is unable or alleges that he/she is unable, to provide a sufficient amount of breath to permit a valid breath test because of a medical condition, the BAT or STT shall again instruct the Employee to attempt to provide an adequate amount. If the

Employee refuses to make the attempt, the BAT or STT shall immediately inform Shaw E & I.

2. If the Employee attempts and fails to provide an adequate amount of breath, the BAT or STT shall so note in the "Remarks" section of the testing form and shall immediately inform Shaw E & I. Shaw E & I shall direct the Employee to obtain, as soon as practical after the attempt, an evaluation from a licensed physician, who is acceptable to Shaw E & I, concerning the Employee's medical ability to provide an adequate amount of breath for the screen.

3. If the physician determines, in his/her reasonable medical judgment, that a medical condition has or could have precluded the Employee from providing an adequate amount of breath, the Employee's failure to provide an adequate amount of breath shall not be deemed as a refusal to take an alcohol test. The physician shall provide to Shaw E & I representative a written statement of the basis of his/her conclusion.

4. If the physician, in his/her reasonable medical judgment, is unable to make the determination that a medical condition has precluded the Employee from providing an adequate amount of breath, the Employee's failure to provide an adequate amount of breath shall be regarded as a refusal to take a test. The physician shall provide a written statement of the basis for his/her conclusion to Shaw E & I.

J. Invalid Tests

1. An evidential breath alcohol test shall be invalid under the following circumstances:

   a. The EBT does not pass its next external calibration check. This invalidates all test results of 0.04 or greater on tests conducted since the last valid external calibration test. This would not invalidate any negative tests conducted.

   b. The BAT does not observe the minimum 15-minute waiting period prior to conducting the confirmation test.

   c. The BAT does not sign the Breath Alcohol Testing form.

   d. The BAT fails to note in the remarks section of the form that the Employee has failed or refused to sign the form following the recording or printing on or attachment to the form of the test results.

The Shaw Drug and Alcohol Policy Acknowledgment

Acknowledgment

I have read, understand and am responsible for the drug and alcohol Policy presented to me by The Shaw Group Inc. I understand that the drug and alcohol Policy that has been provided to me is a summary of Shaw's Policy and does not include the specimen collection and laboratory analysis procedures; however, the complete Policy and procedures are available to me for review by requesting same from my supervisor, Human Resources or Shaw's Substance Abuse Program Administrator. I agree to submit to all of its requirements of this Policy and I understand the disciplinary action that will be taken if I am found in violation of this Policy. **I understand that compliance with this Policy is a condition of my employment with this Company. Additionally, I understand that compliance with this Policy does not guarantee continued employment and shall not alter the basic "at will" status of my employment.**

Employment Consent Form

Laboratory Testing: I hereby give my voluntary consent for a urine and/or blood sample to be collected from me and submitted for alcohol and/or drug testing. The Shaw Group Inc. may be required to provide test results to other companies with whom The Shaw Group Inc. has contracts to undertake certain work. I hereby further consent to the release of testing results to any such company or companies or their agents or designees, where release of this information has been requested by said companies of their agents with respect to work undertaken by The Shaw Group Inc. I hereby understand and agree that the companies and agents to whom this information may be provided are designated as agent of The Shaw Group Inc. with respect to receipt of this information, only.

Search: I hereby give my consent for The Shaw Group Inc. to search my personal effects, locker, lunch box, purses, parcels, personal vehicles and other property located on Company premises, work areas, parking lot or storage area.

I understand that my consent to this procedure is a condition of employment and that refusal to consent will result in my discharge from employment. I further agree to hold The Shaw Group Inc., its agents, directors, officers and Employees harmless from any and all liability in connection with search and investigation.

Do not sign below if you have not received the Drug and alcohol Policy that has been provided to you.

Employee Signature Date

Company Representative Signature

Please Print Your Name Here

This original of this form must be maintained at the Regional Human Resource office and filed within the subject Employee's Human Resource file.

Uncontrolled when printed: Verify latest version on ShawNet/Governance

Reasonable Suspicion Documentation Form

☐ Employee is reporting for duty ☐ Employee is already on duty:

EMPLOYEE NAME:	**DATE OF OBSERVATION:**
LOCATION:	**TIME OF OBSERVATION:** FROM: AM/PM TO: AM/PM

OBSERVED PERSONAL BEHAVIOR (CHECK ALL APPROPRIATE ITEMS)			
BREATH: (Odor of alcoholic beverage)	☐ STRONG ☐ NONE	☐ FAINT	☐ MODERATE
EYES:	☐ BLOODSHOT ☐ CLEAR ☐ DILATED PUPILS	☐ GLASSY ☐ HEAVY EYELIDS ☐ FIXED PUPILS	☐ NORMAL ☐ CONSTRICTED PUPILS
SPEECH:	☐ CONFUSED ☐ ACCENT ☐ SLURRED ☐ NOT ABLE TO UNDERSTAND	☐ STUTTERED ☐ MUMBLED ☐ GOOD ☐ COTTON MOUTHED	☐ THICK TONGUED ☐ FAIR ☐ MUSH MOUTHED ☐ OTHER:_____
ATTITUDE:	☐ EXCITED ☐ INDIFFERENT ☐ CARE FREE ☐ COOPERATIVE ☐ POLITE	☐ COMBATIVE ☐ TALKATIVE ☐ COCKY ☐ PROFANE	☐ HILARIOUS ☐ INSULTING ☐ SLEEPY ☐ OTHER:_____
UNUSUAL ACTION:	☐ HICCOUGHING ☐ FIGHTING ☐ LAUGHING	☐ BELCHING ☐ CRYING	☐ VOMITING ☐ OTHER:_____
BALANCE:	☐ FALLING ☐ SWAYING	☐ NEEDS SUPPORT ☐ WOBBLING	☐ OTHER:_____
WALKING:	☐ FALLING ☐ SWAYING	☐ STAGGERING ☐ STUMBLING	☐ OTHER:_____
TURNING:	☐ FALLING ☐ SWAYING	☐ STAGGERING ☐ HESITANT	☐ OTHER:_____ ☐ STUMBLING

Check All That Apply: ☐ Significant decline in job performance; ☐ Unexplained absences from work station; ☐ Significant change in personality; ☐ Changes in personal hygiene; ☐ Excessive absenteeism/tardiness; ☐ Operates equipment

ANY OTHER UNUSUAL OBSERVED ACTIONS OR STATEMENTS BY THE EMPLOYEE:

Reasonable Suspicion Test Performed? Yes ☐ No ☐ Reason Not Performed: _____

Signature of Supervisor: _____ **Date** ____/____/____ **Time** _____

Signature of Witness: _____ **Date** _____/____/____ **Time**_____

Re-Hire Certification and Agreement
Employees Returning from a Substance Abuse Counseling/Rehabilitation Program

I have completed a substance abuse evaluation or rehabilitation program from a state-certified substance abuse professional and/or program on _____ [date of completion]. I seek re-employment with Shaw and agree that if I am re-hired, I will be subject to periodic unannounced testing for a period of twenty-four (24) months as a condition of my employment.

_____
Print Name Date

_____
Employee's Signature Date

_____
Employee's Social Security Number

_____
Shaw Human Resources Date

_____
Date of Policy Violation (to be completed by H.R.)

1. PURPOSE

This procedure specifies the preservation and maintenance requirements for all employee exposure and medical records. It also establishes procedures for employees, or their authorized representatives, to access copies of these records. The time frame in which the company must respond to a request for records is also set.

2. SCOPE

This procedure applies to all Shaw E&I employee exposure and medical records.

2.1 Exception Provisions

Variances to this procedure shall be requested in accordance with Shaw Environmental & Infrastructure, Inc. (Shaw E&I), Procedure No. EIG-HS-013, "Health and Safety Procedure Variance."

3. REFERENCES

3.1 Internal References

- Shaw E&I Procedure No. EIG-HS-013, "Health and Safety Procedure Variance"

3.2 External References

- 29 Code of Federal Regulations1910.1020, U.S. Government Printing Office, Washington, D.C., <http://www.gpoaccess.gov/cfr/index.html> (July 2008).

4. DEFINITIONS

- **Company**—all wholly-owned subsidiaries of Shaw E&I.
- **Employee exposure record**—A record containing any of the following kinds of information:
  - Environmental (workplace) monitoring or measuring of a toxic substance or harmful physical agent, including personal, area, grab, wipe, or other form of sampling, as well as related collection and analytical methodologies, calculations, and other background data relevant to interpretation of the results obtained
  - Biological monitoring results, which directly assess the absorption of a toxic substance or harmful physical agent by body systems (e.g., the level of a chemical in the blood, urine, breath, hair, fingernails, etc.)
  - Material safety data sheets indicating that the material may pose a hazard to human health
  - In the absence of the above, a chemical inventory or any other record that reveals where and when used and the identity (e.g., chemical, common, or trade name) of a toxic substance of harmful physical agent.

This does not include area measurements or data collected with survey-type instrumentation.

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- **Employee medical record**—A record concerning the health status of an employee, which is made or maintained by a physician, nurse, or other health care personnel, or technician, including:
  - Medical and employment questionnaires or histories (including job description and occupational exposures)
  - The results of medical examinations (pre-employment, pre-assignment, periodic, episodic or exit), laboratory tests (including chest and other x-ray examinations taken for the purposes of establishing a base-line or detecting occupational illness, and all biological monitoring not defined as an "employee exposure record"), and support documentation for such examinations and tests
  - Drug and Alcohol Test Results
  - Medical opinions, diagnoses, progress notes, and recommendations
  - First-aid records
  - Descriptions of treatments and prescriptions
  - Employee medical complaints.
- **Employee**—Any full-time, part-time, site hire, intern, or other person paid salary or wages by the company.

5. RESPONSIBILITY MATRIX

5.1 Procedure Responsibility

The Executive Director of Health and Safety is responsible for the issuance, revision, and maintenance of this procedure.

5.2 Action/Approval Responsibilities

The Responsibility Matrix is Attachment 1, “Maintenance and Access to Employee Medical and Exposure Records, Responsibility Matrix.”

6. PROCEDURE

6.1 Preservation of Records

All employee medical and exposure records shall be preserved and maintained for at least the duration of employment plus 30 years. The Health and Safety Department shall be responsible for securing these records against unauthorized access until the transfer to the company's contracted medical provider has been completed.

Chest x-ray films shall be preserved in their original state for employment plus 30 years.

6.1.1 Medical and Exposure Records

Medical and exposure records for employees who were active on or after May 25, 2002, are retained by CORE Health Networks in Baton Rouge, Louisiana.

6.1.2 Analyses Using Exposure or Medical Records

Each analysis using exposure or medical records shall be preserved and maintained by the health and safety office conducting the analysis for at least 30 years.

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6.1.3 Transfer of Records – Occupational Safety and Health Administration Requirements

Whenever an employer is ceasing to do business, the employer shall transfer all records subject to this section to the successor employer. The successor employer shall receive and maintain these records.

Whenever an employer is ceasing to do business and there is no successor employer to receive and maintain the records subject to this standard, the employer shall notify affected current employees of their rights of access to records at least 3 months prior to the cessation of the employer's business.

Whenever an employer is ceasing to do business and there is no successor employer to receive and maintain the records, or intends to dispose of any records required to be preserved for at least 30 years, the employer shall:

- Transfer the records to the Director of the National Institute for Occupational Safety and Health (NIOSH) if so required by a specific occupational safety and health standard
- Notify the Director of NIOSH in writing of the impending disposal of records at least three months prior to the disposal of the records.

Whenever an employer regularly disposes of records required to be preserved for at least 30 years, the employer, may, with at least three months notice, notify the Director of NIOSH on an annual basis of the records intended to be disposed of in the coming year.

6.1.4 Transfer of Records – Business cessation by wholly owned subsidiaries

All medical and exposure records shall be forwarded to the Health and Safety Department.

6.2 Access to Employee Medical and Exposure Records

The attached "NOTICE" poster (Attachment 2) shall be permanently posted in a conspicuous place available to all employees.

Each current employee shall be notified at least annually of the following:

- Existence, location, and availability of any records
- Person responsible for maintaining and providing access to records
- Each employee's right of access to these records

Access to records beyond the individual employee and the local Health and Safety Department shall be limited to non-company entities with regulatory authority for access, and staff with a need-to-know meeting 29 Code of Federal Regulation 1910.1020 requirements.

6.2.1 Request for Records Held By the Company

The employee, or his/her authorized representative, shall complete Form EI-HS102.1, “Request for Records Held By Contracted Provider,” and present it to the Health and Safety Department.

6.2.2 Request for Records Held By Contracted Provider

The employee, or his/her authorized representative, shall complete a Release Form (Form EIG-HS-102.02) and present it to the Health and Safety Department. The Health and Safety Department shall forward the form to the medical provider.

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6.2.3 Timeliness

All employee requests for records accompanied by an executed request form shall receive a response within 15 business days. This response shall be either delivery of requested records, or an explanation of the delay and an expected delivery date. All request forms shall be retained in the employee's file.

6.3 Subcontractor and Temporary Personnel

For subcontractor and temporary personnel, the company is not the employer, but may generate medical or exposure information about these individuals on a project basis. It is important that the company convey this information to the employer in a timely manner so that the employee can be notified and proper record keeping accomplished.

Whenever the company generates or receives medical or exposure monitoring data for a subcontractor or temporary personnel, the site safety officer or health and safety professional shall complete Form EIG-HS-102.02, "Employer Notification (Subcontractor and Temporary Personnel)" and forward it to the employer with a copy of the record in question attached. This shall be done within 15 days of receipt of said information. A copy of this correspondence shall be retained in the company project or location health and safety records.

7. ATTACHMENTS

- Attachment 1, Maintenance and Access to Employee Medical and Exposure Records, Responsibility Matrix
- Attachment 2, NOTICE

8. FORMS

- Form EIG-HS-102.01, Request for Records Held By Contracted Provider
- Form EIG-HS-102.02, Employer Notification (Subcontractor and Temporary Personnel)

9. RECORDS

- Form EIG-HS-102.01, Request for Records Held By Contracted Provider
- Form EIG-HS-102.02, Employer Notification (Subcontractor and Temporary Personnel)

10. REVISION HISTORY AND APPROVAL

Revision Level / Revision Date	Revision Description	Responsible Manager
00 4/24/2002	Initial issue.	Warren Houseman
01 1/25/2011	Reformatted entire procedure. Updated medical surveillance provider references to CORE Health Networks.	Troy Allen
02 12/5/2011	Modified format to align with Governance Management framework. Updated Form EIG-HS-102.01	Andrew Johnson

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Attachment 1
Maintenance and Access to Employee Medical and Exposure Records
Responsibility Matrix

Actions	Procedure Section	HS	Employee	Medical Provider
Preserve and maintain records	6.1 - 6.3	X		X
Business cessation records transfer	6.1.5	X		
Complete records request form and give to HS	6.2		X	
Notify employee yearly regarding right to access records	6.2	X		
Deliver records promptly upon documented request	6.2.3	X		X
Notify subcontractor and/or temporary agency whenever the company project/location generates medical/exposure data for their respective personnel.	6.3	X		

Attachment 2

NOTICE

As a component of the company Corporate Health & Safety Policy to provide our employees with a safe and healthful workplace, many of our employees participate in our programs for occupational medicine and exposure monitoring.

If you wish to exercise your right of access to your records, or wish to review any health and safety regulation which pertains to your job, contact your local Health & Safety professional.

NOTICIA

Como un componente de las reglas del Seguro de la Salud en la Corporacion, para proveer a nuestros empleados un lugar de trabajo Seguro y Saludable, muchos de nuestros empleados participan en nuestros programas de medicina ocupacional y expocision monitorial (analisis).

Si desea ejercer su derecho o acceso a su archivos o desea revisar qualquier cuidado de la Salud que ocupe en su trabajo, comuniquese con su Seguro de Salud profesional mas cercano.

Uncontrolled when printed: Verify latest version on ShawNet/Governance

Request for Records Held By Contracted Provider

Medical Services
The Shaw Group Inc.
4171 Essen Lane
Baton Rouge, LA 70809

Dear Sir:

This document authorizes The Shaw Group Inc. to release copies of my medical records to:

Name (Print): _____

Address: _____

City: _____ State: _____ Zip Code: _____

I understand that no x-rays will be sent as part of this record. I also appreciate that there is no charge for this service and that the records requested will be mailed within 15 days of receipt of this request by The Shaw Group Inc.

Name (Print): _____

Social Security Number: _____

Signature: _____ Date: _____

Company Manager Authorizing Record Release

Name (Print): _____

Title: _____

Signature _____ Date: _____

Uncontrolled when printed: Verify latest version on ShawNet/Governance

Employer Notification (Subcontractor and Temporary Personnel)

Employee Name: _____

Employee Address: _____

_____

Attention: Health & Safety or Human Resources Manager

Dear Sir:

Shaw E&I has generated medical or exposure monitoring information about your employee(s) listed below, relating to their work for the company project/location shown. You have obligations under the Code of Federal Regulations 29 CFR 1910.1020, or equivalent State regulations, for employee notification and long term record keeping.

The Company has not and will not undertake actions to meet your obligations under this standard. The attached information is provided so that you can meet your employer obligations.

Company Project/Location: _____

Contact Name: _____

Employee(s): _____

_____

_____

_____

_____

_____

Company HS Officer Name (Print): _____

Signature: _____ Date: _____

cc: Complete copy to Company Project/Location HS File

1. PURPOSE

Regulations promulgated by federal and various state Occupational Safety and Health Administrations require workplace industrial hygiene monitoring for hazardous substances. In many instances Shaw Environmental & Infrastructure, Inc. (Shaw E&I) will perform this monitoring for substances not specifically regulated by one of these standards. This procedure prescribes the steps to be taken to notify employees of industrial hygiene monitoring results for either regulated or nonregulated substances.

2. SCOPE

This procedure applies to all industrial hygiene monitoring conducted to evaluate employee exposure to specific hazardous substances.

Variances and exceptions may be requested pursuant to the provisions of Shaw E&I Procedure No. EIG-HS-013, “Health and Safety Procedure Variances.”

3. REFERENCES

- Shaw E&I Procedure No. EIG-HS-013, Health and Safety Procedure Variances

4. DEFINITIONS

- **Company**—Any wholly-owned subsidiaries of the Shaw E&I

5. RESPONSIBILITY MATRIX

5.1 Procedure Responsibility

The Senior Director of Health and Safety is responsible for the issuance, revision, and maintenance of this procedure.

5.2 Action/Approval Responsibilities

The Responsibility Matrix is shown as Attachment 1, “Employee Notification of Industrial Hygiene Monitoring Results, Responsibility Matrix.”

6. PROCEDURE

There are various state and federal regulations which govern employee exposure to specific toxic and hazardous substances. These substance specific regulations differ in the number of days required for the notification of individual employee exposures once monitoring results have been received. Due to this inconsistency, the company has adopted a standard five-day timeframe between the receipt of results and the notification of employees. This standard timeframe is to be applied to all employee exposure monitoring results, regardless if the substance is regulated or not. In the event of changes to current regulatory requirements or when specific standards allow for longer periods of time, the requirements of the individual state or federal standard may be applied in lieu of the five-day period. The decision to use a timeframe longer than five days must first be approved by the Senior Director of Health and Safety.

Within five working days after the receipt of industrial hygiene monitoring results, the health and safety representative must notify each employee, in writing, of the results which represent that employee’s exposure. Monitoring results representative of an employee’s exposure will be reported to the affected employee on Form EIG-HS-104.01. Whenever the results indicate that

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the representative employee exposure exceeds an established exposure limit, the health and safety representative will state that the exposure limit was exceeded and will provide a description of the corrective action taken to reduce exposures to acceptable concentrations. The health and safety representative will also address respirator protection factors and will provide assurances to the employee when protection factor calculations indicate that the use of a respirator has reduced the actual employee exposure to a level below the exposure standard. Results of monitoring for substances which are not covered by a specific regulation will also be reported to employees in the same manner.

In those cases where concentrations exceed the exposure standard, the health and safety representative will indicate what corrective action steps, beyond the use of personnel protective devices, will be taken to maintain concentrations to a level below the exposure standard, for example, engineering controls, administrative controls, work practices, isolation, etc. The monitored employee will acknowledge the receipt of personal exposure sampling results by signing Form EIG-HS-104.01.

7. ATTACHMENTS

- Attachment 1, Employee Notification of Industrial Hygiene Monitoring Results, Responsibility Matrix

8. FORMS

- Form EIG-HS-104.01 Employee Notification of Industrial Hygiene Monitoring Results

9. RECORDS

- Form EIG-HS-104.01 Employee Notification of Industrial Hygiene Monitoring Results

10. REVISION HISTORY AND APPROVAL

Revision Level Revision Date	Revision Description	Responsible Manager
00 4/24/2002	Initial issue	Warren Houseman
01 4/12/2010	The “Employee Notification of Industrial Hygiene Monitoring Results” form was modified. Procedure was reformatted.	Troy Allen
02 8/25/2011	Modified format only to align with Governance Management framework.	Andrew Johnson

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Attachment 1
Employee Notification of Industrial Hygiene Monitoring Results
Responsibility Matrix

Action	Responsible Party			
	Procedure Section	Employee Monitored	HS Representative	Senior Director of Health and Safety
Issue, Revise, and Maintain this procedure	5.1			X
Complete Form EI-HS104.1_0	6.0		X	
Notify employee of monitoring results	6.0		X	
Acknowledge receipt of Form EI-HS104.1_0	6.0	X		

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Employee Notification of Industrial Hygiene Monitoring Results

Employee Name				**Employee No.**			
Project/Location				**Project No.**			
Substance Monitored	**Date**	**Result**			**Exposure Standard***		
		mg/m^3	**ppm**	**Other**	**mg/m^3**	**ppm**	**Other**

***A – OSHA B - ACGIH**

Protective Equipment Used:

For instances where exposures were found to be in excess of an exposure limit, the following corrective action steps (engineering, administrative, job techniques, etc.) are being taken to reduce potential future exposures:

H&S Representative:			
	Printed Name	**Signature**	**Date**
Employee Monitored:			
	Printed Name	**Signature**	**Date**

Distribution: **Employee**
Employee's H&S Representative
Senior Director of Health and Safety

1. PURPOSE

The purpose of this procedure is to describe the company requirements for excavation and trenching safety. These requirements are based on the federal Occupational Safety and Health Administration excavation standard found in 29 Code of Federal Regulations (CFR) 1926, Subpart P.

Some company activities are likely to occur in states or localities that either currently have or will have requirements that differ from those contained within the federal standard. In such circumstances, the local health and safety representative will be responsible for ensuring that these requirements are included in either a site health and safety plan or a similar document and conveyed to all affected employees. If federal, state, or local regulations vary or conflict, the more protective requirements and practices will be followed.

2. SCOPE

This procedure applies to all excavation and trenching activities. Variances and exceptions may be requested pursuant to the provisions of Shaw Environmental & Infrastructure, Inc. (Shaw E&I) Procedure No. EIG-HS-013, “Health and Safety Procedure Variances.”

3. REFERENCES

3.1 Internal References

- Shaw E&I Procedure No. EIG-HS-013, “Health and Safety Procedure Variances”
- Shaw E&I Procedure No. EIG-HS-050, “Training Requirements”
- Shaw E&I Procedure No. EIG-HS-300, “Confined Spaces”
- Shaw E&I Procedure No. EIG-HS-308, “Underground/Overhead Utility Contact Prevention”

3.2 External References

- 29 CFR 1926 Subpart P - Excavations

4. DEFINITIONS

- **Accepted Engineering Practices**—Those requirements or practices which are compatible with standards required by a registered professional engineer.
- **Angle of Repose**—The greatest angle above the horizontal plane at which a material will lie without sliding.
- **Benching**—A method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels of steps, usually with vertical or near-vertical surfaces between levels.
- **Competent Person**—An employee who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous or dangerous to employees and who has the authority to take prompt corrective measures to eliminate them.
- **Company**—All wholly-owned subsidiaries of Shaw E&I.

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- **Excavation**—Any man-made cut, cavity, trench, or depression in an earth surface, including its sides, walls, or faces, formed by earth removal.
- **Registered Professional Engineer**—An individual currently registered as a professional engineer (preferably civil for the purposes of this procedure) in the state where work is to be performed.
- **Sheeting**—Members of a shoring system that retain the earth in position and in turn are supported by other members of the shoring system.
- **Shield**—A structure that is able to withstand the forces imposed on it by a cave-in and thereby protect employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Shields may be pre-manufactured or job-built in accordance with 29 CFR 1926.652(c)(3) or (c)(4). Shields used in trenches are usually referred to as "trench boxes" or "trench shields."
- **Shoring**—Structure such as a metal hydraulic, mechanical, or timber shoring system that supports the sides of an excavation and which is designed to prevent cave-ins.
- **Sloping**—A method of protecting employees from cave-ins by excavating to form sides of an excavation that are inclined away from the excavation so as to prevent cave-ins. The angle of incline required to prevent a cave-in varies with differences in such factors as the soil type, environmental conditions of exposure, and application of surcharge loads.
- **Support System**—A structure such as underpinning, bracing, or shoring that provides support to an adjacent structure, underground installation, or the sides of an excavation.
- **Tabulated Data**—Tables and charts approved by a registered professional engineer and used to design and construct a protective system.
- **Trench**—A narrow (in relation to its length) excavation made below the surface of the ground. In general, the depth is greater than the width at the bottom, but the width of a trench at the bottom is not greater than 15 feet.
- **Type A Soil**—Cohesive soils with an unconfined compressive strength of 1.5 ton per square foot (tsf) (144kPa) or greater. Examples of cohesive soils are clay, silty clay, sandy clay, clay loam and, in some cases, silty clay loam and sandy clay loam. Cemented soils such as caliche and hardpan are also considered Type A. However, soil is NOT Type A if:
  - Soil is fissured
  - Soil is subject to vibration from heavy traffic, pile driving, or similar effects
  - Soil has been previously disturbed
  - Soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V) or greater
  - Material is subjected to other factors that would require it to be classified as a less stable material
- **Type B Soil**—This classification refers to:
  - Cohesive soil with an unconfined compressive strength greater than 0.5 tsf (48 kPa) but less than 1.5 tsf (144 kPa)
  - Granular cohesionless soils including angular gravel (similar to crushed rock), silt, silt loam, sandy loam, and, in some cases, silty clay loam and sandy clay loam
  - Previously disturbed soils except those which would otherwise be classified Type C soil

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- Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subjected to vibration
- Dry rock that is not stable
- Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical (4H:1V), but only if the material would otherwise be classified as Type B

▪ **Type C Soil**—This classification refers to:

- Cohesive soil with an unconfined compressive strength of 0.5 tsf (48 kPa) or less
- Granular soils including gravel, sand, and loamy sand
- Submerged soil or soil from which water is freely seeping
- Submerged rock that is not stable
- Material in a sloped, layered system where the layers dip into the excavation or a slope of four horizontal to one vertical (4H:1V) or steeper

5. RESPONSIBILITIES

5.1 Procedure Responsibility

The Senior Director of Health and Safety is responsible for the issuance, revision, and maintenance of this procedure.

5.2 Action/Approval Responsibilities

The Responsibility Matrix is Attachment 1, “Excavation and Trenching Responsibility Matrix.”

6. PROCEDURE

6.1 Pre-Excavation Requirements

6.1.1 Underground Utilities

Prior to opening an excavation, the estimated location of underground utilities such as sewer, telephone, fuel, electric, water, or any other underground installation that may be reasonably expected to be encountered during the excavation work shall be determined.

Utility companies or a utility location service shall be contacted by the supervisor within the established prenotification time, advised of the proposed work, and asked to delineate the location of all underground utilities. Employees should be careful to protect and preserve the utility markings until they are no longer required for safe excavation. At least 3 feet of clearance between any underground utility and the cutting edge or point of powered excavation equipment will be maintained until the precise location of the utility is determined. Initial excavation within this 3 foot area will be conducted manually per Shaw E&I Procedure No. EIG-HS-308, “Underground/Overhead Utility Contact Prevention.”

6.1.2 Surface Encumbrances

All surface encumbrances (e.g., trees, poles, boulders, etc.) that may create a hazard to employees shall be removed or supported.

6.1.3 Vehicular Traffic

Employees exposed to vehicular traffic shall l wear warning vests or other suitable garments provided by their supervisor. These garments shall be marked with or made of reflectorized or high-visibility material. Traffic control devices (e.g., barricades, signs, cones, flag persons, etc.)

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shall be specified and used in accordance with regulations applicable to the roadway or area in which excavation activities are occurring.

6.1.4 Training

Those who supervise the entry of personnel into an excavation must have completed a training course that included instruction in:

- Types of hazards associated with excavation operations
- Safe work practices and techniques
- A review of applicable Federal, state, and local regulations
- A review of this procedure

Employees who enter excavations are required to complete a site-specific training session to enable them to recognize unsafe conditions in and around the excavation. This training can be conducted during a tailgate safety meeting that emphasizes the specific excavation hazards that may be encountered.

Training documentation shall be maintained in the project file with a copy forwarded to the Knoxville, Tennessee, Training Department.

As part of the standard employee supervision process, training shall be complemented with on-the-job instruction and reinforcement of accepted practices to the extent necessary to assure compliance with this procedure and all other applicable regulations.

6.2 Excavation Work Practices

6.2.1 General

Each employee working within an excavation shall be protected from cave-ins by an adequate protective system designed in accordance with 29 CFR 1926 Subpart P, except when the excavation is made entirely in stable rock or when the excavation is less than 5 feet deep and examination of the ground by a competent person provides no indication of a potential cave-in. A competent person shall ensure that protective systems, when required, are installed and maintained per the design specifications.

No employees shall be permitted to enter an excavation unless it is absolutely essential to do so and all requirements of this procedure are met.

6.2.2 Supervision

Work in an excavation shall at all times be supervised by a competent person. This individual will remain outside of the excavation at all times, and will be responsible for identifying any unusual developments above ground that may warn of impending earth movement.

6.2.3 Soil Classification

Based on the results of tests described in Attachment 4, “Soil Classification Worksheet,” the competent person will classify each soil/rock deposit as stable rock, Type A, Type B, or Type C. When layers of soil/rock exist, the weakest layer will be classified; however, each layer may be classified individually when a more stable layer lies under a less stable layer. If the properties or conditions of a soil/rock deposit change in any way, re-evaluation will be required.

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6.2.4 Access and Egress

Structural ramps that are used solely by employees as a means of access or egress from excavations shall be designed by a competent person. Structural ramps used for access or egress of equipment shall be designed by a competent person qualified in structural design, and shall be constructed in accordance with the design.

A stairway, ladder, ramp, or other safe means of egress shall be located in trench excavations that are 4 or more feet in depth so as to require no more than 25 feet of lateral travel for employees.

6.2.5 Protective Systems

Protective systems shall be designed in accordance with 29 CFR 1926.652(b) or (c) and shall have the capacity to resist without failure all loads that are intended or could reasonably be expected to be applied or transmitted to the system. Attachments 2 and 5 provide guidance on the selection of protective systems for excavations 20 feet or less in depth.

6.2.6 Exposure to Falling Loads

No employees shall be permitted underneath loads handled by lifting or digging equipment. Employees shall be required to stand away from any vehicle being loaded or unloaded to avoid being struck by spillage or falling materials. Operators may remain in the cabs of vehicles being loaded or unloaded provided the vehicles are equipped with a cab shield and/or canopy adequate to protect the operator from shifting or falling materials.

6.2.7 Warning System for Mobil Equipment

When mobile equipment is operated adjacent to an excavation, and the operator does not have a clear and direct view of the edge of the excavation, a warning system shall be utilized such as barricades, hand or mechanical signals, or stop logs.

6.2.8 Hazardous Atmospheres

Where an oxygen deficient (less that 19.5 percent oxygen) or hazardous atmosphere exists, or could reasonably be expected to exist, the excavation shall be tested before employees enter. Testing shall be conducted as often as necessary to ensure that the atmosphere remains safe. Some excavations may be considered confined spaces, which require compliance with Shaw E&I Procedure No. EIG-HS-300, “Confined Spaces.”

Adequate precautions shall be taken to prevent employee exposure to oxygen deficient or hazardous atmospheres. As appropriate, ventilation and/or respiratory protective devices shall be used.

6.2.9 Water Accumulation Hazards

Employees shall not work in excavations in which there is accumulated water, or in excavations in which water is accumulating, unless adequate precautions have been taken to protect employees against the hazards posed by water accumulation. If water is controlled or prevented from accumulating by the use of water removal equipment, the process shall be monitored by a competent person to ensure proper operation.

If the excavation work interrupts the natural drainage of surface water (streams, run-off channels), diversion ditches, dikes, or other suitable means shall be used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation. Excavations subject to run-off from heavy rains shall be regularly inspected by a competent person.

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6.2.10 Stability of Adjacent Structures

Structures adjoining an excavation shall be evaluated to assess their stability. Excavation below the level of the base or footing of any foundation or retaining wall that could reasonably be expected to pose a hazard to employees shall only be permitted when:

- A support system (underpinning) is provided to ensure the safety of employees and the stability of the structure
- Excavation is in stable rock
- A registered professional engineer has determined that the structure will be unaffected by the excavation
- A registered professional engineer has determined that such excavation will not pose a hazard to employees

Sidewalks, pavements, and other surface structures shall not be undermined unless a support system or another method of protection is provided to protect employees from the possible collapse of such structures.

6.2.11 Protection from Loose Rock or Soil

Employees shall be protected from loose rock or soil, which could fall or roll from the excavation face or edge. Such protection could consist of scaling to remove loose materials, or the installation of protective barriers. All spoil shall be placed at least 2 feet from the edge of the excavation. It is strongly recommended that spoil be placed 4 or more feet from the excavation edge so as not to cover surface indicators of subsidence (*i.e.*, fissures or cracks).

6.2.12 Inspections

The competent person shall make daily inspections of excavations, adjacent areas, and protective systems for evidence of conditions that could result in a cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. The inspection shall be made prior to the start of work, and as needed throughout the shift. Inspections shall be made after each rainstorm or other hazard-increasing event and will be documented using Attachment 3, “Excavation Inspection.”

Where the inspection finds evidence of any hazardous condition, exposed employees shall be immediately removed from the hazardous area until necessary precautions have been taken.

6.2.13 Fall Protection

Where employees or equipment are permitted to cross over excavations, walkways or bridges shall be provided. Standard guardrails shall be provided where walkways are 6 feet or more above lower levels.

Adequate barriers or other types of physical protection shall be provided at all remotely located excavations. All wells, pits, shafts, etc., shall be barricaded or covered and shall be backfilled as soon as possible.

7. ATTACHMENTS

- Attachment 1, Excavation and Trenching Responsibility Matrix
- Attachment 2, Shoring or Shielding Options
- Attachment 3, Excavation Inspection

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- Attachment 4, Soil Classification Worksheet
- Attachment 5, Selection of Protective Systems for Excavations 20 Feet or Less in Depth
- Attachment 6, Sloping Options

8. FORMS

None

9. RECORDS

- Excavation Inspection
- Soil Classification Worksheet

10. REVISION HISTORY AND APPROVAL

Revision Level Revision Date	Revision Description	Responsible Manager
00 4/25/2002 2/13/2004	Initial Issue. Changes were made in 2004 to the responsibility matrix only: The Vice president, Health and Safety was changed to the Director of Health and Safety. There was no revision change.	Warren Houseman, Troy Allen
01 9/16/2010	Converted procedure to Standard Operating Procedure format. Corrected errors in Attachments 4 and 5 Added references to Shaw E&I Procedure No. HS 308, Underground/Overhead Utility Contact Prevention	Troy Allen
02 8/25/2011	Modified format only to align with Governance Management framework.	Andrew Johnson

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Attachment 1
Excavation and Trenching Responsibility Matrix

Action	Procedure Section	*Responsible Party*					
		Employee	Supervisor	Registered Professional Engineer	Senior Director of Health and Safety	Local H&S Representative	Competent Person
Incorporate state or local, requirements into project plans.	1.0					X	
Issue, revise, and maintain procedure	5.1				X		
Coordinate identification of underground utilities.	6.1.1		X				
Determine need for traffic control devices.	6.1.3		X				
Participate in excavation training.	6.1.4	X	X			X	X
Ensure that protective systems are installed and maintained.	6.2.1						X
Classify Soil Type	6.2.3						X
Design Structural Ramps	6.2.4						X
Selection and design of protective system(s)	6.2.5			X			
Determine stability of adjacent structures.	6.2.10			X			
Inspecting excavation for hazardous conditions	6.2.12	X	X				X

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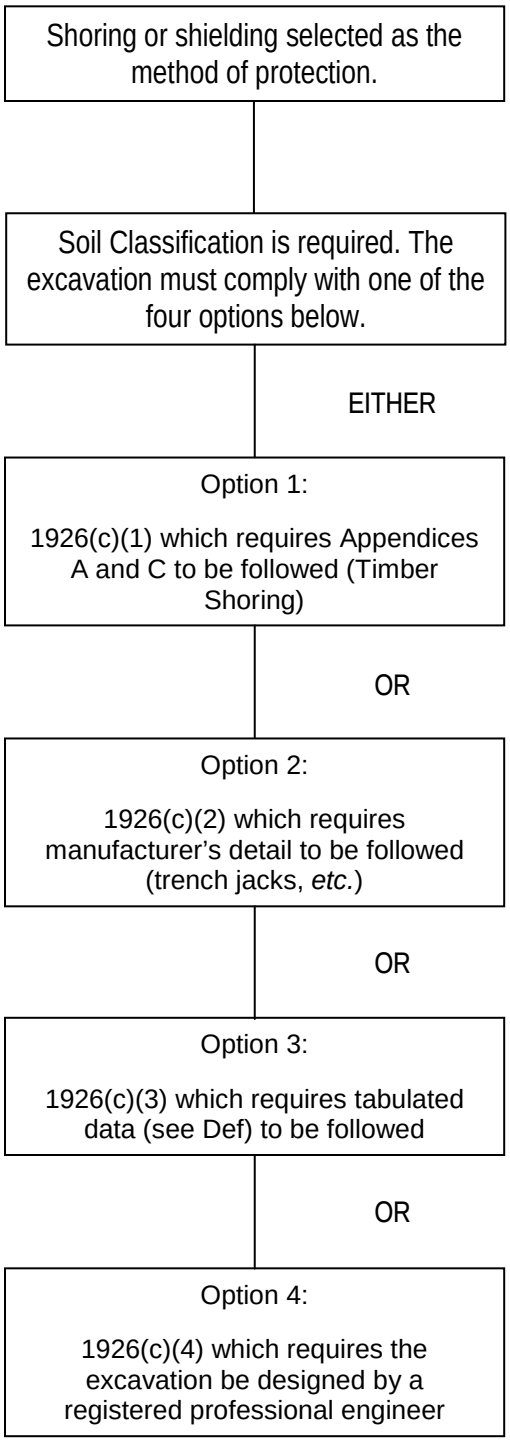
Attachment 2
Shoring or Shielding Options



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Attachment 3
Excavation Inspection

THIS INSPECTION IS TO BE COMPLETED BY THE COMPETENT PERSON

EACH DAY THAT EMPLOYEES WILL BE ENTERING AN EXCAVATION.

Project Name: _____ Project Number: _____

Date: _____ Time: _____ Competent Person: _____

Soil Classification (see Soil Classification Worksheet): _____

Excavation Depth: _____ Excavation Width: _____

Type of Protective System Used: _____

		YES	NO	N/A
1.	**GENERAL:**			
	Surface encumbrances removed or supported			
	Employees protected from loose rock or soil that could pose a hazard by falling or rolling into the excavation.			
	Hard hats, steel-toed boots, and safety glasses worn by all employees.			
	Spoils, materials, and equipment set back at least 2 feet from the edge of the excavation.			
	Walkways over excavations 6 feet or more above lower levels are equipped with standard guardrails.			
	Warning vest or other highly visible clothing provided and worn by all employees exposed to public vehicular traffic.			
	Employees required to stand away from vehicles being loaded or unloaded.			
	Warning system established and utilized when mobile equipment is operating near excavation edge.			
	Employees prohibited from going under suspended loads.			
2.	**UTILITIES:**			
	Utility companies contacted and/or utility locations delineated.			
	Underground installations protected, supported, or removed while excavation is open.			
3.	**MEANS OF ACCESS AND EGRESS:**			
	Lateral travel to means of egress no greater than 25 feet in trench excavations 4 feet or more in depth.			
	Ladders used in excavations secured and extended 3 feet above the edge of the trench.			
	Structural ramps used by employees designed by a competent person.			
	Structural ramps used for equipment designed by a registered professional engineer.			

4.	**WET CONDITIONS:**			
	Precautions taken to protect from the accumulation of water.			
	Water removal equipment monitored by a competent person.			
	Surface water or runoff diverted or controlled to prevent accumulation in the excavation.			
	Inspections made after every rainstorm or other hazard-increasing occurrence.			
5.	**HAZARDOUS ATMOSPHERE:**			
	Atmosphere within the excavation tested where there is a reasonable possibility of an oxygen deficient, combustible, or otherwise hazardous atmosphere.			
	Adequate precautions taken to protect employee from exposure to a hazardous atmosphere.			
	Testing conducted to ensure that the atmosphere remains safe.			
	Emergency equipment, such as breathing apparatus, safety harness and line, and basket stretcher readily available where hazardous atmosphere does exist.			
6.	**SUPPORT SYSTEMS:**			
	Materials and/or equipment for support systems selected based on soil analysis, trench depth, and expected loads.			
	Materials and equipment used for protective systems inspected and in good condition.			
	Damaged materials and equipment used for protective systems inspected by a Registered Professional Engineer after repairs and before being placed back into service.			
	Protective systems installed without exposing employees to the hazards of cave-ins, collapses, or from being struck by materials or equipment.			
	Members of support systems securely fastened to prevent failure.			
	Support systems provided to insure stability of adjacent structures, buildings, roadways, sidewalks, walls, *etc.*			
	Excavations below the level of the base or footings approved by a registered professional engineer.			
	Removal of support systems progresses from the bottom, and members are released slowly as to note any indication of possible failure.			
	Excavation of material to a level of greater than 2 feet below the bottom of the support system and only if the system is designed to support the loads calculated for the full depth.			
	Shield system placed to prevent lateral movement.			
	Employees are prohibited from remaining in shield system during vertical movement.			
7.	**REMARKS:**			

Attachment 4
Soils Classification Worksheet

The following worksheet outlines the visual and manual tests that the competent person must perform at least once, and each time soil conditions change. At least one visual and one manual test must be performed; however, performing several tests is recommended so that the condition of the excavation is thoroughly examined.

Project Name: _____ Project Number: _____
Date: _____ Time: _____
Where was the sample taken from? _____

I.	**VISUAL TESTS:** *One or more visual tests are required for each classification and each time conditions change.*		
1.	Estimate range of particle sizes:	a. primarily fine-grained = cohesive material b. primarily coarse-grained = granular material	
2.	Observe excavated soil:	a. clumps = cohesive material b. breaks up easily = granular material	
3.	Observe sides and adjacent surface area of opened excavation:	a. crack like openings = fissured material b. soil spalls off vertical sides = possible fissured material	
4.	Previous excavation activities:	a. previously disturbed soil	b. not previously disturbed soil
5.	Observe opened side of excavation:	a. layered systems c. estimate degree of slope of layers:	b. layers sloped towards excavation _____
6.	Water condition:	a. evidence of surface water c. depth of water table :	b. water seeping from sides _____
7.	Vibration present:	a. area adjacent to excavation	b. area within excavation

II.	**MANUAL TESTS:** *One or more manual tests are required for classification and each time soil conditions change.*	
1.	Plastically- soil is cohesive if following is true:	a. mold soil samples into a small ball b. roll ball into thread 1/8″ diameter c. pick up 2" length of 1/8″ thread by one end without breaking
2.	Dry Soil Strength:	a. crumbles on its own or with moderate pressure = granular b. falls into clumps which break into smaller clumps that are only broken with difficulty = clay with gravel, sand, or silt. c. breaks into clumps which do not break into smaller clumps and can only be broken with difficulty with no visual indication of fissures = unfissured.
3.	Thumb penetration test: *(These tests are to be run on a large clump of material as soon as it is excavated.)*	a. can be easily indented by the thumb but penetrated by thumb only with great effort Type A b. easily penetrated several inches by thumb and molded by light finger pressure = Type C
4.	Unconfined Compressive Strength: (*Saturated Soil Needed)*	a. Pocket Penetrometer reading (take 10 readings and average) 0 - 0.5 = Type C, 0.5 - 1.5 = Type B, 1.5 - 2.0 = Type A b. Shear Vane reading X2: 0 - 0.5 = Type C, 0.5 - 1.5 = Type B,1.5 - 2.0 = Type A
5.	Drying Test: *(A dry soil sample 1" thick X 6' diameter is needed)*	a. develops cracks = fissured material b. dries without cracks and breaks by hand with considerable force significant cohesive content = unfissured cohesive material. c. sample breaks easily by hand = fissured cohesive or granular material d. easily pulverize dry clumps by hand or by stepping on them = granular e. don't pulverize easily = fissured cohesive.

SOIL CLASSIFICATION: Type A Type B Type C Stable Rock Other _____

COMPETENT PERSON: _____ _____ _____
Print Name Signature Date

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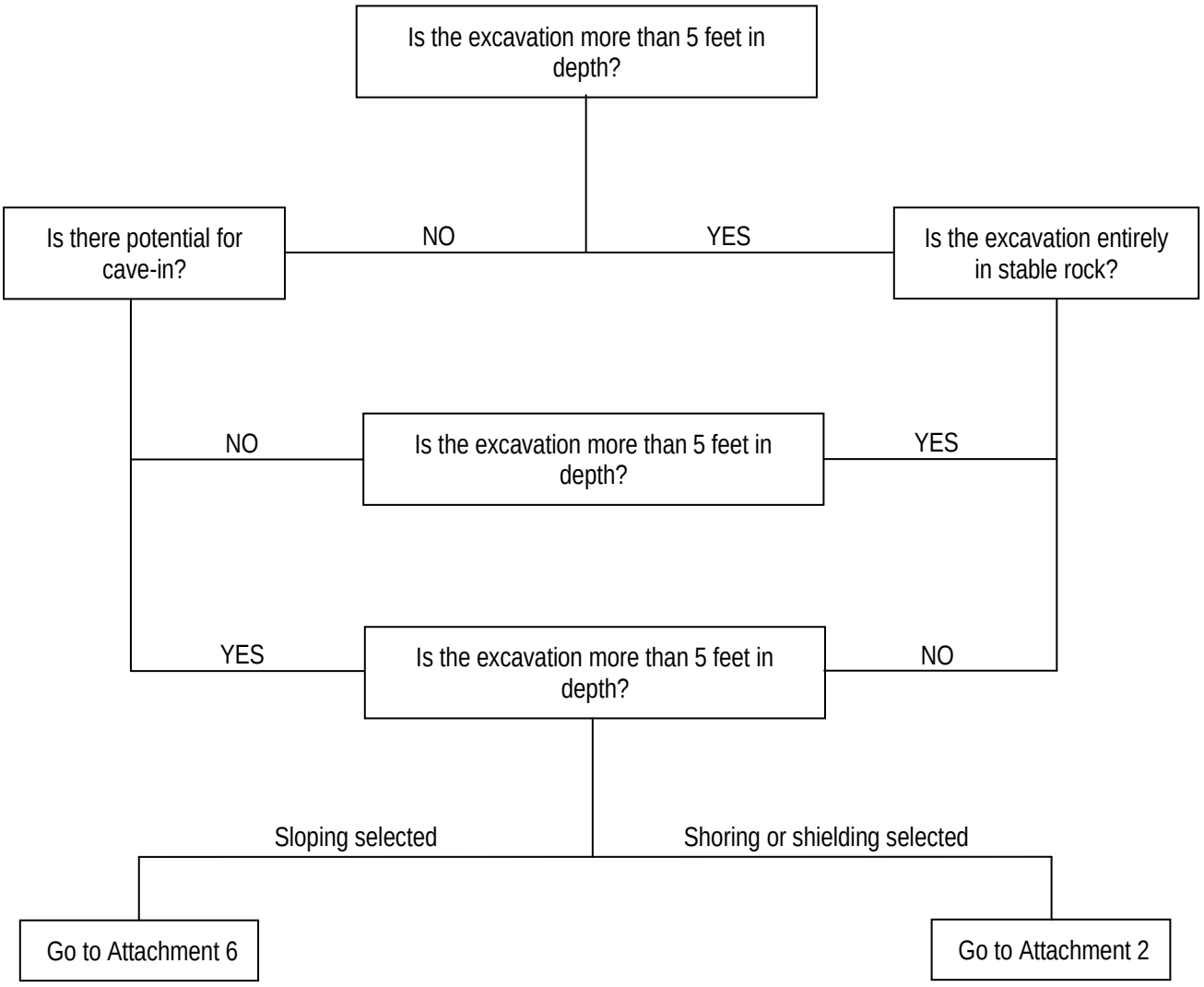
Attachment 5
Selection of Protective Systems for Excavations 20 Feet or Less in Depth



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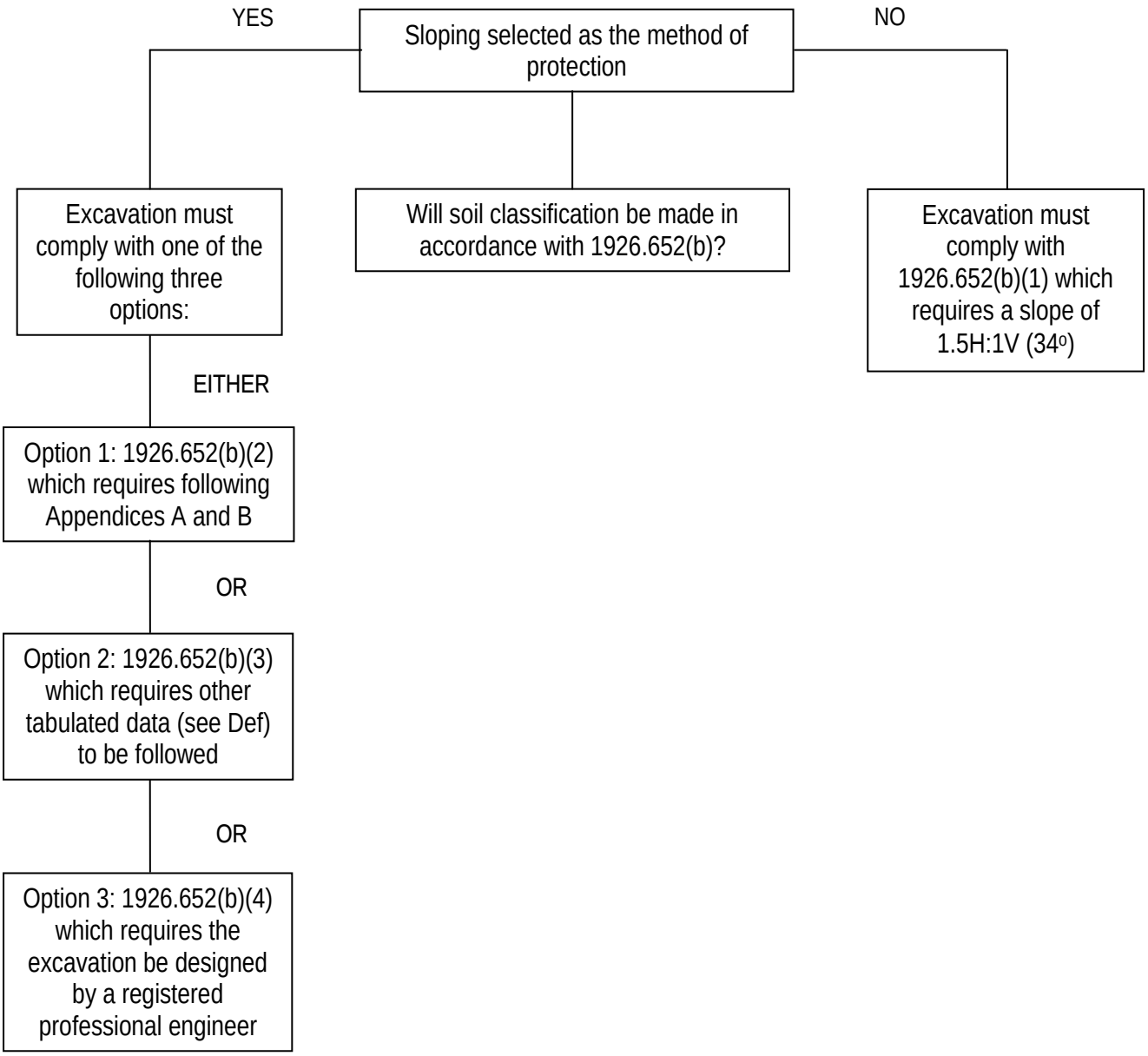
Attachment 6
Sloping Options



1. PURPOSE

This procedure prescribes the steps to be followed in order to prevent accidents involving the contact with or damage of underground/overhead utilities. The company provides the operational and training practices required to safely execute work where underground/overhead utility hazards may exist.

2. SCOPE

This procedure applies to all excavation and trenching activities.

2.1 Exception Provisions

Anytime a minimum of a 5-foot clearance cannot be obtained by either hand digging, vacuum excavation, or by using geophysical means, the Field Team Leader (FTL) must obtain a variance from the Regional Vice President (or equivalent level such as Operations Director for Federal Business Line) or designee to proceed with drilling operations in that area. This would include an initial verbal variance documented in the field log followed up by a written (email) approval from either the Regional Vice President (or equivalent level or title) or designee. The record of communication will be noted in the field log for the project, and a record of the approval or denial will be placed in the project file. The Health and Safety Department will only serve as a consultant to this procedure and is not required to sign the variance.

A variance form can be obtained in Form EIG-HS-308.1, “Variance Request Form.” A flowchart to assist one in determining how and when a variance should be obtained can be found as Attachment 1, “Flowchart to Obtain a Variance.”

3. REFERENCES

- Shaw Environmental & Infrastructure, Inc. (Shaw E&I) Procedure No. EIG-HS-013, “Health and Safety Procedure Variances”
- Shaw E&I Procedure No. EIG-HS-020, “Accident Prevention Program: Reporting, Investigation, and Review”
- Shaw E&I Procedure No. EIG-HS-050, “Training Requirements”
- Shaw E&I Procedure No. EIG-HS-307, “Excavation and Trenching”
- Shaw E&I Form EIG-HS-308.01, “Variance Request Form”

4. DEFINITIONS

- **Boring Activities**—Any mechanical or manual penetration of the earth’s surface below 5 feet using drilling, Geoprobes, hand auguring equipment, or similar type of equipment. Boring activities also include the installation of stakes or fence posts to a depth of 5 feet or greater.
- **Company**—All wholly-owned subsidiaries of Shaw E&I.
- **Competent Person – Drilling Oversight (CPDO) Training**—When drilling activity is to take place the Shaw FTL must have successfully completed Shaw’s in-house training pertinent to competent person drilling oversight (CPDO Training). The FTL is required not only to have successfully completed CPDO training but to have an appropriate educational background,

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coupled with field experience and the authority to make changes to correct deficiencies, or to stop the job if need be.

- **Competent Person – Excavation and Trenching—A person** who is capable of identifying existing and predictable hazards in the excavation/trenching work area and who has the authority to take prompt corrective measures to eliminate them. NOTE: Excavation/Trenching training is required when trenching/excavation hazards are present/anticipated (i.e., spoil piles, use of 3-foot or larger diameter augers, or other circumstances) but only recommended when trenching/excavation hazards are not present/anticipated.
- **Excavation Activities**—Any mechanical or manual penetration of the earth's surface below 5 feet using heavy equipment such as excavators, backhoes, dozers, etc. Excavation activities also include manual use of hand shovels, pick-axes, etc. to a depth of 5 feet or greater. The use of 3-foot or larger diameter augers is also included.
- **Excavation**—Any manmade cut, cavity, trench, or depression in an earth surface formed by earth removal.
- **Underground Utility**—Any active or inactive subsurface or buried structure that is or was designed to service a public or private facility. These may include, but are not limited, to the following:
  - Electric power lines
  - Natural gas lines
  - Telephone lines
  - Telephone cables and fiber optic lines
  - Water lines
  - Steam and pneumatic lines
  - Sewer lines
  - Drain lines
  - Underground storage tanks
  - Septic tanks
  - Process or product lines
- **Overhead Utility**—Any active or inactive overhead structure that is or was designed to service a public or private facility. These may include, but are not limited, to the following:
  - Overhead power lines
  - Overhead telephone lines
  - Overhead fiber optic lines
  - Overhead cables
  - Overhead supports
  - Overhead piping
  - Traffic lights
  - Utility bridges

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- **One Call Center**—Each state has a One Call, Dig Safe, Miss Dig, etc. dial-in number for requesting mark-out of buried public utilities, such as gas lines, electrical lines, telephone/cable lines, sewer lines, and water lines. This number is typically called a minimum of 72 hours prior to subsurface activities depending on the particular state in which the work will be conducted. The One Call Center will notify the local public utilities for a line location mark-out for the particular location. The individual public utilities must locate and mark-out the utilities upon request. In most cases, the markouts will not be performed on private property. A confirmation number is established and confirmation report generated and submitted to the requester.

- **As-Built Drawings**—As-built drawings are blueprints that are usually obtained from the facility owner or client. They show original buried utilities and any modifications that have been made.

- **Private Utility Locating Service**—A private utility locating service is a firm established to locate underground utilities using specialized locating equipment, such as ground penetrating radar location devices or radio transmitter type utility locating equipment.

- **Fiber Optic Service Lines**—Fiber optic service lines are communication lines that are buried underground. When damaged, these lines are very expensive to replace. Fiber optic companies routinely provide on-site supervision, if requested. The company encourages this practice.

- **Field Team Leader**—The FTL is the person with whom the responsibility of the execution of the field work resides. This person may be the Project Manager, Senior Geologist, Staff Geologist, etc. This individual must have the sufficient experience, training, and field knowledge to ensure all site configuration information is collected and analyzed.

- **Site Survey**—A site survey is an inspection of the work site to look for signs of other buried utilities that may not be indicated through as-built drawings or through utility locating services. The survey typically involves inspection of overhead electrical services, inspection of basements, utility rooms, garages, etc., for signs of old electrical conduits or fuel/water/septic lines. The FTL must contact the appropriate site representative to provide any additional information that may be marked on the as-builts.

- **Vacuum Excavator**—Equipment that excavates underground utilities with a combination of alternating water-and-air or air-and air pulsations (e.g., Air knife, water knife, etc.)

5. RESPONSIBILITY

5.1 Procedure Responsibility

The Executive Director of Health and Safety is responsible for the issuance, revision, and maintenance of this procedure. Also, see Attachment 2, “Underground/Overhead Utility Contact Prevention Responsibility Matrix,” for matrix of responsibilities.

5.2 Action/Approval Responsibilities

The Responsibility Matrix is Attachment 2.

6. PROCEDURE

Underground/overhead utilities may be encountered at any job site. The guidelines established in this procedure were developed to help identify and mitigate the potential hazards associated with this type of work.

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Any subsurface activity is subject to the underground utility locating regulations for the state where the work will be conducted. This procedure authorizes the use of state, local, or other required practices, but requires that the practice, which most limits the liability to Shaw for damaged utilities, is utilized. No variance is required under these circumstances, but the project-specific Health and Safety Plan (HASP) or Work Plan shall fully document these more protective procedures.

6.1 Boring Activity Requirements

6.1.1 Preliminary Requirements

The Project Manager or designee must visit the site to mark the boring locations so they can be clearly identified and then contact the One Call Center for the state in which the work is to be performed in to formally request a utility mark out at the particular work location(s).

Prior to assignment of work the FTL will assure that all affected employees receive an overview of the hazards of encountering underground/overhead utilities. The FTL is responsible to review this procedure, the work practices to control these hazards, and the roles and responsibilities of each worker with the work crew. This procedure and other requirements that may be contained in the site specific HASP shall be reinforced during daily Tailgate Safety Meetings.

6.1.2 Operating Requirements

Prior to conducting any project site activities, the FTL must ensure that all existing underground/overhead utilities in the work area are located per the state or local mark-out protocols. The Pre-Boring/Excavation Checklist (Form EIG-HS-308.02) will assist the FTL with this assessment. Documentation of utility mark-out must be completed using the Utility Mark-out Documentation form (EIG-HS-308.03). No boring work is to be performed until all utility mark-outs are verified.

While on site, the FTL must conduct a site survey to search for signs of other buried or overhead utilities. This will include areas such as garages, basements, etc. The results of such surveys must be documented on the Utility Mark-out Documentation form (EIG-HS-308.03). The property owner, client, or facility operator must be consulted on the issue of underground utilities. All knowledge of past and present utilities must be evaluated prior to conducting work.

After all mark outs have been completed, and the boring locations have been accepted by the FTL prior to drilling, each borehole location must be hand dug or vacuum excavated to a minimum of 5 feet bgs.

If the investigation requires boreholes in an area not covered by a municipal one call system (on private property), then the FTL must utilize appropriate geophysical techniques, hand held utility locating devices, a private utility locating firm, or other approved method to determine the locations of underground utilities. The current accepted geophysical methods for the investigation and location of buried utilities include: Ground Penetrating Radar (GPR), Time Domain and/or Frequency Domain Electromagnetic methods, Magnetometer, and Inductive/Conductive Radio-Magnetic methods. The geophysical methods can be very useful for locating buried utility lines in areas where hand digging is not possible or practical. However, it must be noted that these methods do have limitations that are a function of soil conditions, depth of investigation, imaging resolution, or other factors.

If it is determined that a noninvasive geophysical investigation may be needed, assistance with selecting the appropriate method(s) can be obtained from the Shaw E&I Science and Technology Division, Geophysics & Mapping Group, and a variance request must be submitted and approved prior to the inception of intrusive field activity.

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Should the local geology be prone to refusal or should there be any other reason the boring location cannot be cleared to a minimum of 5 feet bgs then the appropriate aforementioned alternative methods should be utilized to ensure the boring location is clear of utilities 5 feet bgs, and a variance request must be submitted for review.

6.2 Excavation Activity Requirements

6.2.1 Preliminary Requirements

The Project Manager or designee must visit the site to mark the excavation locations so they can be clearly identified and then contact the One Call Center for the state in which the work is to be performed in to formally request a utility mark out at the particular work location(s).

Prior to assignment of work the FTL will assure that all affected employees receive an overview of the hazards of encountering underground/overhead utilities. The FTL is responsible for reviewing this procedure, the work practices to control these hazards, and the roles and responsibilities of each worker with the work crew. This procedure and other requirements that may be contained in the site specific HASP shall be reinforced during daily Tailgate Safety Meetings.

6.2.2 Operating Requirements

Prior to conducting any project site activities, the FTL must ensure that all existing underground/overhead utilities in the work area are located per the state or local mark-out protocols. Documentation of utility mark-out must be completed using the Utility Mark-out Documentation form (EIG-HS-308.03). No boring work is to be performed until all utility mark-outs are verified.

While on site, the FTL must conduct a site survey to search for signs of other buried or overhead utilities. This will include areas such as garages, basements, etc. The results of such surveys must be documented on the Utility Mark-out Documentation form (EIG-HS-308.03). The property owner, client, or facility operator must be consulted on the issue of underground utilities. All knowledge of past and present utilities must be evaluated prior to conducting work.

After all mark outs have been completed, and the excavation locations have been accepted by the FTL prior to excavation, each utility identified inside the excavation location must be hand dug (see restrictions under Section 5.3) or vacuum excavated to a verify the utility location. The utility locations must be exposed in enough locations to verify its path of travel. If possible, the excavation location should be moved away from any utilities.

If the investigation requires excavation activities in an area not covered by a municipal one call system (on private property), then the FTL must utilize appropriate geophysical techniques, hand held utility locating devices, a private utility locating firm, or other approved method to determine the locations of underground utilities. The current accepted geophysical methods for the investigation and location of buried utilities include: GPR, Time Domain and/or Frequency Domain Electromagnetic methods, Magnetometer, and Inductive/Conductive Radio-Magnetic methods. The geophysical methods can be very useful for locating buried utility lines in areas where hand digging is not possible or practical. However, it must be noted that these methods do have limitations that are a function of soil conditions, depth of investigation, imaging resolution, or other factors.

If it is determined that a noninvasive geophysical investigation may be needed, assistance with selecting the appropriate method(s) can be obtained from the Shaw E&I Science and Technology Division, Geophysics & Mapping Group, and a variance request must be submitted and approved prior to the inception of intrusive field activity.

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6.3 Other Requirements

Only hand digging is permitted within 3 feet of underground high voltage, product, or gas lines. Once the line is exposed heavy equipment can be used, but must remain at least 3 feet from the exposed line.

Only experienced, demonstrably proficient equipment operators, as determined by the Project Manager, will be used to operate such heavy equipment as drill rigs, backhoes, front-end loaders, cranes, etc.

Due to the sensitivity and costs associated with damage to fiber optic cables, the FTL must have documented verbal contact and an agreement with the fiber optic company for all work within 50 feet of the fiber optic cables. Subsurface investigations near fiber optic cables are more fully discussed in site specific HASPs.

6.4 Overhead Utilities Requirements

The FTL is responsible for marking (warning tape, flags, etc.) overhead utility locations where heavy equipment, or other equipment, has the potential for contacting overhead utilities. Conduct a site inspection on a daily basis to determine where activities will take place and the location of overhead utilities and overhead obstructions. Once they have been identified, place warning tape on poles and/or guy wires and attempt to plan the work so that no contact will be made with the overhead utilities or obstructions. Share the information with all site personnel during the tailgate safety meeting.

When working around overhead utilities, one or more of the following conditions shall be met:

- The Project Manager shall confirm with the utility company that the power is de-energized (preferably in writing).
- The minimal clearance distances shall be established and maintained according to Attachment 3, “Minimum Clearance Distances.”
- Insulating blankets shall be used to isolate the power line and the utility company shall provide the minimum safe operating distance in writing to the Project Manager. Insulating blankets must be placed by the utility company.

Maintain at least 10 feet from overhead power lines, up to 50 kilovolts (kV). For voltages over 50 kV, add 0.4 inches per kV to obtain the safe distance between equipment and power lines. If voltage is unknown, remain at least 20 feet from overhead power lines. See Attachment 3 for the Minimum Clearance Distance table. As a precaution, a spotter must be used at all times when it is possible to violate the minimum distance requirements for overhead utilities. If contact is deemed unavoidable, consult with the client and the respective health and safety representative to evaluate the area to determine if the particular overhead utility can be removed prior to engaging in the activity.

6.5 Training Requirements

6.5.1 Competent Person Drilling Oversight Training

The FTL (at least one on-site Shaw person will be performing the drilling oversight) will be required to have successfully completed the approved internal CPDO training. It is the Project Manager’s responsibility to ensure that the FTL has completed the CPDO training prior to overseeing boring activities.

Prior to assignment of work the FTL will assure that all affected employees receive an overview of the hazards of encountering underground/overhead utilities. The FTL is responsible for reviewing

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this procedure, the work practices to control these hazards, and the roles and responsibilities of each worker with the work crew. This procedure and other requirements that may be contained in the site specific HASP shall be reinforced during daily tailgate safety meetings. A list of Frequently Asked Questions is provided as Attachment 4, "Frequently Asked Questions."

6.5.2 Trenching/Excavation Training

The FTL or at least one on-site Shaw employee will be required to have successfully completed Trenching/Excavation training prior to the inception of site work activity when excavation activities (i.e., excavations, test pits, use of 3-foot diameter augers, or anytime similar hazards are present) are present/anticipated. NOTE: This training is now recommended rather than required when trenching/excavation hazards are NOT anticipated/required.

6.6 Incident Reporting Requirements

Employees are required to immediately report to their direct supervisor any overhead or underground utility contact incident, or near miss incidents. Any supervisor (but preferably the supervisor directly responsible for the involved employees) with first-hand knowledge of an incident is required to investigate the incident. The Project Manager and respective Health and Safety Manager or Representative shall be informed of the incident immediately.

At a minimum, the incident investigation will require completion of the incident investigation report and General Liability Property Damage and Loss Report form found in Shaw E&I Procedure No. HS020.

In addition, Attachment 5, "Underground Utility Hits – Tip Sheet for Incident Investigations," provides a "Tip Sheet" to help properly assess and investigate the incident causes and recommendations or requirements.

6.7 Local Jurisdiction Requirements

Where local jurisdictions or clients have established requirements different from those in this procedure, the practice which most limits the liability to Shaw for damaged utilities shall be utilized. No variance is required under these circumstances but the project-specific HASP or Work Plan shall fully document the alternate procedures.

7. ATTACHMENTS

- Attachment 1, Flowchart to Obtain a Variance
- Attachment 2, Underground/Overhead Utility Contact Prevention Responsibility Matrix
- Attachment 3, Minimum Clearance Distances
- Attachment 4, Frequently Asked Questions
- Attachment 5, Underground Utility Hits – Tip Sheet for Incident Investigations

8. FORMS

- EIG-HS-308.01, Variance Request Form
- EIG-HS-308.02, Pre-Boring Checklist
- EIG-HS-308.03, Utility Mark-Out Documentation

9. RECORDS

- EIG-HS-308.01, Variance Request Form

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- EIG-HS-308.02, Pre-Boring Checklist
- EIG-HS-308.03, Utility Mark-Out Documentation

10. REVISION HISTORY AND APPROVAL

Revision Level Revision Date	Revision Description	Responsible Manager
00 N/A	Initial issue information is unavailable.	N/A
01 2/20/2006	Revision 1 information is unavailable.	Troy Allen
02 9/28/2010	Revised procedure format. Added “boring activities, “excavation activities,” and “vacuum excavator” to definitions section. Provided separate section for “boring activities” and “excavation activities.” After Revision 1 posting and individual found an error that was corrected regarding Competent Person- Drilling Oversight (CPDO) training. The Note that said: “The CPDO training requirement will become effective September 1, 2006> This means that every FTL will have successfully completed CPDO Training prior to August 31, 2006.” Was removed as it was not relevant anymore.	Troy Allen
03 8/25/2011	Modified format only to align with Governance Management framework.	Andrew Johnson

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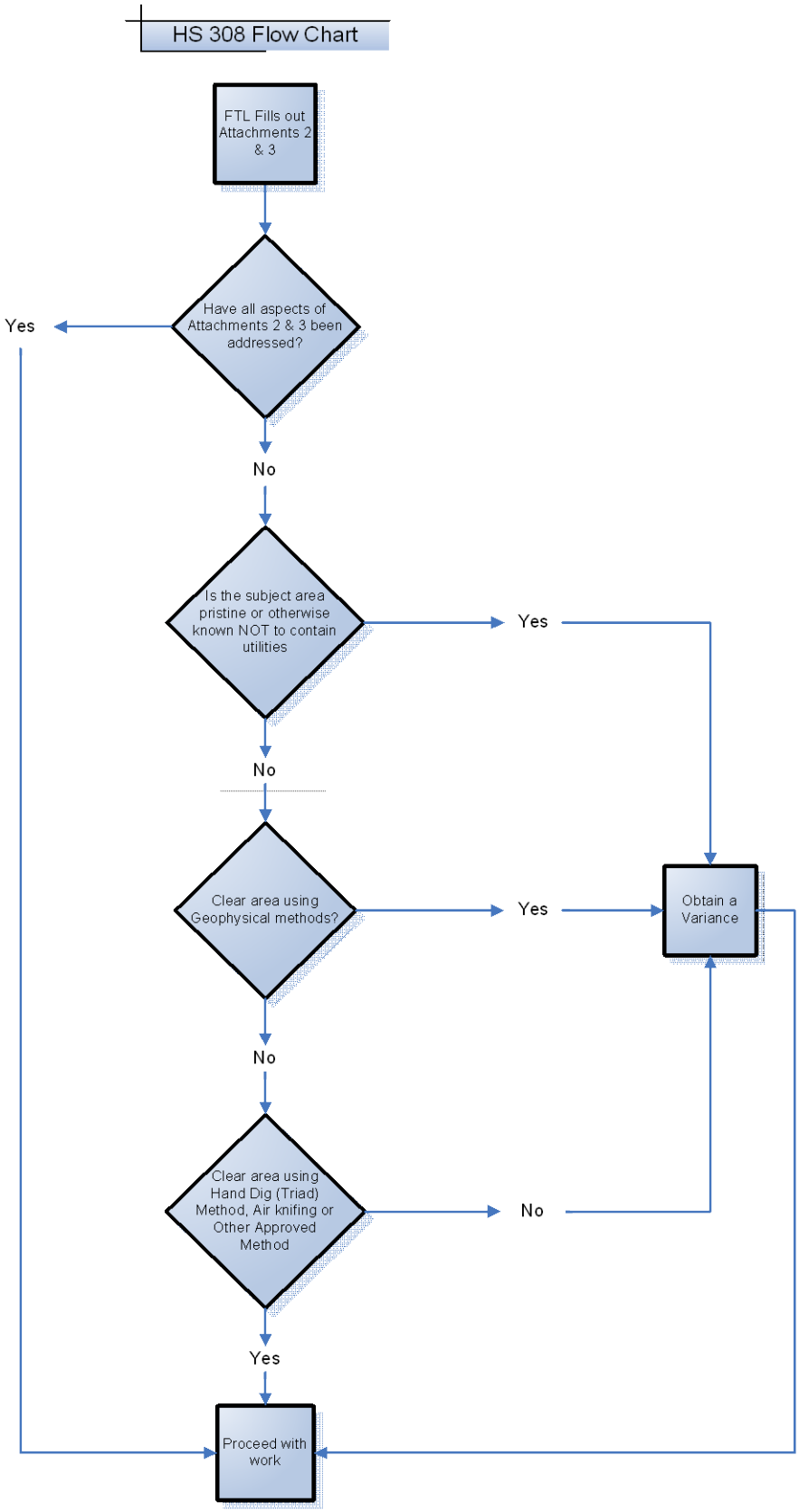
Attachment 1
Flowchart to Obtain a Variance



Attachment 2
Underground/Overhead Utility Contact Prevention Responsibility Matrix

Action	Procedure Section	Vice President	Project Manager	Field Team Leader	Supervisor	HS Representative
Project-specific HASP or Work Plan shall document the practices to be used at a particular site.	6.0		X	X		X
Contact the One Call Center for mark out of utilities at the site	6.1.2		X			
Complete Utility Mark-out Documentation Form	6.1.2		X	X		
Only experienced demonstrably proficient equipment operators will be used to operate such heavy equipment as backhoes, front-end loaders, cranes, etc.	6.3			X		
Provide training*	6.5					
Incident Investigation and Reporting	6.6		X		X	
Exceptions to Procedure	2.1	X	X	X		

*Provided by Shaw's Training Department.

Attachment 3
Minimum Clearance Distances

When work is undertaken near electrical lines, the distance maintained from those lines shall also meet the minimum distances for electrical hazards as defined below:

NOTE: This procedure primarily focuses on electrical overhead utilities; however, all other hazards shall be taken into consideration when performing work.

Normal System Voltage	Required Minimum Clearance Distances
0-50kV	10'
51-100kV	11.6'
101-200kV	15'
201-300kV	18.3'
301-500kV	25'
501-750kV	33.3'
751-1000kV	41.7'

***For those locations where utility companies specify more stringent safe distances, those distances shall be observed.**

Attachment 4
Frequently Asked Questions (FAQ)

During the roll-out of this revision of EIG-HS-308 a variety of questions/comments/concerns arose. These concerns have been put in the form of most frequently asked questions (FAQs) and their respective responses. These FAQs will clear up misunderstanding pertaining to this procedure, and provide valuable information that will help our workforce have a better understanding of how this procedure should be implemented. Please review the FAQs below:

1. *No other competitor of Shaw has felt the need to do anything as extreme as this procedure to ensure minimization of utility hits. Instituting this procedure will put us out of business.*

Response: After thorough review of claims and incidents involving drilling activities and underground utilities, the committee believes that our business/client needs are best served by adopting this policy. And that the likelihood of being put out of business is much greater from continuing to do business the way we currently do it than by adopting this improved policy. The committee realized that 100% adherence to this procedure at all work sites is likely not possible. For those cases where legitimate reasons exist for non-compliance, the committee realized that an effective responsive (variance) system must be in place. The committee believes that the variance procedure, as stated in the policy, should address the exceptions as they occur.

The Committee is not aware of any specific ASTM or true "industry standard". However, the committee is aware that best practices can vary tremendously and many times are client dependent. For example one extremely large Shaw client requires that we continuously probe. On the other end of the spectrum some clients look completely to Shaw for guidance in these matters.

2. *Our clients want us to do the work but do not wish to pay the additional fees involved with this new procedure. Could we offer them a two tiered pricing, one to do it the old way, and one to do it the new way?*

Response: The committee believes that contacting an underground utility of any type, no matter who is at fault or who ultimately pays for fixing, the outcome is a "black eye" for all involved. When these events occur, even if Shaw is not at fault, the committee believes that continued good client relations, and the potential for obtaining future business lessens as utility hits/incidents occur. This procedure is designed to minimize health and safety risks to our workers AND to mitigate liability to Shaw. Receiving the necessary compensation for the precautionary measures outlined in the procedure would be expected, and should be itemized in the initial proposal including a statement as to what will specifically be done in the field to mitigate risks relative to underground utilities and WHY Shaw believes these steps are necessary. However, if the client is willing to assume the entire liability resulting from "hitting" an underground utility, the contract should be written to reflect this and a variance would be in order. Keep in mind that Shaw cannot allow a client's desires to take on liability to affect the health and safety of workers. No matter what the client desires might be, Shaw would still expect the basic procedures to be followed for health and safety purposes. The training though yet to be

finalized will provide project manager's examples of wording to be used in proposals and contracts.

3. *Hand digging to 5' is impossible during frost conditions in Minnesota, Wisconsin and many northern areas. How should this be addressed?*

Response: When conditions present themselves that do not allow for hand digging each borehole, other methods must be used for clearance and a variance must be obtained. The alternative methods include a range of non-invasive geophysical survey techniques designed specifically for locating buried utilities, pipelines, tank (UST), and other buried objects that can interfere with drilling. These non-invasive geophysical methods are suggested and mentioned in the procedure.

4. *What if the field crew runs into refusal during hand dig clearance?*

Response: If refusal occurs and moving to an alternate spot presents the same problem, hand digging may not be possible as mentioned in #2 above. When conditions present themselves that do not allow for hand digging each borehole, other methods must be used for clearance and/or a variance must be obtained. Of course, we expect that the dig safe folks to be contacted, and that a private locating service be utilized if available. Should a private locating service not be available, we can use trained internal sources.

The alternative methods include a range of non-invasive geophysical survey techniques designed specifically for locating buried utilities, pipelines, tank (UST), and other buried objects that can interfere with drilling. The current accepted geophysical methods for the investigation and location of buried utilities include: Ground Penetrating Radar (GPR), Time Domain and/or Frequency Domain Electromagnetic methods, Magnetometer, and Inductive/Conductive Radio-Magnetic methods. These non-invasive geophysical methods are suggested and discussed in the procedures. The geophysical methods can be very useful for locating buried utility lines in areas where drilling and digging are not possible or practical, but these methods do have some limitations that are a function of soil conditions, depth of investigation, and imaging resolution.

If it is determined that a non-invasive geophysical investigation may be needed, assistance with selecting the appropriate method(s) can be obtained from the Shaw E&I Science and Technology Division, Geophysics & Mapping Group. Of course, it is expected that the "dig safe" folks will be contacted, and that a private utility locating service be utilized when appropriate (utility location method is known to be feasible), and if available. Should a private locating service not be available, we can use trained internal Shaw E&I personnel resources to perform utility line location work. Finally, if the Project Manager has determined that a variance to the procedure is justified, a variance request should be submitted for review.

5. *Why is trenching/excavation training required for putting in Geoprobe® boreholes? This seems like tremendous overkill.*

Response: The committee believes that, in general, trenching/excavation training is a good educational tool that promotes overall health and safety awareness and provides important information/techniques for our field staff. Trenching/excavation training provides insights into

fall hazards, spoil pile placement, and many other related safety issues. Many of our drilling jobs have involved oversized auger bits (3' in diameter) where a large deep borehole is created. The committee agrees that when the diameter of the borehole lessens (i.e. use of a Geoprobe®), the impact of trenching/excavation training decreases. Trenching excavation training is now a requirement only when large boreholes are created or other hazards as mentioned above are present, but only recommended training when Geoprobe ® or similar equipment is being used and the result is trenching excavation type hazards do NOT exist. NOTE: Specific training pertinent to drilling/ Geoprobing ®/boring (CPDO training) will be provided and will be mandatory. Additionally, CPDO and trenching / excavation training are both required on projects where 3' or larger diameter boreholes are to be drilled.

6. *Are there any training requirements besides trenching/excavation training?*

Response: The committee evaluated a need for training specific to the HS 308 policy (drilling) and solicited the assistance of the training department and certain operations employees to develop CPDO training. This CPDO training includes basic steps needed to be taken from call the dig-safe number, private utility searches, geo-physical capabilities, probing, hand augering, air knifing, water pumping/knifing, hand digging, and others.

7. *Hand diggings create heat stress, tripping hazards, back injuries, and other hazards and are unnecessary.*

Response: The committee did not envision using a spade and a strong back to dig various 5' holes at the field site. The committee does envision using an air knife, water knife, probe, or other method rather than a hand shovel. The committee understands that not all methods may be acceptable in all states, municipalities or to all clients. The committee was also aware that when all else fails one could consider using a l" diameter stainless steel auger placing 5' bgs hand borings in a triangular pattern where the auger bit could be placed in between these small hand borings. The committee envisions this theme and methodology to be expanded within the upcoming training. Additional information on augering techniques will be provided in the specific training (CPDO) mentioned above.

8. *I need to put borings in pristine farmland next door to a contamination zone. There are no and have never been any utilities in this area. What should I do?*

Response: Once you go through the proper utility locate procedure and are confident that no utilities exist in the subject area, you need to obtain a variance. This would also hold true for pristine forest preserves, wildlife refuges, or other areas not affected by utilities.

9. *Who needs to sign off on a variance?*

Response: Variances are signed by the Area Vice President (or designee, which may be delegated to the BLM for each office) along with the Project/Program Manager/Director. When we know in advance that EIG-HS-308 cannot be adhered to, one should make plans to get a formal variance approval and appropriate paperwork developed two weeks prior to field activity. Variances can also be obtained when field conditions arise that make adherence to EIG-HS-308

impossible. The variance can be obtained via cell phone in the field with the PM and appropriate management with the outcome noted in the field logbook followed up by an appropriate e-mail. This e-mail should be kept in the project file as proof of variance approval. It is recommended that variances be obtained as soon as it is known that they will be required.

10. What constitutes a "probe"? I assume a Geoprobe® is not valid?

Response: A Geoprobe® is NOT a valid probe in that Geoprobes® have caused damage to sewer lines and other utilities. Probes are typically made of a fiberglass-like material that have a pointed end but will not damage subsurface utilities and allows for the field staff to sense if underground items are encountered.

11. Under 5.1, is a subcontractor a designee?

Response: Although a subcontractor can make arrangements to contact dig safe and more, Shaw must ensure that the sub has, in fact, done what they had agreed to do. It should be remembered that typically on drilling projects, from many of our customer's perspective, the liability remains with Shaw, and they will look to Shaw, not our subs, for resolution of any events that occur. Hence, it is incumbent on Shaw to insure that our procedures are followed by Shaw and Shaw subs.

12. Does ground surface include concrete, asphalt or other man-made coverings?

Response: A simple NO. Some of our projects include drilling through airport runways or tarmacs which can be up to 15" in depth. Manmade surfaces do NOT count in the 5' hand dig clearance specification. If we are attempting to advance boreholes below existing concrete surfaces, the geology below the concrete will be exposed by cutting the concrete and removal of the concrete. After the concrete is removed and the geology is exposed, a hand auger can then be used.

Hopefully, the twelve concerns above and the responses to these comments will have helped users understand the implementation of this EIG-HS-308 policy. More importantly the committee realizes that information on this subject will be provided during the training mentioned above. It is the committee's belief that once this program has been completely rolled out the need for variances will be minimal and the interactions of the safety department with operations management with this entire process will make ensure success.

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Attachment 5
Underground Utility Hits
Tip Sheet for Incident Investigations

1. Location of the incident.
2. The time of day the incident occurred.
3. What type of utility was hit?
4. How deep was the line hit (in feet)?
5. Who called Designated Locator Service?
6. Note the “One Call” number on the Incident Investigation Follow-up report.
7. Attach the “One Call” record keeping documentation.
8. Were mark-outs completed by the utilities? If so, please identify.
9. Were mark-outs legible at the site?
10. Was the mark-out of the line that was hit accurate?
11. Was the mark-out misinterpreted?
12. Is there a utility damage sheet attached to the Incident Investigation Follow-up Report?
13. Have there been any faults or oversights by any 3rd party? If so, is it documented on the Incident Investigation Follow-up Report?
14. Did the FTL interview the property owner/manager prior to the incident?
15. Was pre-screened by hand digging 5 feet?
16. Were any supplemental utility locator devices used? If so, did we obtain them? If so, were they used on site?
17. Were there blueprints/as built plans available? If so, did we obtain them? If so, were they used on site?
18. Who is paying for the repairs?
19. Please define the total hours and cost estimate/impact to address the utility damage incident:

_____ Site time in hours (not billed to the job)

_____ PM time hours (not billed to the job)

_____ H&S time in hours (not billed to the job)

_____ BLM Time in hours (not billed to the job)

_____ Rework/non-billable time (estimate)

_____ Subcontractor rework/non-billable costs (estimate)

_____ Repair costs to company (estimate)

_____ Repair cost to customer (estimate)

20. Has the FTL completed Shaw's in-house CPDO training?
21. Has the FTL completed trenching/excavation training?
22. Is he/she current with the OSHA 40 hour and 8 hour refresher? If so, what are the dates of the training?
23. Who was the Site Safety Officer on the job site?
24. Does he/she have OSHA 8 hour supervisor training? If so, what are the dates of the training?
25. What was the name of the drilling subcontractor that was on site?
26. Have we researched the training background for this vendor?
27. Was a JSA performed at least once during the day that covered utility contacts and associated hazards?
28. Does this vendor have approved status?
29. Was there a tailgate safety meeting that took place?
30. Were utility mark-outs addressed at the tailgate safety meeting?
31. Were there any markings nearby the "hit" area?

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Variance Request Form

Variance Request for Company Procedure: EIG-HS-308-Underground/Overhead Utility Clearance procedure	Date of Request:
Requestor:	Location:
Reason for the variance:	
Alternate Procedure(s) that will be implemented:	
APPROVED	**REJECTED**
Regional VP or Designee	

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Pre-Boring Checklist

Purpose: This form is designed to help the FTL make decisions during boring/excavation around underground/overhead utilities.

DATE _____ PROJECT NAME/NUMBER _____

Field Team Leader Name: _____

DURATION/SUMMARY OF WORK TO BE PERFORMED: _____

_____

Consideration	Check	Check	Explanation	Initial
Has the state one-call been contacted?	☐ Yes	☐ No		
Are any as-built drawings available? If so, do they show any utilities?	☐ Yes	☐ No		
Has a visual inspection of the work area(s) been completed?	☐ Yes	☐ No		
If one-call not available has a private locating service or Shaw S&T group been contacted?	☐ Yes	☐ No		
Were any utilities identified through private locating service? If so, indicate on site drawings.	☐ Yes	☐ No		
Are there any fiber optic cables within 50 feet of hole locations?	☐ Yes	☐ No		
If fiber optic cables are within 50 feet has an agreement with the fiber optic company been established?	☐ Yes	☐ No		
Can a test borehole be advanced by hand digging, probing, post hole digging, and/or air knifed to 5 feet bgs?	☐ Yes	☐ No		
If hand digging, probing, post hole digging, and or air knifing to 5 feet bgs is not possible, can a non-invasive geophysical investigation be conducted? If not, why?	☐ Yes	☐ No		
Are you comfortable with approving this authorization?	☐ Yes	☐ No		
Other considerations:				

Utility Mark-Out Documentation

Project Name: _____ **Location:** _____
FTL Name: _____ **Date:** _____
Utility Called: _____ **Confirmation #:** _____
Subcontractor: _____ **Task/Activity:** _____
County of work: _____ **Municipality of work:** _____

Before work is done on any site, contact the appropriate local utility locating service (One Call, Miss Dig, Uloco, etc.) or a local utility contractor to have sub grade utilities marked. NOTE: Boring locations to be placed not in the public right of way are typically not marked out by the public utility mark out, and a private utility locate service must be engaged. Indicate to the utility locator the nearest intersecting street for the site: _____
_____ **Confirmation No:** _____.

List utility firms (public and private) and the utility they will mark.

Utility Marker Emergency Telephone Numbers Major Utilities Marked by Color Code			
Name of Utility Company	Utility	Color Code	Emergency Telephone Number
	Water	**Blue**	
	Gas	**Yellow**	
	Electric	**Red**	
	Telephone/ Cable/ Communication	**Orange**	
	Sewer	**Green**	

"ALL UNDERGROUND UTILITIES MAY NOT BE LOCATED BY THE LOCAL UTILITY SERVICE". Accordingly, you must list other known utilities in the area that the "One Call" service will not contact:

Attach photos of the area prior to placing boreholes.
Take photos of the area indicating minimum 5' hand dig, post hole dig, probe, GPR or other:
NOTE: For any borehole, should 5' minimum clearance not be obtained, you must contact Business Line Vice President or equivalent (Operations Director or other on the Federal Business Line) and obtain a variance.

Completed by: _____
_____

_____ _____ _____
Name **Signature** **Date**

1. PURPOSE

This procedure establishes the minimum requirements for the lockout and tagout of energy and hazardous material sources and must be used to:

- Ensure that all machinery, equipment, or confined spaces are isolated from all potential hazard sources (mechanical, electric, chemical hazards, etc.) and are locked out and tagged out prior to employees performing any servicing, maintenance, or entry activities.
- Ensure that field projects where hazardous energy/material sources are present develop a site-specific Lockout/Tagout procedure.
- Ensure that equipment can accommodate locks. Additional means such as a tagout program may be used to ensure safety when locks are not used.
- Establish procedures for release of the Lockout/Tagout that include machine inspections, notification and safe positioning of workers, and removal of the Lock/Tag.
- Ensure the use of standardized locks and tags that identify the worker using them, making sure that locks and tags are of sufficient quality and durability to ensure their effectiveness.
- Provide the necessary employee training.

For a basic overview of the Lockout/Tagout System refer to the "Flow Diagram - Overview: Lockout/Tagout System" (Attachment 2).

2. SCOPE

This procedure applies to all Shaw E&I Project Sites and Office Locations (Warehouses, etc.) where workers could be expected to remove any equipment from service for maintenance, malfunction or other valid reason during the course of their regular employment.

2.1 Exception Provisions

Variances to this procedure shall be requested in accordance with procedure EIG-HS-013 Health and Safety Procedure Variances.

3. REFERENCES

- EIG-HS-050 Training Requirements
- EIG-HS-052 Health and Safety Plans
- EIG-HS-300 Confined Spaces
- EIG-HS-301 Confined Spaces, Marine
- EIG-HS-302 Confined Spaces, Leaded Product
- EIG-HS-310 Hazardous Waste Operations
- EIG-HS-311 Emergency Response Operations
- EIG-HS-312 Hazardous Waste Operations at TSD Facilities

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4. DEFINITIONS

- **Affected Employee**—An employee whose job requires him/her to operate or use a machine or equipment on which servicing or maintenance is being performed under lockout and tagout, or whose job requires the employee to work in an area in which isolation of hazards is necessary to provide a safe workplace.
- **Authorized Employee**—A person who locks out or tags out machines or equipment in order to perform servicing or maintenance on that machine or equipment. An affected employee becomes an authorized employee when that employee's duties include performing servicing or maintenance.
- **Blanking or Blinding**—The absolute closure of a pipe, line, or duct by the fastening of a solid plate (such as a spectacle blind or skillet blind) that completely covers the bore, and that is capable of withstanding the maximum pressure of the pipe, line, or duct with no leakage beyond the plate.
- **Capable of Being Locked Out**—An energy/hazard isolating device is capable of being locked out if it has a hasp or other means of attachment to which, or through which, a lock can be affixed, or it has a locking mechanism built into it. Other energy isolating devices are capable of being locked out, if lockout can be achieved without the need to dismantle, rebuild, or replace the energy/hazard isolating device or permanently alter its energy control capability.
- **Double Valve and Vent**—A valve arrangement in a piping system in which three valves are arranged in conjunction with a vent line. One valve is upstream of the vent, another downstream, and one is on the vent itself. To isolate the downstream system, the vent valve is opened, the other two are closed, and all three valves are locked in this position.
- **Energized**—Connected to an energy source or containing residual or stored energy.
- **Energy Isolating Device**—A mechanical device that physically prevents the transmission or release or energy, including but not limited to the following: A manually operated electrical circuit breaker, a disconnect switch, a manually operated switch by which the conductors of a circuit can be disconnected from all ungrounded supply conductors and, in addition, no pole can be operated independently; a line valve; a block; and any similar device used to block or isolate energy. Push buttons, selector switches and other control circuit type devices are not energy isolating devices.
- **Energy Source**—Any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or other energy.
- **Group Lock Box**—A device capable of holding and securing the key or other release mechanism for a group lock, which can accomodate the individual locks from all members of the work crew.
- **Hot Tap**—A procedure used in repair, maintenance, and service activities which involves welding on a piece of equipment (pipeline, vessel or tank) under pressure, in order to install connections or appurtenances. It is commonly used to replace or add sections of pipeline without the interruption of service for air, gas, water, steam, and petrochemical distribution systems.
- **Lockout**—The placement of an energy/hazard isolating device, in accordance with an established procedure, which ensures that the equipment being controlled cannot be operated until the device is removed.
- **Lockout Device**—A device that utilizes a positive means such as a lock, either key or combination type, to hold an energy/hazard isolating device in the safe position and prevent

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the energization of a machine or equipment. This includes blank flanges and bolted slip blinds.

5. RESPONSIBILITIES

5.1 Procedures Responsibility

The Director of Health & Safety is responsible for the issuance, revision and maintenance of this procedure.

5.2 Action/Approval Responsibilities

The Responsibility Matrix is Attachment 1.

6. PROCEDURE

6.1 Scope/Application

This procedure covers any activity which requires isolation of a source of energy or hazardous material, such as, the servicing and maintenance of equipment and confined space entry. It outlines methods to prevent the unexpected energization or start-up of the equipment, or release of stored energy or material that could cause injury to employees.

For any projects planned for more than 30 days with lockout/tagout planned for more than seven calendar days or when locking/tagging out specialized equipment having its own lockout requirements, a site-specific/equipment specific plan must be developed and incorporated as part of the Site-Specific Health and Safety Plan. Otherwise Attachments 4-7 (discussed later in text) must be utilized to document lockout/tagout.

In situations where our client has specific lockout/tagout requirements, Shaw Environmental & Infrastructure, Inc. (Shaw E & I) personnel can follow client procedures after an Shaw E & I health and safety professional has approved them as being at least as protective as Shaw E & I procedures. In such cases, the client procedures shall be incorporated into the Shaw E & I health and safety plan and all affected employees trained on these procedures.

6.1.1 Exclusions

Normal operations including repetitive, routine minor adjustments that do not require removal of equipment guarding.

When work is conducted on equipment where an employee has direct control over the cord(s) or plug(s) connected to the associated equipment.

6.1.2 References

OSHA General Industry Standard, 29 CFR 1910.147, The Control of Hazardous Energy (Lockout/Tagout), 29 CFR 1910.146, Permit Required Confined Spaces, and 29 CFR1910.331-335, Safety-Related Work Practices.

6.2 Responsibility

Each new, transferred, authorized or affected employee and other employees whose work operations are or may be in an area where lockout/tagout procedures are utilized must be instructed in the purpose and use of this lockout/tagout procedure.

- All Personnel—All site personnel will be responsible for continuous adherence to the health and safety procedures during the performance of assigned work. In no case may work be performed in a manner that conflicts with the intent of this procedure.

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- Authorized Employee—The authorized employee, or his/her designee, is responsible for reviewing the planned activities prior to commencement of work and confirming that the maintenance manager or his designee of the particular facility where the work is to be accomplished is made aware of the nature and extent of the work and when it is to commence.

- Site Supervisor—The site supervisor is responsible for verifying that all proper lockout/tagout procedures have been followed. The site supervisor must ensure that the power disconnects, appropriate attachment of locks and tags, and proper documentation of the procedure are implemented. He/she is also the designated custodian and controller for all locks, tags, and group lock boxes issued to authorized employees.

- Subcontractors, Visitors and Other On-Site Personnel—Subcontractors are responsible for the health and safety of their employees and for complying with the requirements established by the site Health & Safety Plan. All Shaw E & I subcontractors and visitors are responsible to the Shaw E & I site supervisor.

- Site Health and Safety Coordinator—The health and safety coordinator will assist in compliance with the other applicable company policies and procedures, and the Health and Safety Plan.

6.3 Procedures for Lockout/Tagout

Lockout and tagout devices must be capable of withstanding the environment to which they are exposed for the maximum period of time that exposure is expected.

Locks are to be used when a machine, equipment, or piping system is capable of being locked out. All locks must be accompanied by a tag to indicate the name of the employee applying the lockout device and warn against the hazard if the valve is opened, or the machine/equipment is energized. A legend such as "This lock and tag to be removed only by authorized personnel" with an additional message: "Do Not Start," "Do Not Open," "Do Not Close," "Do Not Energize," or "Do Not Operate" must be utilized.

All tags and their means of attachment must be sturdy enough to prevent inadvertent removal. The tag attachment will be attachable by hand, self-locking, non-releasable, and non-reusable, with a minimum unlocking strength of not less than 50 pounds. Tags must be durable and not deteriorate from exposure to weather conditions and corrosive environments or cause the message on the tag (hand-written or pre-existing) to become illegible. Lockout and tagout devices must be singularly identified; must be the only device(s) used for controlling energy; and must not be used for other purposes.

All equipment must be designed with a hazardous energy/material isolating device as a means of protection for the employee against injury during repairs. **All new equipment installed must be designed to accept a lockout device.**

Authorized padlocks will be assigned to each authorized employee. Each group's lock will be individually keyed and the supervisor on each shift will maintain possession of the master key for these padlocks. The specific project must provide a sufficient number of locks for each employee on site.

All tags must contain the authorized employee name, date of application of the lock, equipment name or number and the reason for lockout. The tag must be attached to the lockout device.

On any equipment that can start automatically, the main disconnect must be switched to the "off" position, locked, and tagged by the authorized employee. This switch must be turned off before opening the main power disconnect and remain off until the disconnect is closed. Locking out 220v, 440v and other equipment must always be done at the main feed or starter panel.

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All hazardous material lines must be blanked, blinded, or double valve and vent locked to prevent release of hazardous material.

Blanking or blinding of hazardous material lines are preferable to the double valve and vent technique. All blanks and blinds must be identified with tags in the same manner as locks.

A "Lockout Log" (Attachment 3) must be maintained by the site supervisor. This log must be included in the Health and Safety Plan.

6.3.1 Lockout/Tagout Overview

- Check equipment file for specific lockout/tagout procedures.
- Determine the requirements for lockout. If there is more than one energy source to the equipment, document each source.
- Conduct a survey to locate and identify all energy isolation devices that apply to the equipment.
- Use the equipment type-specific procedures as outlined in Attachments 4-7, if applicable. Complete the "Lockout/Tagout Procedure for Specific Equipment" form (Attachment 8) logging all data and return to the site-supervisor.
- Shut off energy source(s) to affected equipment.
- Affix lock(s) and tag(s) to each energy source controlling device.
- Identify work on process lines or vessels and determine isolation requirements.
- Blind, blank, disconnect, or double valve and vent all hazardous material lines, including steam, and identify the isolation points with tags.
- When only tag is used because machine or equipment can't be locked out, the following steps must be taken: Remove fuses, block machine, etc. and complete the "Lockout/Tagout Procedure for Specific Equipment" form (Attachment 8) and give to the site supervisor for the record.
- Stored energy - Relieve all stored energy from capacitor banks, springs, compressed air, hydraulic, steam, etc.
- Verify isolation of energy has occurred by attempting to activate equipment by using the on/off switch.
- Return control switch to "off" position before proceeding with work.

6.3.2 Removal of Lockout/Tagout

- Ensure that nonessential items, such as tools, etc., are removed from equipment.
- Ensure that equipment components are intact.
- Check work area to ensure that all employees are safely positioned or removed from the area.
- Notify all affected employees and site supervisor before re-energizing the equipment.
- Remove lockout/tagout device.
- Re-energize equipment or open valves and restore flow in process line, place back in into service.

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6.3.3 Preparation for Confined Space Entry

1. Refer to Shaw E & I Procedures EIG-HS-300, EIG-HS-301, or EIG-HS-302 for Confined Space Entry.
2. Blank or blind piping, identify with tags.
3. Misalign or remove sections of lines, pipes, or ducts, identify with tags.
4. Double valve and vent system, identify with tags.
5. Lockout or tagout all sources of energy.
6. Block or disconnect all mechanical linkages.

If it is impossible or impractical to lockout a piece of equipment, the site supervisor, H&S Professional, and the Maintenance Engineer of the facility must approve a method to make the equipment safe before any activities beyond normal operations of the equipment are performed. This can be done by disconnecting wiring, removing fuses, disconnecting or blanking supply lines, etc. "Danger - Do Not Operate" tags must be used to describe the condition.

The practice of permitting a person to place or remove a lock for someone else is prohibited. No employee can be sure he/she is safe until he/she places their own lock correctly.

6.4 Safety Audit

6.4.1 Verification Audit

A periodic audit of the lockout/tagout system must be performed to ensure that the requirements of this procedure are being imple-mented. The audit will be conducted by authorized and qualified employees other than the ones(s) utilizing the procedurebeing inspected. Any deficiencies that are observed must be corrected immediately. For each project, the site-supervisor will be responsible for daily audits of lockout/tagout systems to ensure proper installation of locks and tags to the equipment and adherence to the appropriate procedures.

Where lockout or tagout is used for energy control, the periodic inspection must include a review, between the inspector and each authorized employee, of that employee's responsibilities under the energy control procedure being inspected.

6.4.2 Follow-up Audit

A follow-up audit must be conducted to ensure that all deficiencies noted have been corrected.

6.4.3 Documentation

Audit documentation must identify the machine or equipment on which the lockout procedure is being utilized, the date of the inspection, employees interviewed and employee(s) performing the inspection. The audit results must be provided to the Health & Safety Department to be documented as being performed.

6.5 Training

Training must be provided to ensure that the purpose and function of the energy control program are understood by employees, and that the knowledge and skills required for the safe application, usage, and removal of the energy controls are acquired by employees.

- Each authorized employee must receive training in the recognition of applicable hazardous energy/material sources, the type and magnitude of the energy available in the workplace, and the methods and means necessary for isolation and control.

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- All affected employees must be instructed in the purpose and use of the lock and tag system.
- All other employees (including new hires) whose work operations are or may be in an area where lockout/tagout may be utilized, must be instructed about the procedure, and the prohibition relating to attempts to restart or re-energize machines or equipment that are locked out or tagged out.
- Retraining must be conducted for all authorized and affected employees whenever there is a change in job assignment, change in equipment, changes in a process that presents a new hazard or there is a change in the lockout/tagout procedure. Retraining must also be conducted whenever there is significant evidence, based on the periodic audits, indicating employee deviation from, or lack of understanding of, the lockout/tagout procedure.
- Employee site-specific training must be documented to ensure that it has beenaccomplished and is being kept up to date. The documentation must contain each employee's name and dates of training.

Documentation of employee training and retraining must be maintained and kept up to date by the Shaw E & I H&S representative and forwarded to the Shaw E & I Training Department.

6.6 Shift or Personnel Changes

Specific procedures must be utilized during shift or personnel changes to ensure the continuity of lockout or tagout protection. These must include provision for the orderly transfer of lockout or tagout device protection between off-going and oncoming employees to minimize exposure to hazards from the unexpected energization or start-up of the machine or equipment or the release of stored energy. All site-specific locks in place must be covered in the tailgate safety meetings on each shift.

All individual lock(s) of the outgoing shift working on equipment will be removed and replaced by the on-coming shift's individual lock(s). The authorized employees of the on-coming shift must inspect and "try" the system to ensure de-energization.

The site supervisor must re-audit the system as necessary.

6.7 Troubleshooting

Special precautions must be observed when the authorized employee must perform maintenance troubleshooting tasks with energized equipment. This function requires added caution and communications between all other affected employees to ensure employee protection.

An authorized employee must identify all start-stop locations and circuit breakers for disconnecting equipment. All other affected employees must be kept informed throughout the testing and troubleshooting. If the job is left incomplete, the authorized employee must install his/her individual lock and tag before leaving the job.

The following sequence must be followed when troubleshooting any equipment:

1. Written approval including detailed work plan, must be obtained from the site supervisor and H&S Professional to ensure that troubleshooting can be performed safely.
2. Inspect and clear machine or equipment of all tools and unnecessary materials.
3. Ensure that all affected employees are positioned out of the way of machine activation. Instruct all affected employees in the procedures that must be followed, the potential hazards that may exist, and the safety precautions that have been taken. Document this training on the Tailgate Safety meeting form.

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4. Remove the lockout and tagout devices.

5. Energize and proceed with the troubleshooting, testing or positioning of the machine or equipment.

6. De-energize, reapply all lockout and tagout devices and "try" the system to ensure de-energization or place machine back into service.

6.8 Group Lockout/Tagout

When servicing and/or maintenance is performed by a crew, craft, department or other group, the work crew must use a procedure which affords the employees a level of protection equivalent to that provided by the implementation of a personal lockout or tagout device.

- Primary responsibility is vested in an authorized employee for a set number of employees working under the protection of a group lockout or tagout device.

- Provision for the authorized employee to ascertain the exposure status of individual group members with regard to the lockout or tagout of the machine or equipment; and

- When more than one crew, craft, department, etc. is involved, assignment of overall job associated lockout or tagout control responsibility to an authorized employee to coordinate affected work forces and ensure continuity of protection; and

- Each authorized employee must affix a personal lockout or tagout device to the group lockout device, group lockbox, or comparable mechanism when he or she begins work, and must remove those devices when he or she stops working on the machine or equipment being serviced or maintained.

The following procedure applies to distribution and utilities systems. The employee authorized to "Group Lockout" will lock and tag out the system. Using the "group lockout" locks and tags. The "Group Lockout" must be signed by the authorized employee.

1. Use of personal tags and locks on the "Group Lock Box" must follow the normal lockout/tagout procedure.

2. The authorized employee must verify that all energy sources are in a neutral state.

3. The authorized employee places the group lock and tags on the hazard isolation device.

4. The authorized employee then places the "Group Lock Key" in the "Group Lock Box", and tag the box with a "DANGER DO NOT OPERATE" tag stating which system is locked out and why.

5. Each employee, prior to working on the "Group Lockout" system, must attach his/her personal tag and lock to the "Group Lockout Box."

6. Upon completion of work, all employees must remove their personal lock and tag.

7. The authorized employee must them remove the "Group Lock" locks and tags and follow normal procedures for restoring energy.

8. If repairs take more than the initiating shift, and the authorized employee is not remaining on the job for the completion, he/she may transfer "Authorization" to another employee by stating so on the "DANGER DO NOT OPERATE" tag. The employee identified then becomes the authorized employee. He/she is now authorized to remove the "Group Lockout" locks and tags installed by the original authorized employee if the work is completed on that shift. The follow-up shift must them follow normal procedures for "Group Lock/Tagout."

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6.9 Outside Personnel (Contractors, etc.)

Whenever outside servicing personnel are to be engaged in activities covered by the scope and application of this standard, the on site employer and the outside employer must inform each other of their respective lockout or tagout procedures.

All subcontractor's lockout/tagout procedures must be reviewed and approved by Shaw E & I prior to the project.

6.10 Special Situations

If lockout/tagout lasts for more than one shift, the appropriate protection must not be interrupted. No lock is to be removed until the next shift is ready to lockout the equipment.

When the employee(s) who originally applied a lock(s) is not at the site to remove it, the lock can be removed only in an emergency and only under the direction of an authorized employee, the site-supervisor, and if applicable the site-safety and health coordinator. Such actions and associated personnel safeguards shall be documented on the Field Activity Daily Log and the Lockout Log.

7. ATTACHMENTS

- Responsibility Matrix
- Flow Diagram - Overview: Lockout/Tagout System
- Lockout Log
- Lockout/Tagout for Electrical Equipment
- Lockout/Tagout for Compressed Air and Gases
- Lockout/Tagout for Steam, Water, and Fluid Lines
- Lockout/Tagout for Hydraulic Equipment
- Lockout/Tagout Procedure for Specific Equipment

8. FORMS

None

9. RECORDS

- Lockout Log
- Lockout/Tagout for Electrical Equipment
- Lockout/Tagout for Compressed Air and Gases
- Lockout/Tagout for Steam, Water, and Fluid Lines
- Lockout/Tagout for Hydraulic Equipment
- Lockout/Tagout Procedure for Specific Equipment

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10. REVISION HISTORY AND APPROVAL

Revision Level Revision Date	Revision Description	Responsible Manager
00 2/13/2004	Initial issue.	Troy Allen
01 8/25/2011	Modified format only to align with Governance Management framework.	Andrew Johnson

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Attachment 1
Control of Hazardous Energy Source (Lockout/Tagout)
Responsibility Matrix

Action	Procedure Section	*Responsible Party*						
		Location Mgr.	**Authorized Associate**	**Site Supervisor**	**Sub-contractor**	**HS**	**All**	**Training Dept.**
Comply with procedure	5.2				X		X	
Review plan & notify maintenance	5.2		X					
Verify proper procedures followed	5.2`	X		X		X		
Verification audit - daily	5.4.1			X				
Provide training to associates	5.5	X						
Attend appropriate training	5.5						X	
Maintain training records	5.5							X
Write/approve location lockout plan, if required	5.1		X			X		

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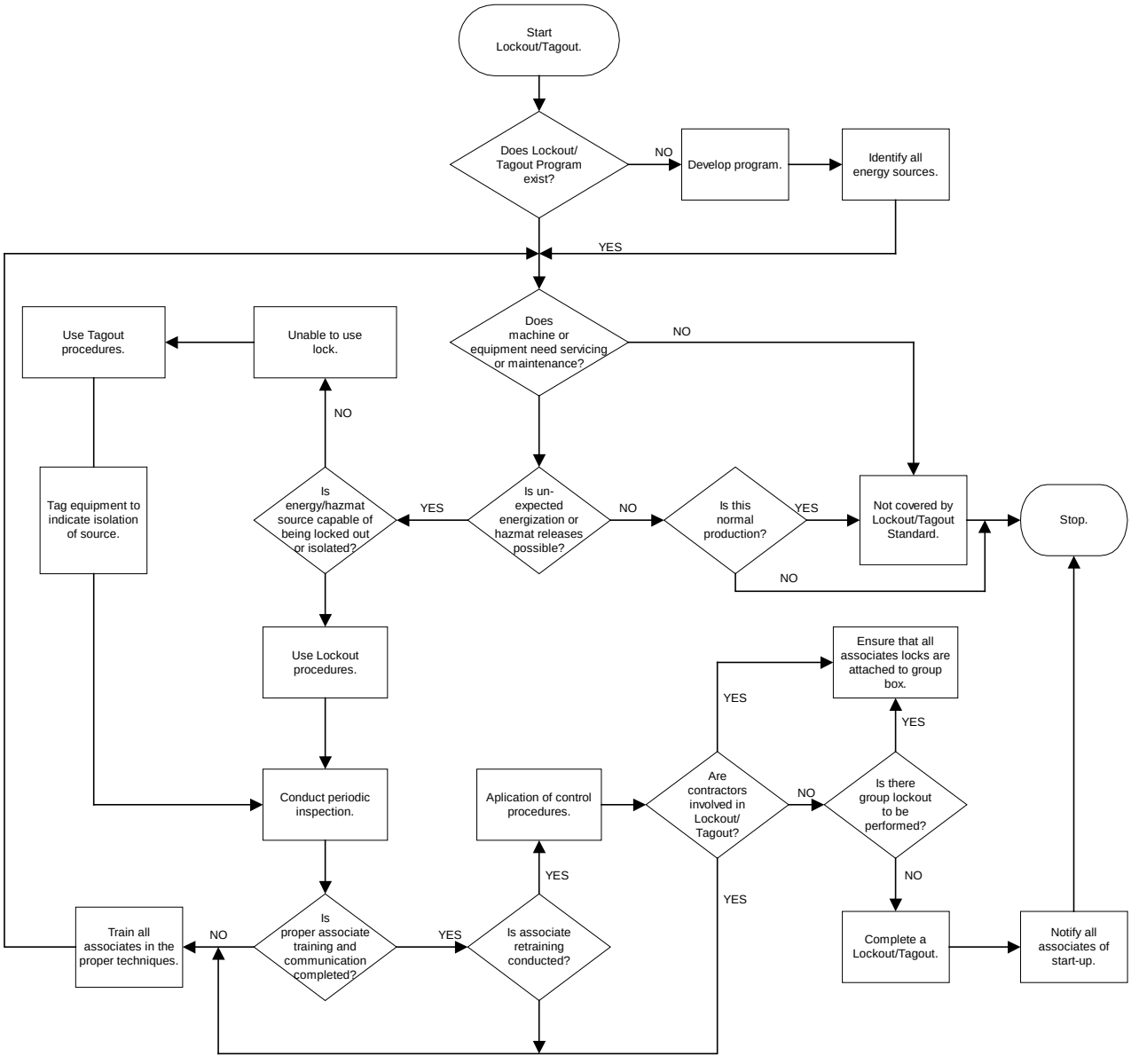
Attachment 2
Flo Diagram
Overview of the Lockout/Tagout System



HS3152/VISIO

Attachment 3
Lockout Log

Authorized Employee	Date	Equipment Name	Equipment Number	Reason for Lockout

Attachment 4
Lockout/Tagout for Electrical Equipment

Job: _____

Device: _____

Location: _____

Authorized Person: _____

Site Supervisor:

PREPARATION FOR SHUTDOWN

1. Determine power type and shutoff location
2. Determine if there is more than one energy source
3. Determine magnitude of power (voltage)
4. Notify affected employees in the area that equipment will be under lockout for maintenance.
5. Shutoff power sources to machine.

LOCKOUT/TAGOUT

6. Lock and tag main power switches in the OFF position, remove fuses.
7. Verify that no power is available to the equipment using a voltmeter, if necessary.
8. Drain devices such as capacitor banks.
9. Verify that these devices have no stored energy by use of the voltmeter.
10. Repair equipment.

RETURN TO SERVICE

11. Be sure all connections are made and any unused tools and equipment are removed.
12. Remove lock if necessary to verify machine is repaired. The maintenance employee, while verifying the machine is repaired cannot leave the immediate area.
13. Remove tag from machine.
14. Notify employees in the area that the equipment is available.

Signature:

Authorized Person: _____

Site Supervisor: _____

Attachment 5
Lockout/Tagout for Compressed Air and Gases

Job: _____

Device: _____

Location: _____

Authorized Person: _____

Site Supervisor:

PREPARATION FOR SHUTDOWN

1. Determine types and shutoff location
2. Determine if there is more than one energy source
3. Determine magnitude of compressed air, gas, steam, water, or fluids.
4. Notify affected employees in the area that equipment will be locked out for maintenance.
5. Shutoff main supply to machine.

LOCKOUT/TAGOUT

6. Lock and tag main supply in the OFF position.
7. Bleed line and verify that no air or gases remain in the equipment.
8. Repair equipment.

RETURN TO SERVICE

9. Be sure all connections are made and any unused tools and equipment are removed.
10. Remove lock if necessary to verify proper operation.
12. Remove tag.
13. Notify employees in the area that the equipment is available.

Signature:

Authorized Person: _____

Site Supervisor: _____

Attachment 6
Lockout/Tagout for Steam, Water, and Fluid Lines

Job: _____

Device: _____

Location: _____

Authorized Person: _____

Site Supervisor: _____

_____

PREPARATION FOR SHUTDOWN

1. Determine types and shutoff location
2. Determine if there is more than one energy source
3. Determine magnitude of compressed air or gas.
4. Notify affected employees in the area that equipment will be under lockout for maintenance.
5. Disconnect/shutoff main steam, water or fluid lines to equipment.

LOCKOUT/TAGOUT

6. Lock and tag main supply (i.e. chaining through valve handle with lock) in the OFF position with a bleeder open on the load side.
7. Drain fluids from shutoff valves to equipment.
8. Repair equipment.

RETURN TO SERVICE

9. Be sure all connections are made and any unused tools and equipment are removed.
10. Remove lock if necessary to verify machine is repaired. The maintenance employee cannot leave the immediate area, while verifying the machine is repaired.
11. Remove tag from machine.
12. Notify employees in the area that the equipment is available.

Signature:

Authorized Person: _____

Site Supervisor: _____

Attachment 7
Lockout/Tagout for Hydraulic Equipment

Job:_____

Device:_____

Location:_____

Authorized Person:_____

Site Supervisor: _____

_____

PREPARATION FOR SHUTDOWN

1. Determine types and shutoff location
2. Determine if there is more than one energy source
3. Determine magnitude of energy (pressure).
4. Notify affected employees in the area that equipment will be under lockout for maintenance.
5. Shutoff main hydraulic to equipment.

LOCKOUT/TAGOUT

6. Lock and tag main supply in the OFF position.
7. Drain fluids from shutoff valves to equipment.
8. Verify that the hydraulic fluid is disconnected.
9. Block ram or items controlled by the hydraulic system using the appropriate blocking.
10. Repair equipment.

RETURN TO SERVICE

11. Be sure all connections are made and any unused tools and equipment are removed.
12. Remove lock if necessary to verify machine is repaired. Maintenance employee cannot leave the immediate area, while verifying the machine is repaired.
13. Remove tag from machine.
14. Notify employees in the area that the equipment is available.

Signature:

Authorized Person:_____

Site Supervisor:_____

Attachment 8
Lockout/Tagout Procedure for Specific Equipment

Equipment:		
Cat. No. and Location:		
Serial Number (if available):		
Electrical:	Voltage:	Location:
Describe:		
Air (Type):		Location:
Describe:		
Gases (Type):		Location:
Describe:		
Steam (Type):		Location:
Describe:		
Water:		Location:
Describe:		
Fluids:		Location:
Describe:		
Hydraulic:		Location:
Describe:		
Stored Energy- Capacitors, Springs, Etc.:		
Describe:		

LOG DATA AND RETURN TO SITE-SUPERVISOR

STANDARD OPERATING PROCEDURE

Subject: Heat Stress

UNCONTROLLED WHEN PRINTED

1. PURPOSE

This procedure establishes guidelines to protect employees from the effects of heat related illness. It describes the five major types of heat-induced illnesses, methods of prevention and treatment, and prescribes heat stress monitoring methods.

2. SCOPE

This procedure applies to all job sites of The Shaw Group Inc.'s Environmental & Infrastructure Group (Shaw E&I) having potential heat stress conditions. Variances and exceptions may be requested pursuant to the provisions of Procedure No. EI-HS013, "Health and Safety Procedure Variance."

3. REFERENCES

- Procedure No. EI-HS013, Health and Safety Procedure Variance
- Title 8, California Code of Regulations, Section 3395, *Heat Stress Prevention*

4. DEFINITIONS

- **Acclimatization**—Temporary adaptation of the body to work in the heat that occurs gradually when a person is exposed to it. Acclimatization peaks in most people within 4 to 14 days of regular work for at least 2 hours per day in the heat.
- **Company**—All wholly-owned subsidiaries of Shaw E&I.
- **Heat Stress**—The net heat load to which a worker may be exposed from the combined contributions of metabolic cost of work, clothing requirements, and environmental factors such as air temperature, humidity, air movement, and radiant heat exchange. Mild or moderate heat stress can cause discomfort and adversely affect performance and safety but is not harmful to health. As the heat stress approaches human tolerance limits, the risk of heat illness increases.
- **Shade**—Blockage from direct sunlight. Canopies, umbrellas, and other temporary structures or devices may be used to provide shade. One indication that blockage is sufficient is when objects do not cast a shadow in the area of blocked sunlight. Shade is not adequate when heat in the area of shade defeats the purpose of the shade, which is to allow the body to cool.

5. RESPONSIBILITY MATRIX

5.1 Procedure Responsibility

The Senior Director of Health and Safety is responsible for the issuance, revision, and maintenance of this procedure.

5.2 Action/Approval Responsibilities

The Responsibility Matrix is shown as Attachment 1, "Responsibility Matrix."

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6. PROCEDURE

Adverse climatic conditions are important considerations in planning and conducting site operations. High ambient temperature can result in deleterious health effects ranging from transient heat fatigue, physical discomfort, reduced efficiency, personal illness, and increased accident probability to serious illness or death. Heat stress is of particular concern when chemical protective garments are worn; these garments prevent evaporative body cooling, thereby placing employees at considerably higher risk of developing heat stress.

Heat stress is caused by a number of interacting environmental and personal risk factors. Environmental risk factors include air temperature, relative humidity, radiant heat from the sun and other sources, conductive heat sources such as the ground, air movement, workload severity and duration, and personal protective equipment and clothing. Personal risk factors include age, degree of acclimatization, overall health, water consumption, alcohol consumption, caffeine consumption, and use of prescription or over-the-counter drugs that affect the body's water retention or other physiological responses to heat. Because heat stress is a common and potentially serious occupational illness, regular monitoring and other preventive precautions are vital.

6.1 Signs, Symptoms, and First Aid (Referenced from American Red Cross, First Aid/ Cardiopulmonary Resuscitation/AED for the Workplace, 2006)

Employees must immediately report to the Site Supervisor or to the Site Safety Officer any symptoms or signs of heat illness experienced by themselves or observed in co-workers. Regardless of the worker's protests, no employees with any symptoms of possible serious heat illness should be sent home or left unattended without medical assessment and authorization.

6.1.1 Heat Rash

Heat rash can be caused by continuous exposure to hot and humid air and skin abrasion from sweat soaked clothing.

Signs and Symptoms: The condition is characterized by a localized red skin rash and reduced sweating. Aside from being a nuisance, the ability to tolerate heat is reduced.

First Aid: Remove clothing from affected area. Wash skin with mild soap and water, rinse clean, and allow it to dry thoroughly.

6.1.2 Heat Cramps

Heat cramps are caused by profuse perspiration with inadequate electrolytic fluid replacement. This often robs the larger muscle groups (abdominal and quadriceps) of blood, which can cause painful muscle spasms and pain.

Signs and Symptoms: Muscle spasms and pain in the extremities and abdomen.

First Aid: Remove worker to a cool place and give sips of cool water. Watch for signs of heat exhaustion or stroke.

6.1.3 Heat Syncope (Fainting)

Heat syncope is a loss of consciousness because of low blood pressure. Heat causes the blood vessels to expand (dilate), so body fluid moves into the legs by gravity, which causes low blood pressure and may result in fainting. Heat syncope can be caused by blood pooling in the legs after standing still for a long time in a hot environment. It can also be caused after vigorous physical activity for two or more hours. The risk of heat syncope is higher among those who are not acclimated and to those who are dehydrated.

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Signs and Symptoms: Feeling faint or lightheaded; pale, cool, and moist skin; lightheadedness when changing position, such as moving from a lying position to a standing position.

First Aid: Remove worker to a cool, shaded place. Give sips of cool water. Loosen tight clothing. Remove perspiration-soaked clothing. Place the worker in a seated or supine position with legs raised. Apply cool, wet towels to the skin. Fan the person. Watch for signs of heat stroke.

6.1.4 Heat Exhaustion

Heat exhaustion is an early indicator that the body's cooling system is becoming overwhelmed.

Signs and Symptoms: Cool, moist, pale, ashen or flushed skin, headache, nausea, dizziness, weakness, exhaustion, heavy sweating.

First Aid: Remove worker to a cool, shaded place. Give sips of cool water. Loosen tight clothing. Remove perspiration-soaked clothing. Place the worker in a seated or supine position with legs raised. Apply cool, wet towels to the skin. Fan the person. Watch for signs of heat stroke.

6.1.5 Heat Stroke

Heat stroke is when the body's systems are overwhelmed by heat and stop functioning. Heat stroke is a life-threatening condition.

Signs and Symptoms: Red, hot, dry skin, changes in the level of consciousness, vomiting. **This is a medical emergency! Call 911 immediately**.

First Aid: Move worker to a cool, shaded place. Loosen tight clothing. Remove perspiration soaked clothing. Place the worker in a seated or supine position with legs raised. Apply cool, wet towels to the skin. Fan the person. If the person is conscious, give small amounts of cool water to drink. If the person refuses water, vomits, or starts to lose consciousness, place the person on his or her side and continue to cool the person by applying ice or cold packs on their wrists, ankles, groin, neck, and in the armpits. Continue to check breathing and signs of life (coughing, slight body movement, or a pulse.)

6.1.6 Emergency Planning

The site-specific health and safety plan and/or job safety analysis must specify the site-specific procedures for providing emergency medical services, contacting emergency medical services, and directing emergency responders to the work site.

6.2 Prevention

The prevention of heat-related illnesses requires adequate hydration, nutrition, acclimatization, access to shade if heat stress symptoms appear, monitoring, and in some cases the use of cooling devices.

6.2.1 Hydration

During periods of high heat, adequate liquids must be provided to replace lost body fluids. Most people do not become aware of thirst until they have lost 1 to 2 liters of body fluids. Highly motivated workers may incur losses of 3 to 4 liters before extreme thirst forces them to stop and drink. Therefore, workers must drink more than the amount required to satisfy thirst. Prehydration, the consuming of a large drink of water immediately before the start of heat exposure, is highly recommended.

In California, workers potentially exposed to heat stress in outdoor work sites are required to have ready and easy access to potable water or liquid sufficient to provide one quart per employee per hour (Title 8, California Code of Regulations, Section 3395, Heat Stress Prevention). Replacement fluids can be a 0.1 percent salt water solution, commercial "sports drinks" or "thirst quenchers," or a combination of these with fresh water. However, drinks that are popular because they "cut" thirst are

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not recommended, because they inhibit intake before rehydration is complete. For this reason it is better to drink water or dilute flavored beverages and to avoid carbonation, caffeine, and drinks with heavy concentrations of sugar or salt.

The replacement fluid temperature should be kept cool, 50 degrees Fahrenheit (°F) to 60°F, and must be located within a few steps of each worker or brought to the worker every hour or more frequently under the most stressful conditions.

Alcohol is a common and serious problem among those who work in heat. Alcohol not only impairs intake of food and water, but also acts as a diuretic (increase in urination) and disturbs judgment. The adverse effects of alcohol extend many hours beyond the time of intake.

6.2.2 Nutrition

Workers in high heat areas should eat well balanced meals in order to replace salt and minerals lost in perspiration. High sweat rates involve a continuous loss of sodium chloride and small amounts of potassium, which must be replaced on a daily basis. In addition, work in heat accelerates the turnover of trace elements including magnesium and zinc. All of these essential elements should normally be obtained from wholesome food.

Do not consume salt tablets, as they are easily abused, and overdoses lead to gastro-intestinal problems, increased urine output, and greater susceptibility to heat illness. If salt and mineral loss is a problem, employees should consider lightly salting their regular meals and increasing fruit consumption to replace these losses.

6.2.3 Acclimatization

Acclimatization can greatly increase human tolerance to heat, so that work becomes less physically challenging after a period of gradual adjustment. Individuals with a high level of physical fitness generally display partial heat acclimatization and are able to complete the process more quickly and with less stress than sedentary persons. Season may also affect the time that must be allowed for acclimatization. Workers recruited in summer may already be partly heat acclimatized, while winter hires will require a longer period of adjustment.

Acclimatization for heavy work under extremely hot conditions may require a period of 4 to 10 days of progressively increasing work time starting with about 2 hours work per day. For less severe conditions, the first 2 to 3 days of work in the heat should be limited to 2 to 4 hours. Employees undergoing acclimatization need to be monitored closely for signs and symptoms of heat illness.

Maintenance of full heat acclimatization requires exposure to work in heat three to four times per week; lower frequency or passive exposure to heat have a much weaker effect and may allow gradual decay of heat tolerance. However, weekends off work have no measurable effect on acclimatization. Discontinuing heat exposure for 2 to 3 weeks will cause loss of most acclimatization, although some will be retained in persons exposed to hot weather and/or regular aerobic exercise.

6.2.4 Access to Shade

Employees suffering from heat illness or believing a recovery period is needed will be provided access to an area with shade that is either open to the air or provided with ventilation for cooling for a period of no less than 5 minutes. Access to shade will be permitted at all times. **Employees will remove chemical protective garments during rest periods and will not be assigned other tasks during rest periods**.

6.2.5 Cooling Devices

Vortex tubes or cooling vests may be worn beneath impermeable clothing. If cooling devices are worn, only physiological monitoring will be used to determine work activity.

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6.3 Monitoring

Susceptibility to heat stress depends on numerous factors including ambient temperature, humidity, radiant heat, air movement, personal protective equipment, the degree of acclimatization, and physical condition of the individual workers. Therefore, the decision to start either environmental or physiological heat stress monitoring must be based on the experience and observations of the Site Safety Officer and on the professional judgment of the Health and Safety Manager and in consideration of the guidelines summarized below. **However, on all job sites having potential heat stress conditions, the monitoring of site workers by watching for the signs and symptoms of heat stress (see Section 6.1 above) must be ongoing by Supervisors, Site Safety Officers, and the workers themselves.**

6.3.1 Environmental Monitoring (American Conference of Governmental Industrial Hygienists [ACGIH], Threshold Limit Values [TLV], and Biological Exposure Indices [BEI], most recent edition)

The Wet Bulb Globe Temperature (WBGT) index is the simplest and most suitable technique to evaluate the environmental heat stress factors. If employees are performing moderate to heavy physical work on construction/remediation sites in standard permeable cotton or synthetic work clothing, heat stress monitoring is advisable when the ambient air temperature exceeds 90°F and any time discomfort due to heat stress is either noticed or reported. Either the WBGT index or physiological monitoring may be used. When WBGT exceeds 78°F, the work regiment in Table 2 of the ACGIH TLV/BEI booklet should be followed. **Note: WBGT measurements are not designed for and should not be used to assess heat stress involving the use of semi permeable or impermeable protective clothing**.

6.3.2 Physiological Monitoring (National Institute for Occupational Safety and Health/Occupational Safety and Health Administration/United States Coast Guard/U.S. Environmental Protection Agency, Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, 1985)

Physiological monitoring can be used in lieu of or in addition to WBGT. The advantage of physiological monitoring is that it determines each individual's unique response to environmental heat stress factors. If employees are wearing impermeable protective clothing, physiological monitoring is advisable beginning at 70°F and/or any time discomfort due to heat stress is either noticed or reported.

Physiological monitoring may be performed by the Site Safety Officer. Alternatively, it may be self-performed if the affected employees have been trained to do so. The following two parameters are to be monitored at the beginning of each rest period:

- **Heart Rate**—Radial (wrist) pulse will be determined as early as possible during each rest period. Monitoring consists of taking the radial pulse of a worker for 30 seconds immediately after exiting the work area. If the heart rate exceeds 110 beats per minute at the beginning of the rest period, shorten the next work cycle by one-third and keep the rest period the same. If the heart rate still exceeds 110 beats per minute at the next rest period, increase the following rest period by one-third. The initial rest period should be at least 5 minutes.

- **Body Temperature**—Each individual will measure his/her oral temperature with a disposable thermometer for one minute or with an electronic aural device as early as possible in the first rest period. If the temperature exceeds 99.6°F at the beginning of the rest period, then the work cycle will be decreased by one-third with the rest period remaining the same. Return to work is not permitted if body temperature exceeds 100.4°F.

  NOTE: Some aural temperature devices, which are also known as ear canal or tympanic devices, will not work accurately in high intensity ambient light.

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Attachment 2, "Heat Stress Monitoring Record," will be used to record the results of heat stress monitoring.

6.4 Training

Employees potentially exposed to heat stress conditions will be trained on the contents of this procedure. This training may be conducted during Daily Tailgate Safety Meetings. Training topics and attendance must be documented.

6.4.1 Supervisor Training Requirements

Site Supervisors shall receive specific training in protocols to prevent heat related illness, and recognizing signs and symptoms of different stages of heat related illness. Training shall also include company guidelines for initial treatment of suspected heat related illness which will include emergency response procedures as set forth in section 6.1.6 of this procedure.

7. ATTACHMENTS

- Attachment 1, Heat Stress Responsibility Matrix

8. FORMS

- Form EI-HS400.1_0, Heat Stress Monitoring Record

9. REVISION HISTORY AND APPROVAL

Revision Level / Revision Date	Revision Description	Responsible Manager
01 05/06/2009	• Heat syncope (fainting) was added to this procedure. • The first aid treatments, for each of the heat stress conditions, have been updated to reflect current American Red Cross guidance. • Nutrition (Section 6.2.2) and access to shade (Section 6.2.4) discussions have been added to the procedure. • The heart rate component of the physiological monitoring section has been modified.	Mike Zustra
02 5/4/2011	Added section 6.4.1 Supervisors Training Requirements as per ISNetWorld review.	David Quinn

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Attachment 1
Heat Stress Responsibility Matrix

Action	Procedure Section	Responsible Party			
		Senior Director of Health and Safety	Project Supervisor	Site Safety Officer	All Site Workers
Issuance, Revision, and Maintenance of Procedure	3.1	X			
Immediately report symptoms or signs of heat illness in themselves or others to the Site Supervisor or Safety Officer	5.0				X
Conduct Monitoring	5.3			X	
Inform Employees About Procedure	5.4		X	X	

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Heat Stress Monitoring Record

Project/Location _____ Date _____

Employee Name	Initial Reading Time	First Work Period Time		Second Work Period Time		Third Work Period Time		Fourth Work Period Time		Fifth Work Period Time		Sixth Work Period Time	
	WBGT (°F)	WBGT (°F)		WBGT (°F)		WBGT (°F)		WBGT (°F)		WBGT (°F)		WBGT (°F)	
	Air Temp. (°F)	Air Temp. (°F)		Air Temp. (°F)		Air Temp. (°F)		Air Temp. (°F)		Air Temp. (°F)		Air Temp. (°F)	
	Initial Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.
	Initial H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.
	Initial Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.
	Initial H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.
	Initial Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.
	Initial H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.
	Initial Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.
	Initial H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.

1. PURPOSE

The purpose of this procedure is to establish the guidelines necessary to protect employees from the adverse health effects caused by exposure to low temperature environments.

2. SCOPE

This procedure applies to all Shaw E&I Project Sites where workers could be exposed to excessive cold during the course of their regular employment.

2.1 Exception Provisions

Variances may be requested as described in procedure EIG-HS-013; Health and Safety Procedure Variances.

3. REFERENCES

- Shaw Environmental & Infrastructure, Inc. (Shaw E & I) Procedure HS051-Tailgate Safety Meetings
- Shaw E & I Procedure HS600-Personal Protective Equipment
- Threshold Limit Values and Biological Exposure Indices, American Conference of Governmental Industrial Hygienists.
- Standard First Aid Workbook, American Red Cross

4. DEFINITIONS

None

5. RESPONSIBILITIES

5.1 Procedure Responsibility

The Director of Health and Safety is responsible for the issuance, revision, and maintenance of this procedure.

5.2 Action/Approval Responsibilities

The responsibility matrix is Attachment 1.

6. PROCEDURE

Most cold related worker fatalities have resulted from failure to escape low air temperatures, or from immersion in low temperature water. Employees should be protected from exposure to cold so that their deep core temperature does not fall below 96.8° degrees Fahrenheit. Core body temperatures below this level will likely result in reduced mental alertness, reduction in rational decision making, or loss of consciousness with the threat of fatal consequences.

6.1 Signs and Symptoms of Cold Stress

Several factors increase the harmful effects of cold including, being very young or old, wet clothing, having wounds or fractures, smoking, drinking alcoholic beverages, fatigue, emotional stress and certain diseases and medications. The two most prominent adverse effects from

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exposure to cold temperatures are frostbite and hypothermia. Treatment for cold related injuries should be administered by a person qualified in first aid or a professional medical provider.

6.1.1 Frostbite

Frostbite is the most common injury caused by exposure to cold temperatures. It occurs when cells of the body freeze restricting blood flow and causing tissue damage. The first sign of frostbite is slightly flushed skin which then changes to white or grayish yellow and finally grayish blue. Pain is some- times initially felt but is often followed by a cold numb feeling.

6.1.2 Hypothermia

Hypothermia is the most severe form of cold stress and results from a drop in the body's core temperature. The initial signs include; shivering, numbness, confusion, weakness, impaired judgment, impaired vision, and drowsiness. Hypothermia victims typically progress through five stages of the condition including; (1) shivering, (2) apathy, (3) loss of consciousness, (4) decreasing pulse and breathing rate, and (5) death.

6.2 Precautionary Measures

It is recommended that employees wear insulated clothing to maintain core temperatures above 96.8°F when working in air temperatures below 40°F. This protective clothing may include but is not limited to:

- Insulated suits, such as whole-body thermal underwear
- Wool or polypropylene socks
- Insulated gloves and boots
- Insulated head cover, such as knit caps, hard hat liners, etc.

When conducting work in air temperatures below 35°F, the following practices shall be followed:

- If the clothing of an employee is expected to become wet, the outer layers of clothing must be impermeable to water.
- If an employee's underclothing becomes wet it must be changed immediately. If the clothing becomes wet from sweating, the employee may finish the task which caused the sweating before changing into dry clothing.
- Employees will be provided a warm area (65°F or above) to change from work clothing into street clothing and for breaks.
- Hot liquids, such as soups, warm drinks, etc. shall be provided in the break area. The intake of caffeine containing products shall be discouraged due to their diuretic and circulatory effects.
- If appropriate, approved space heaters may be provided in the work area to warm the hands, feet, etc.
- The buddy system shall be practiced. Any employee observed with signs of cold stress shall immediately proceed to the break area.
- Employees will be reminded to layer their clothing, i.e., wear thinner, lighter clothing next to the body with heavier clothing layered outside the inner clothing.
- Avoid overdressing when going into warm areas or when performing activities which are strenuous. This could potentially lead to heat stress situations.

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- Auxiliary heated versions of handwear, footwear, etc., can be used in lieu of mittens, insulated socks, etc. if extremely cold conditions exist.
- Employees handling liquids with high evaporation rates (gasoline, hexane, alcohol, etc.) shall take special precautions to avoid soaking of clothing with the liquids because of the added danger of cold injury caused by evaporative cooling.
- Work shall be arranged in such a way that sitting still or standing for long periods is minimized.
- If the air temperature is 20°F or below the hands shall be protected by mittens or gloves prior to contact with cold surfaces such as metal, etc.

Air temperature is not the only factor to be considered while evaluating cold stress situations. Wind chill cooling rate and the cooling power of air are critical factors. The higher the wind speed the greater the risk of experiencing cold related injuries. For exposed skin, continuous exposure should not be permitted when the air speed and temperature result in an equivalent chill temperature of -25°F of less. The wind chill table provided in attachment two can be used to help assess hazardous conditions attributable to wind chill effects.

6.3 Training

Training on the contents of this procedure will be conducted during tailgate safety meetings held at project or office locations where employees are exposed to cold temperatures. Topics to be discussed during this training will include:

- Proper rewarming procedures and first aid treatment of cold related cases
- Proper clothing practices
- Eating and drinking habits
- Recognition of signs and symptoms of cold stress
- Safe cold weather work practices.

7. ATTACHMENTS

- Attachment 1, Responsibility Matrix
- Attachment 2, Windchill Table

8. FORMS

None

9. RECORDS

None

10. REVISION HISTORY AND APPROVAL

Revision Level Revision Date	Revision Description	Responsible Manager
00 02/11/2004	Initial issue	Troy Allen
01	Modified format only to align with Governance Management framework.	Andrew Johnson

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Revision Level Revision Date	Revision Description	Responsible Manager
8/25/2011		

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Attachment 1
Cold Stress
Responsibility Matrix

Action	*Responsible Party*			
	Procedure Section	**Employee**	**Local HS Representative**	**Director of Health and Safety**
Issuance, revision and maintenance of this procedure	3.1			X
Provide training	4.2		X	
Receive training	4.2	X		

Attachment 2
Windchill Table

	Actual Temperature Reading (°F)											
Estimated Wind Speed (mph)	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (°F)											
Calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect.)	LITTLE DANGER In under an hour with dry skin. Maximum danger is false sense of security.				INCREASING DANGER Danger from freezing of exposed flesh within one minute.			GREAT DANGER Flesh may freeze within 30 seconds.				
	Trenchfoot and immersion foot may occur at any point on this chart.											

1. PURPOSE

The purpose of this procedure is to establish and administer a Hearing Conservation Program designed to prevent potential hearing damage when employees are exposed to sound equal to or greater than an 8-hour time-weighted average (TWA) sound level of 85 decibels (dB).

2. SCOPE

This procedure applies to employees that routinely work in environments where they may be exposed to excessive noise and prescribes control measures to prevent employee exposure to excessive sound levels.

3. REFERENCES

3.1 Internal References

- Procedure No. EIG-HS-013, *Health and Safety Procedure Variances*
- Procedure No. EIG-HS-100, *Medical Policies and Procedures*

3.2 External References

- Title 29 Code of Federal Regulations Part 1910, Subpart G, Section 95, *Occupational Noise Exposure*

4. DEFINITIONS

- **Action Level**—An 8-hour TWA of 85 dB or a dose of 50 percent.
- **Company**—All wholly-owned subsidiaries of Shaw Environmental & Infrastructure, Inc.
- **Decibel (dB)**—A unit for comparing two power levels or measuring the intensity of a sound.
- **Personal Protective Equipment (PPE)**—Specialized clothing or equipment worn by an employee to protect him/her from a hazard.
- **Standard Threshold Shift**—Change in hearing threshold relative to the baseline audiogram of 10 dB or more at 2,000, 3,000, and 4,000 Hz in either ear.
- **Time-Weighted Average (TWA)**—Time-weighted average.

5. RESPONSIBILITIES

5.1 Director of Health and Safety

The Director of Health and Safety is responsible for issuing, revising, and maintaining this procedure.

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5.2 Health and Safety Representative

The Health and Safety Representative is responsible for the following:

- Providing training to employees
- Monitoring employee exposure to sound

5.3 Project/Location Manager

The Project Manager or Location Manager is responsible for providing a copy or posting a copy of 29 Code of Federal Regulations (CFR) 1910.95 at the project location.

6. GENERAL

The Company hearing conservation program will be implemented and protection against the effects of sound exposure will be provided whenever sound levels exceed the action level.

6.1 Monitoring

Monitoring of employee exposures to sound will be conducted whenever it is anticipated that exposure may exceed the action level. This monitoring will be conducted by a qualified individual who, through professional credentials, training, or experience, has the necessary qualifications to specify and use the type of monitoring equipment (area or personal) that will best represent employee exposures. This monitoring will be repeated whenever changes in the work environment lead to the possibility of additional exposures or inadequacy of selected hearing protection. Employees will be provided the opportunity to observe monitoring and will be notified when the results exceed the action level.

Sound level monitoring instrumentation will be operated on the A-weighted scale in slow response mode. Employee sound exposures will be computed in accordance with Attachment 1, Sound Exposure Computation, and without regard to any attenuation provided by the use of hearing protection.

6.2 Audiometric Testing

Audiometric testing will be provided to all employees exposed at or above the action level. Testing will be in accordance with EIG-HS-100, *Medical Policies and Procedures*.

6.2.1 Baseline Audiogram

Audiometric test results obtained from the pre-hire medical examination will be used as the baseline audiogram. Testing to establish a baseline audiogram shall be preceded by at least 14 hours without exposure to workplace sound. Employees will also be notified of the need to avoid high levels of non-occupational sound exposure during this 14-hour period.

6.2.2 Annual Audiograms

Annual audiograms will be conducted for all employees exposed at or above the action level during the preceding year. Each annual audiogram will be compared to that employees baseline audiogram to determine if the audiogram is valid and if a Standard Threshold Shift (STS) has occurred. If an STS has occurred, the use of hearing protection shall be reevaluated and/or refitted and if necessary a medical evaluation may be required.

6.3 Employee Training and Information

All employees who are exposed to sound levels above the action level are required to participate in a formal training program. This program will be presented by a health and safety representative and include, as a minimum, the following information:

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- The effects of sound on hearing
- The purpose of hearing protection; the advantages, disadvantages, and attenuation of various types; and instructions on selection, fitting, use, and care
- The specific nature of operations which could result in exposure to excessive sound levels
- The purpose of audiometric testing and an explanation of the test procedures
- The engineering controls and administrative practices associated with the employee's job assignment

This training program will be repeated annually, and training shall be updated consistent with changes in PPE and work processes. Participating employees are required to complete the Hearing Protection Training Completion Record (Form EIG-HS-402.01). This record will be maintained by the Company Training Department in Knoxville. In addition, tailgate safety meetings will be periodically used to instruct employees on the need for hearing protection in designated areas.

The project/location manager will make available to affected employees or their authorized representatives a copy of 29 CFR 1910.95 and will also post a copy in the workplace.

6.3.1 Control Measures

A straightforward method of controlling sound exposure is to examine the problem in terms of the following three basic elements:

- Sound arises from a source;
- Travels over a path; and
- Affects a receiver or listener.

The solution to a given sound problem might require alteration or modification of any or all of these three basic elements including:

- Modifying the source to reduce its sound output;
- Altering or controlling the transmission path to reduce the sound level reaching the listener; and
- Providing the receiver with hearing protection (but only if the sound source or path cannot be controlled)

6.3.2 Sound Control at the Source

Perhaps the best method for controlling sound at its source is the initial equipment selection process. The following summarizes those features that the buyer should look for and steps to be taken in selecting equipment:

- Low-sound certification
- Advertisement of a quiet operation, evidence of sound control design
- Evidence of lower and slower operating characteristics
- Conductance of side-by-side sound tests of equipment
- Request an on-site or in operation inspection of mechanical equipment before purchase

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Most mechanical devices are complex sound generators. Though it is impractical to discuss all possible solutions to all sound problems, some general control measures and methods have been provided below:

- Reduce impact or impulse sound by reducing the weight, size, or height of fall of impacting mass.
- Reduce speed in machines and flow velocities and pressure in fluid conveyance systems.
- Balance rotating parts to control machinery sound and vibration of fans, fly wheels, pulleys, cams, shafts, etc.
- Reduce frictional resistance between rotating, sliding, or moving parts by frequent lubrication and proper alignment; static and dynamic balancing of rotating parts; and/or correction of eccentricity or Aout-of-roundness≅ of wheels, gears, rollers, pulleys, etc.
- Reduce resistance in air or fluid systems by use of low flow velocities, smooth surfaces of duct or pipe systems, and long-radius turns and flared sections in pipes, etc., to reduce turbulence.
- Isolate vibration elements in machinery; install motors, pumps, etc., on most massive part of machine; use belt or roller drives in place of gear trains; use flexible hoses and wiring instead of rigid piping and stiff wiring; etc.
- Apply vibration damping materials such as liquid mastics; pads of rubber, felt, foam, or fibrous blankets; or sheet metal viscoelastic laminates or composites to vibrating machine surface.
- Reduce sound leakage from the interior of machines such as compressors by sealing or covering all openings or applying acoustical materials to machine interiors.

6.3.3 Sound Control in the Transmission Path

Another effective way to limit employee exposure to sound is through the use of transmission path controls. These controls may include, but are not necessarily limited to:

- Separation of the sound source and receiver.
- Use of sound absorbing materials on ceiling, floor, or wall surfaces.
- Use of sound barriers and deflectors in the sound path.
- Use of acoustical lining on inside surfaces of passageways, ducts, pipe chases, or electrical channels.
- Use of mufflers or silencers on all gasoline or diesel engines, regardless of size, and particularly on equipment when large quantities of high-pressure, high-velocity gases, liquids, steam, or air are discharged.
- Use of vibration isolators and flexible couplers where the sound transmission path is structural in character.

6.3.4 Protection for the Receiver

When engineering controls fail to reduce sound levels to below the action level, hearing protection will be provided. Hearing protection will be provided at no cost to employees and will be replaced as necessary.

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Supervisors will ensure that hearing protection is worn by all employees who are exposed at or above the action level. Employees will be given the opportunity to select their hearing protection from a variety of suitable protection devices that attenuate their exposure to the action level or below. Attenuations are determined by subtracting 7 dB from the noise reduction rating of the protector and subtracting the remainder from the TWA sound level.

6.3.5 Recordkeeping

The Company will maintain records of all audiometric test records required by this procedure and retain them for at least the following periods:

- Sound exposure measurement records will be retained for two (2) years.
- Audiometric test records will be retained for the duration of the affected employee's employment.

All records required by this procedure will be provided upon request to employees, former employees, representatives designated by the individual employee, and any authorized government representative.

6.4 EXCEPTION PROVISIONS

Variances and exceptions may be requested pursuant to the provisions of EIG-HS-013, *Health and Safety Procedure Variances*.

7. ATTACHMENTS

- Attachment 1, Sound Exposure Computation

8. FORMS

- EIG-HS-402.01, Hearing Protection Training Completion Record

9. RECORDS

- EIG-HS-402.01, Hearing Protection Training Completion Record

10. REVISION HISTORY AND APPROVAL

Revision Level Revision Date	Revision Description	Responsible Manager
00 04/25/2002	Initial Issue.	Troy Allen
01 11/28/2011	Added "Responsibilities" section. Made minor editorial correction to cross-references. Revised format to match governance standard. Changes in sections 5.3.2 and 5.4 and editorial changes were made. Attachment 2 was converted to a form since the employee is required to initial and sign.	Andrew Johnson

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Attachment 1
Sound Exposure Computation

Computation of Employee Sound Exposure

A. Sound dose is computed using Table 1 as follows:

When the sound level is constant over the entire work shift, the sound dose (D), in percent, is given by:

$$D = 100\ C/T$$

Where C is the total length of the work day, in hours, and T is given in Table 1.

B. When the work shift sound exposure is composed of two or more periods of sound at different levels, the total sound dose over the work day is given by:

$$D = 100\ (C_1/T_1 + C_2/T_2 \ldots + C_n/T_n)$$

Where C_n indicates the total time of exposure at a specific sound level and T_n indicates the reference duration for that level as given by Table 1.

C. The eight-hour TWA sound level, in decibels, may be computed from the dose, in percent, by means of the formula:

$$TWA = 16.61 \log_{10} (D/100) + 90$$

For an eight-hour work shift with the sound level constant over the entire shift, the TWA is equal to the measured sound level.

Conversion between a Dose and an 8-Hour TWA Sound Level

Sound exposure is usually measured with an audio dosimeter which gives a readout in terms of Adose.≅ Dosimeter readings can be converted to an 8-hour TWA sound level.

In order to convert the reading of a dosimeter into TWA, use Table 2. This table applies to dosimeters that are set to calculate dose or percent exposure according to the relationships in Table 1. So, for example, ADose of 91 percent over an 8-hour day results in a TWA of 89.3 decibels and ADose of 50 percent corresponds to a TWA of 85 decibels.

If the dose as read on the dosimeter is less than or greater than the values found in Table 2, the TWA may be calculated by using the formula:

$$TWA= 16.61 \log_{10} (D/100) + 90$$

Where TWA equals 8-hour TWA sound level and D equals accumulated dose in percent exposure.

Table 1
Permissible Sound Exposure

A-Weighted Sound Level (decibels)	Permitted Duration Per Workday (T) (hours)	A-Weighted Sound Level (decibels)	Permitted Duration Per Workday (T) (hours)
80	32.0	106	0.87
81	27.9	107	0.76
82	24.3	108	0.66
83	21.1	109	0.57
84	18.4	110	0.50
85	16.0	111	0.44
86	13.9	112	0.38
87	12.1	113	0.33
88	10.6	114	0.29
89	9.2	115	0.25
90	8.0	116	0.22
91	7.0	117	0.19
92	6.1	118	0.16
93	5.3	119	0.14
94	4.6	120	0.125
95	4.0	121	0.11
96	3.5	122	0.095
97	3.0	123	0.082

Table 1 (continued)
Permissible Sound Exposure

A-Weighted Sound Level (decibels)	Permitted Duration Per Workday (T) (hours)	A-Weighted Sound Level (decibels)	Permitted Duration Per Workday (T) (hours)
98	2.6	124	0.072
99	2.3	125	0.063
100	2.0	126	0.054
101	1.7	127	0.047
102	1.5	128	0.041
103	1.3	129	0.036
104	1.1	130	0.031
105	1.0		

Table 2
Conversion from a Percent Sound Exposure or a Dose to an 8-Hour TWA Sound Level

Dose or Percent Sound Exposure (D)	TWA	Dose or Percent Sound Exposure (D)	TWA	Dose or Percent Sound Exposure (D)	TWA	Dose or Percent Sound Exposure (D)	TWA
10	73.4	104	90.3	260	96.9	640	103.4
15	76.3	105	90.4	270	97.2	650	103.5
20	78.4	106	90.4	280	97.4	660	103.6
25	80.0	107	90.5	290	97.7	670	103.7
30	81.3	108	90.6	300	97.9	680	103.8
35	82.4	109	90.6	310	98.2	690	103.9
40	83.4	110	90.7	320	98.4	700	104.0
45	84.2	111	90.8	330	98.6	710	104.1
50	85.0	112	90.8	340	98.8	720	104.2
55	85.7	113	90.9	350	99.0	730	104.3
60	86.3	114	90.9	360	99.2	740	104.4
65	86.9	115	91.1	370	99.4	750	104.5
70	87.4	116	91.1	380	99.6	760	104.6
75	87.9	117	91.1	390	99.8	770	104.7
80	88.4	118	91.2	400	100.0	780	104.8
81	88.5	119	91.3	410	100.2	790	104.9

Table 2 (continued)
Conversion from a Percent Sound Exposure or a Dose to an 8-Hour TWA Sound Level

Dose or Percent Sound Exposure (D)	TWA	Dose or Percent Sound Exposure (D)	TWA	Dose or Percent Sound Exposure (D)	TWA	Dose or Percent Sound Exposure (D)	WA
82	88.6	120	91.3	420	100.4	800	105.0
83	88.7	125	91.6	430	100.5	810	105.1
84	88.7	130	91.9	440	100.7	820	105.2
85	88.8	135	92.2	450	100.8	830	105.3
86	88.9	140	92.4	460	101.0	840	105.4
87	89.0	145	92.7	470	101.2	850	105.4
88	89.1	150	92.9	480	101.3	860	105.5
89	89.2	155	93.2	490	101.5	870	105.6
90	89.2	160	93.2	500	101.6	880	105.7
91	89.3	165	93.6	510	101.8	890	105.8
92	89.4	170	93.8	520	101.9	900	105.8
93	89.5	175	94.0	530	102.0	910	105.9
94	89.6	180	94.2	540	102.2	920	106.0
95	89.6	185	94.4	550	102.3	930	106.1
96	89.7	190	94.6	560	102.4	940	106.2
97	89.8	195	94.8	570	102.6	950	106.2

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Table 2 (continued)
Conversion from a Percent Sound Exposure or a Dose to an 8-Hour TWA Sound Level

Dose or Percent Sound Exposure (D)	TWA	Dose or Percent Sound Exposure (D)	TWA	Dose or Percent Sound Exposure (D)	TWA	Dose or Percent Sound Exposure (D)	TWA
98	89.9	200	95.0	580	102.7	960	106.3
99	89.9	210	95.4	590	102.8	970	106.4
100	90.0	220	95.7	600	102.9	980	106.5
101	90.1	230	96.0	610	103.0	990	106.5
102	90.1	240	96.3	620	103.2	999	106.6
103	90.2	250	96.6	630	103.3		

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Hearing Protection Training Completion Record

	INITIAL
1. I have been informed about the health hazards associated with exposure to excessive sound levels and its potential effect on hearing.	
2. I have been informed about the types of work that may result in exposure to excessive sound levels, and the necessary protective steps to prevent excessive exposure, including engineering controls and administrative practices.	
3. I understand the purpose for, proper use, and limitations of hearing protection devices, and I have received instructions on selection, fitting, use, and care of such devices.	
4. I have been informed about the purpose of audiometric testing and an explanation of the test procedures.	
5. Copies of the applicable regulations governing occupational exposure to excessive sound have been made available to me.	

PRINT NAME: _____

SIGNATURE: _____

EMPLOYEE NUMBER: _____

DATE: _____

Please File Completed Forms and Forward a Copy to the Knoxville Training Department

PROCEDURE

Subject: HANDLING OF BLOOD OR OTHER POTENTIALLY INFECTIOUS MATERIAL

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1.0 PURPOSE AND SUMMARY

The potential for accidental transmission of infectious agents to persons handling infectious materials in the workplace has prompted various governmental agencies to adopt recommended work practices and regulations to govern this area. Shaw Environmental & Infrastructure, Inc. (Shaw E & I) encounters potentially infectious agents in various types of work, including:

- Packaging, handling, and disposal of biological wastes at clandestine and legal laboratory operations:
- Work in areas with exposed human or animal excrement, or where materials contaminated with body fluids are found; and
- Emergency response operations involving infectious wastes or other potentially infectious materials.

Exposure control programs must address at least the following:

- Exposure determination,
- Exposure control plan,
- Medical surveillance and prophylactic measures,
- Personal protective equipment,
- Training,
- Work practices, and
- Accidental exposure follow-up

2.0 TABLE OF CONTENTS

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3.0 RESPONSIBILITY MATRIX

3.1 Procedure Responsibility

The Vice President of Health and Safety is responsible for the issuance, revision, and maintenance of this procedure.

3.2 Action/Approval Responsibilities

The Responsibility Matrix is Attachment 1 in Section 8.0.

4.0 DEFINITIONS

Blood- Human blood, human blood components and products made from human blood.

Blood-borne Pathogens- Pathogenic microorganisms that are present in human blood and can cause disease in humans. These pathogens include, but are not limited to, hepatitis B virus (HBV) and human immunodeficiency virus (HIV).

Disinfect- To inactivate all recognized pathogenic microorganisms but not necessarily all microbial forms (e.g. bacterial endospores) on inanimate objects.

Exposure Incident- A specific eye, mouth, other mucous membrane, non-intact skin, or parenteral contact with blood or other potentially infectious materials that results from the performance of an employee's duties.

Infectious Waste- Blood and blood products, contaminated sharps, pathological wastes and microbiological wastes.

Occupational Exposure- Reasonably anticipated skin, eye, mucous membrane, or parenteral contact with blood or other potentially infectious materials that may result from the performance of an employee's duties. This definition excludes incidental exposures that may take place on the job, and that are neither reasonably nor routinely expected and that the worker is not required to incur in the normal course of employment.

Other Potentially Infectious Materials- (1) The following body fluids: semen, vaginal secretions, cerebrospinal fluid, synovial fluid, pleural fluid, pericardial fluid, peritoneal fluid, amniotic fluid, saliva in dental procedures, and any body fluid that is visibly contaminated with blood. (2) Any unfixed tissue or organ (other than intact skin) from a human (living or dead). (3) HIV- or HBV-containing cell or tissue cultures, organ cultures, and culture medium or other solutions; and blood, organs or other tissues from experimental animals infected with HIV or HBV. (4) Any experimental animal tissue or cultures.

Parenteral- Exposure occurring as a result of piercing the skin barrier (e.g. subcutaneous, intramuscular, intravenous routes).

Patient- Any individual, living or dead, whose blood, body fluids, tissues, or organs may be a source of exposure to the employee. Examples include, but are not limited to, hospital and clinic patients; clients in institutions for the mentally impaired or mentally disabled; trauma victims; clients of drug and alcohol treatment facilities; residents of hospices and nursing homes; human remains prior to embalming; and individuals who donate or sell blood or blood components.

Personal Protective Equipment- Specialized clothing or equipment worn by an employee to protect him/her from a hazard.

Sharps- Any object that can penetrate the skin including, but not limited to, needles, scalpels, and broken capillary tubes.

Sterilize- The use of a physical or chemical procedure to destroy all microbial life including highly resistant bacterial endospores.

Universal Precautions- A method of infection control in which all human blood and certain human body fluids are treated as if known to be infectious for HIV, HBV, and other blood-borne pathogens.

Work Practice Controls- Controls that reduce the likelihood of exposure by altering the manner in which a task is performed.

5.0 TEXT

5.1 Exposure Control Plan

Each project, including emergency response, involving potential for occupational exposure shall have, as part of the site-specific health and safety plan, a written exposure control plan designed to minimize or eliminate employee exposure. This plan shall be prepared prior to the commencement of work, and shall contain as a minimum:

5.1.1 Exposure Determination. Each task or procedure where occupational exposure may take place must be identified and documented. Such determination of potential exposure shall be made without regard to the use of personal protective equipment.

5.1.2 Schedule of Implementation. The schedule and method of implementation of the Exposure Control Plan must be specified.

5.1.3 Exposure Evaluation. Each plan shall reflect the requirements in 29CFR1910.1030(c)(2) and (f)(3), covering evaluations of an exposure incident.

5.1.4 Review and Update. Provision must be made for the review and update of the Exposure Control Plan.

5.1.5 Protective Measures. Work practices and personal protective equipment shall be specified for each task or procedure where an occupational exposure may occur.

5.2 Methods of Compliance

5.2.1 General. Universal Precautions as described below shall be observed to prevent contact with blood and other potentially infectious materials.

Universal Precautions

- All workers shall routinely use appropriate barrier precautions to prevent skin and mucous-membrane exposure when contact with blood or other body fluids is anticipated. Gloves should be worn for touching blood and body fluids, mucous membranes, or non-intact skin for handling items or surfaces soiled with blood or body fluids. Masks (as selected and approved by health and safety) and protective eye wear or face shields shall be worn during procedures that are likely to generate droplets of blood or other body fluids to prevent exposure of mucous membranes of the mouth, nose, and eyes. Protective suits shall be worn during procedures that are likely to generate splashes of blood or other body fluids.

- Hands and other skin surfaces shall be washed immediately and thoroughly if contaminated with blood or other body fluids. Hands shall be washed immediately after gloves are removed, using a disinfectant soap.

- All workers shall take precautions to prevent injuries caused by needles, scalpels, and other sharp instruments or devices during handling. To prevent needle stick injuries, needles should not be recapped, purposely bent or broken by hand, removed from disposable syringes, or otherwise manipulated by hand. Disposable syringes and needles, scalpels, blades, and other sharp items shall be placed in puncture-resistant containers for disposal.

- Mouthpieces, resuscitation bags, or other ventilation devices should be available for use in areas in which the need for resuscitation is foreseeable.

- Workers who have exudative lesions or weeping dermatitis shall be excluded from handling potentially infectious materials until the condition resolves.

- Pregnant workers should be especially familiar with and strictly adhere to precautions to minimize the risk of transmission.

5.2.2 Engineering and Work Practice Controls. Universal precautions shall be supplemented by the following work practice controls:

- All personal protective equipment shall be removed immediately upon leaving the work area, or as soon as possible if overtly contaminated, placed in an appropriately designed area or container for storage, decontamination or disposal.

- Eating, drinking, smoking, applying cosmetics or lip balm, and handling contact lenses are prohibited in work areas where there is a potential for occupational exposure.

- Food and drink shall not be stored in refrigerators, freezers, or cabinets where blood or other potentially infectious materials are stored or in other areas of possible contamination.

- All procedures involving blood or other potentially infectious materials shall be performed in such a manner as to minimize splashing, spraying, and aerosolization of these substances.

- Mouth pipetting is prohibited.

5.2.3 Housekeeping

- A written schedule of routine cleaning and disinfection shall be established, as appropriate, for each facility or operation.

- Work surfaces shall be decontaminated immediately after any spill of potentially infectious materials, and at the end of the work shift. An effective disinfection solution can be prepared by diluting household chlorine bleach with water to make a 10% bleach solution (1 part bleach + 9 parts water).

- Reusable items contaminated with potentially infectious materials shall be decontaminated prior to washing and/or reuse.

- All bins, pails, cans, and similar receptacles intended for reuse which have a potential for becoming contaminated with blood or other potentially infections materials shall be inspected, cleaned, and disinfected on a regularly scheduled basis and cleaned and disinfected immediately or as soon as possible upon visible contamination.

- Broken glassware which may be contaminated shall not be picked up directly with the hands. It shall be cleaned up using mechanical means.

5.2.4 Personal Protective Equipment

- Protection for the eyes, face, hands, body, feet, and against inhalation hazards shall be provided as appropriate for each job.

- Gloves shall be worn when employee has the potential for the hands to have direct skin contact with blood, other potentially infectious materials, mucous membranes, non-intact skin, and when handling items or surfaces soiled with blood or other potentially infectious materials.

- Disposable (single use) gloves, such as surgical or examination gloves, shall be replaced when visibly soiled, torn, punctured, or when their ability to function as a barrier is compromised. They shall not be washed or disinfected for re-use.

- Utility gloves may be disinfected for re-use if the integrity of the glove is not compromised; however, they must be discarded if they are cracked, peeling, discolored, torn, punctured, or exhibit other signs of deterioration.

- Masks and eye protection or chin-length face shields shall be worn whenever splashes, spray, splatter, droplets, or aerosols of blood or other potentially infectious materials may be generated and there is a potential for eye, nose, or mouth contamination.

- Fluid-resistant clothing (e.g. coated Tyvek suits) shall be worn if there is a potential for splashing or spraying of blood or potentially infectious materials.

- Surgical caps or hoods shall be worn if there is a potential for splashing or splattering of blood or potentially infectious materials on the head.

- Fluid-proof clothing (e.g. coated Tyvek suits) shall be worn if there is a potential for clothing becoming soaked with blood or other potentially infectious materials.

- Fluid-proof shoe covering shall be worn if there is a potential for shoes to become contaminated and/or soaked with blood or other potentially infectious materials.

- **Emergency Response.** During emergency operations involving potentially infectious materials 29CFR1910.120 is controlling. This regulation requires the use of NIOSH approved respirators for aerosol protection, not "masks".

5.2.5 Infectious Waste Disposal

- All infectious waste destined for disposal shall be placed in closable, leakproof containers or bags that are color coded or labeled as required by paragraph 5.2.7 of this procedure.

  If outside contamination of the container or bag is likely to occur then a second leakproof container or bag which is closable and labeled or color-coded as described in paragraph 5.2.7 shall be placed over the outside of the first and closed to prevent leakage during handling, storage, and transport.

  Disposal of all infectious waste shall be in accordance with applicable Federal, State and local regulations.

- Sharps shall be disposed of in closable, puncture resistant, disposable containers which are leakproof on the sides and bottom and that are labeled or color-coded according to paragraph 5.2.7.

  These containers shall be easily accessible to personnel and located in the immediate area of use.

  These containers shall be replaced and not allowed to overfill.

5.2.6 Laundry. Laundry from workplaces with employees covered under this policy that is contaminated with blood or other potentially infectious materials or may contain contaminated sharps shall be treated as if it were contaminated and shall be handled as little as possible and with minimum of agitation.

Contaminated laundry shall be bagged at the location where it is used and shall not be sorted or rinsed.

Contaminated laundry shall be placed and transported in bags that are labeled or color-coded as described in paragraph 5.2.7. Whenever this laundry is wet and presents the potential for soak-through or leakage from the bag, it shall be placed and transported in leakproof bags.

5.2.7 Communication of Hazards

5.2.7.1 Signs and Labels

- All work areas where potentially infectious agents are present shall be posted with signs bearing the following legend:

[Name of the Infectious Agent]
[Special requirements for entering area]
[Name, telephone number of the laboratory director or other responsible person]

- Warning labels shall be affixed to containers of infectious waste; refrigerators and freezers containing blood and other potentially infectious materials; and other containers used to store or transport blood or other potentially infectious materials.

Labels shall include the following legend:

These labels shall be fluorescent orange or orange-red or a similar predominant color, with lettering or symbols in a contrasting color.

Labels shall either be an integral part of the container or shall be affixed as close as safely possible to the container by string, wire, adhesive, or other method that prevents their loss or unintentional removal.

- Red bags or red containers may be substituted for labels on containers of infectious waste.

5.2.8 Training. All employees assigned to jobs with occupational exposure to potentially infectious materials shall receive specialized training prior to commencement of work and at least annually thereafter, covering the following elements:

- A copy of 29CFR1910.1030 and this procedure including an explanation of the contents;
- A general explanation of the epidemiology and symptoms of bloodborne diseases;
- An explanation of the modes of transmission of bloodborne pathogens;
- An explanation of the appropriate methods for recognizing tasks and other activities that may involve exposure to blood and other potentially infectious materials;
- An explanation of the use and limitations of practices that will prevent or reduce exposure including appropriate engineering controls, work practices, and personal protective equipment;
- Information of the types, proper use, location, removal, handling, decontamination and/or disposal of personal protective equipment;
- An explanation of the basis for selection of personal protective equipment;
- Information on the hepatitis B vaccine, including information on its efficacy, safety, and the benefits of being vaccinated;
- Information on the appropriate actions to take and persons to contact in an emergency;
- An explanation of the procedure to follow if an exposure incident occurs including the method of reporting the incident and the medical follow-up that will be made available. Also information on the medical counseling that is provided for exposed individuals; and
- An explanation of required signs and labels.

5.2.9 Training Records. Training records shall include the following information and be maintained for five (5) years:

- The date of the training sessions;
- The contents or a summary of the training sessions;
- The names of persons conducting the training; and
- The names of all persons attending the training sessions.

5.2.10 Medical Requirements

5.2.10.1 Medical Evaluations. All employees will receive medical evaluations in accordance with Shaw E & I Procedure HS100, and records will be maintained per Shaw E & I Procedure HS102.

5.2.10.2 Vaccinations. All employees with occupational exposure shall receive the hepatitis B vaccination (HBV) and tetanus vaccination prior to workplace exposure, unless they read and sign the Hepatitis B and Tetanus Vaccination Declination Form (Attachment 3).

- Hepatitis B Vaccination. Recombivax or Accelerated Recombivax vaccines shall be utilized. If the employee has received the HBV previously and/or antibody testing reveals that the employee is immune, a new vaccination is not required.

  Employees may be subjected to occupational exposure after receiving the first shot in the HBV series. Antibody testing shall be performed 30 days after completing the HBV series. Employees unable to develop immunity shall be precluded from further occupational exposure.

  Should a booster dose(s) be recommended by a physician, they shall be provided according to standard recommendations for medical practice.

- Tetanus Vaccination. Current status for tetanus vaccination is within 5 years. Documentation of current status shall be maintained for all employees subject to this policy.

- Post-exposure evaluation and follow-up. All exposure incidents shall be reported as an industrial injury. The Corporate Medical Director shall be advised immediately via the Corporate H&S office. Following a report of an exposure incident, the employer shall make available to each employee a confidential medical evaluation and follow-up including at least the following elements:

- Documentation of the route(s) of exposure, HBV and HIV antibody status of the source patient(s) (if known), and how the exposure occurred. The medical confidentiality rights of the source patient shall be preserved at all times.

- If the source patient can be determined and permission is obtained, collection of and testing of the source patient's blood to determine the presence of HIV or HBV infection shall be conducted under the direction of the attending physician.

- Collection of blood from the exposed employee as soon as possible after the exposure incident for the determination of HIV and/or HBV status. Actual core antibody and surface antigen testing of the blood or serum sample may be done at that time or at a later date if the employee so requests. If the test is deferred, arrangements shall be made through the attending physician to properly archive the specimen.

- Follow-up of the exposed employee including antibody and antigen testing, counseling, illness reporting, and safe and effective post-exposure prophylaxis, according to standard recommendations for medical practice as defined by the Corporate Medical Director.

5.2.10.3 Physician Information. Information provided to the physician. The employer shall provide the following information to the evaluating physician:

- A copy of 29CFR1910.1030 and its appendices, and

- A description of the affected employee's duties as they relate to the employee's occupational exposure.

5.2.10.4 Physician Opinion. Physician's written opinion. For each evaluation, obtain and provide the employee with a copy of the evaluating physician's written opinion within 15 working days of the completion of the evaluation. The written opinion shall be limited to the following information:

- The physician's recommended limitations upon the employee's ability to receive hepatitis B vaccination.

- A statement that the employee has been informed of the results of the medical evaluation and that the employee has been told about any medical conditions resulting from exposure to blood or other potentially infectious materials which require further evaluation or treatment.

- Specific findings or diagnoses, which are related to the employee's ability to receive HBV vaccination. Any other findings and diagnoses shall remain confidential.

5.3 First Aid/CPR Trained Personnel

This procedure is applicable to personnel designated as first aid/CPR providers when it is determined that the facility or project location cannot comply with the requirement to be in "close proximity" to professional medical aid under 29CFR1910.151. (NOTE: This requirement is generally met if a "911" paramedic response system or equivalent serves the area.)

Except where Shaw E & I is required to provide designated first aid/CPR providers under 29CFR1910.151, it is our policy to train a broad base of employees who render emergency assistance on a voluntary basis. Where designated responders are required, a minimum of two persons per shift shall be qualified in accordance with this procedure. Small locations or projects may reduce this number to one per shift with the prior approval of the regional or divisional HS Manager.

When voluntary or non-designated first aid/CPR providers are used, the special provisions listed below shall be followed.

- The Exposure Control Plan shall provide for offering the hepatitis B vaccination, within twenty-four hours, to any unvaccinated first aid/CPR provider rendering aid in an incident involving the presence of blood or other potentially infectious materials.

- A Supervisor's Employee Injury Report (SEIR) shall be completed for all first aid/CPR providers involved in an incident with blood or other potentially infectious materials. The manager or HS professional MUST specifically indicate whether an "exposure incident" as defined in section 4.4 of this procedure took place, and what protective equipment was used.

- Each location shall maintain a list of all such first aid incidents as an attachment to their OSHA Log of Occupational Injuries and Illnesses. The log and first aid incident list (or copies) shall be forwarded to the corporate HS office on February 1 of the following year.

- All associates who are first aid/CPR trained and may provide assistance, shall be trained in these requirements for voluntary providers and the general provisions of this procedure.

6.0 EXCEPTION PROVISIONS

All exceptions to established policy shall follow the provisions of Shaw E & I Procedure HS013: Health and Safety Procedure Variance.

7.0 CROSS REFERENCES

HS101 Management of Employee Exposure & Medical Records
HS102 Drug & Alcohol Testing

8.0 ATTACHMENTS

1. Responsibility Matrix
2. Personal Protection Equipment Matrix
3. Hepatitis B Vaccination Declination Form

ATTACHMENT 1
HANDLING OF BLOOD OR OTHER POTENTIALLY INFECTIOUS MATERIALS

Responsibility Matrix

Action	Procedure Section	*Responsible Party*		
		Manager	**HS**	**Associates**
Develop and implement Exposure Control Plans	5.1	X	X	X
Require use of work practices and other controls	5.2-5.6	X		
Use proper work practices and controls, as described	5.2-5.6, 5.8, 5.10			X
Post areas	5.7	X		
Provide and attend training	5.8	X	X	X
Maintain training and medical records	5.9-5.10		X	
Coordinate medical requirements	5.10		X	

ATTACHMENT 2

BIOWASTE PPE MATRIX

	Minimal[1] Exposure Potential	Slight[2] Exposure Potential	Moderate[3] Exposure Potential
Respirator Protection	None	Surgical mask or half mask with HEPA filters	Full facepiece APR with HEPA filters
Eye Protection	Glasses or safety glasses	Goggles	N/A
Face Protection	None	Face shield	N/A
Head Protection	Hardhat	Hardhat	Hardhat and fluid resistant hood
Hand Protection	Fluid resistant[4] gloves	Cut resistant[5] outer glove and fluid resistant inner glove	Cut resistant outer glove and fluid resistant inner glove
Body Protection	Work uniform or coveralls	Work uniform and Tyvek[6] coveralls	Work uniform and poly-Tyvek type coveralls
Footwear	PVC or Nitrile boots	PVC or Nitrile boots	PVC or Nitrile boots

1 Minimal Exposure: Handling boxed wastes, not cut or splash potential.

2 Slight Exposure: Handling bagged wastes, slight cut or splash potential.

3 Moderate Exposure: Handling loose wastes, slight cut and moderate to high splash potential.

4 Fluid resistant means able to prevent penetration of undamaged glove by liquids likely to be encountered. NOTE: Surgical or exam gloves alone **do not** meet this requirement.

5 Cut resistant means able to resist mechanical damage from accidental contact with sharps and from routing work activities. Leather or heavy canvas gloves will usually be acceptable; specialized gloves (Kelvar, knitted steel, etc.) may be required for specific tasks.

6 Mention of a specific trade name does not require the use of the product; it is intended only for illustrative reasons.

ATTACHMENT 3
HEPATITIS B AND TETANUS VACCINATION DECLINATION

Due to the potential for you to have occupational exposure to potentially infectious materials in your work, the company will provide and encourages you to accept, vaccination for Hepatitis B and Tetanus. Information to assist you in this decision is provided below.

Tetanus

- A bacterial disease causing muscle spasms, seizures, and "lockjaw".
- This single injection vaccination has few side effects.
- There is minimal loss in protection if the vaccination is given at the time of an exposure/injury rather than in advance.

Hepatitis B

- A viral infection of the liver.
- About 9,500 occupational cases occur annually, mostly in health care workers, with about 200 deaths.
- This three injection vaccination has few side effects.
- Vaccination is 90% effective for at least seven years when given prior to exposure.
- Vaccination is 70-88% effective when given within one week of exposure.
- Hepatitis B can survive in the environment for 24-48 hours after drying.
- Risk of infection from one cut or puncture wound from a contaminated object:
  - Hepatitis B Virus 6-30%
  - Human Immunodeficiency Virus (AIDS) 0.5%

If you wish to talk to a company doctor before making your decision, please ask the Health and Safety department to make arrangements for you. *If you choose to decline vaccination at this time, you must print and sign your name, and date the bottom of this form.*

Elayne Theriault, M.D.

Warren Houseman
Vice President, Health & Safety

I understand that due to my occupational exposure to blood or other potentially infectious materials I may be at risk of acquiring Hepatitis B Virus (HBV) infection.

I have been given the opportunity to be vaccinated by hepatitis B vaccine, at no charge to myself. However, I decline Hepatitis B vaccination at this time. I understand that by declining this vaccine, I continue to be at risk of acquiring Hepatitis B, a serious disease.

If in the future I continue to have occupational exposure to blood or other potentially infectious materials and I want to be vaccinated with Hepatitis B vaccine, I can receive this vaccination series at no charge to me.

~~Name (print)~~ _____

Signature _____ Date _____

STANDARD OPERATING PROCEDURE

Subject: Personal Protective Equipment

UNCONTROLLED WHEN PRINTED

1. PURPOSE

This procedure stipulates that the company will provide the personal protective equipment (PPE) necessary for employees to perform their work safely, as established by the Health and Safety Department. Head, eye, body, and foot protection are discussed in this procedure. The language covering respiratory and hearing protection is cross referenced to the appropriate company procedures.

2. SCOPE

This procedure applies to all company-provided PPE.

2.1 Exception Provisions

Variances and exceptions shall be permitted pursuant to the provisions of Shaw Environmental & Infrastructure, Inc. (Shaw E&I), Procedure No. HS013, "Health & Safety Procedure Variances."

3. REFERENCES

3.1 Internal References

- Shaw E&I Procedure No. HS013, "Health & Safety Procedure Variances."
- Shaw E&I Procedure No. HS050, “Employee and Subcontractor Health and Safety Training Requirements”
- Shaw E&I Procedure No. HS402, “Hearing Conservation Program”
- Shaw E&I Procedure No. HS601, “Respiratory Protection Program”

3.2 External References

- American National Standards Institute (ANSI) Standard Z41, Personal Protection - Protective Footwear
- ANSI Standard Z87.0, Practice for Occupational and Educational Eye and Face Protection
- ANSI Standard Z89.1, Protective Headwear for Industrial Workers
- ASTM International (ASTM), http://www.astm.org/Standard/index.shtml
- 29CFR 1910.132, 29CFR1910.133,29CFR1910.135 & 29CFR1910.136

4. DEFINITIONS

- **Company**—All wholly-owned subsidiaries of Shaw E&I.

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5. RESPONSIBILITY MATRIX

5.1 Procedure Responsibility

The Senior Director of Health and Safety is responsible for the issuance, revision, and maintenance of this procedure.

5.2 Action/Approval Responsibilities

The responsibility requirements are included in Attachment 1, "Personal Protective Equipment Responsibility Matrix."

6. PROCEDURE

The company will provide suitable PPE as required for the nature of the job being performed, such as, but not limited to, rubber boots, protective clothing covering (*e.g.*, Tyvek®), respirators, face shields, safety eyewear, respirator ophthalmic hanger devices, hard hats, and gloves. This PPE will be specified by the Health and Safety Department prior to use, subject to an assessment of the hazards to which employees will be potentially exposed. Documentation shall be in the project-specific Health and Safety Plan (HASP) or equivalent document.

Employees shall use approved PPE on any task where there is potential exposure to physical hazards such as equipment operation, objects dropping from above, or flying particles; or exposure to toxic or irritating gases, fumes, vapors, liquids, or other materials, which might cause respiratory distress or skin irritation.

Employees shall be trained in the proper use, maintenance, and limitations of PPE. Safety equipment shall be replaced when it is damaged, contaminated, or has worn out. Training requirements are summarized in company Shaw E&I Procedure No. HS050, "Employee and Subcontractor Health and Safety Training Requirements."

Employees shall wear hard hats, eye protection, and steel-toed foot protection (chemical resistant when required) at all job sites and industrial facilities, unless HASP/site rules provide exemption. It is the responsibility of all employees to report to any work site prepared to work in Level D PPE. Level D PPE consists of hard hat, eye protection, steel-toed foot protection, long pants, shirt with sleeves, and outer clothing appropriate for the weather. All other protective equipment is the responsibility of the project.

6.1 Eye Protection

All employees engaged in or working in areas adjacent to eye-hazardous activities or operations shall wear appropriate eye protection.

- Safety glasses are required for impact protection, and shall meet ANSI Standard Z87.1 requirements and must include rigid side shields.
- "Over the Glasses" safety glasses shall be provided to employees that infrequently require the use of prescription eyewear.
- Contact lenses are generally permitted with the exception of client-specific, Chemical Hygiene Plan or HASP prohibitions.
- Chemical goggles are required for protection against chemical splash.
- Face shields are required for face protection from chemical splash. Supplemental eye protection, such as, goggles or safety glasses, must be worn when face shields are used.

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- Full-face respirators can provide eye and face protection in lieu of safety glasses, goggles, or face shields.

6.1.1 Prescription Eye Protection

The company will provide all employees with protective eyewear meeting the ANSI Z87.1 standard. Should an employee require prescription eyewear, he/she shall have three options: (1) the employee shall obtain prescription eyewear, meeting the ANSI Z87.1 standard, through the Shaw E&I approved vendor with concurrence of their home department. (2) The employee may purchase and use approved ANSI Z87.1 eyewear. (3) The employee may elect to use their own prescription eyewear with the use of “Over the Glasses” safety glasses meeting ANSI Standard Z87.1. In all cases, lenses shall be clear polycarbonate or plastic, and clearly marked as complying with ANSI Z87.1. Special tints or dark lenses can be used for special applications (*e.g.*, extended outdoor work). . Sunglasses are not permitted to be worn indoors.

There are some cases whereby employees, requiring corrective lenses, are assigned to projects requiring the use of full face respirators. In those cases, the company shall purchase lenses and frames sized for the particular respirator insert.

Under the limited circumstances where the company will provide prescription safety eyewear using the AIRGAS prescription safety glass program, such purchases must be approved by the project or appropriate department/local manager responsible for paying the resulting invoice. The AIRGAS Prescription Safety Eyewear Order/Authorization Form is included as Attachment 2. Glasses shall only be provided every two years unless damaged on-the-job, or the employee exhibits a significant change of prescription.

If approved, the company will pay for fitting services and one pair of safety glasses; however, employees will arrange and pay for the eye examination portion. Employees purchasing their own prescription eyewear shall be reimbursed a maximum of $70.00 following verification that they meet applicable ANSI requirements.

6.2 Foot Protection

Employees are responsible for their own basic footwear and foot protection. Basic foot protection is required for all job sites and industrial locations. Specialized footwear shall be provided by the company as required by the nature of the work. Special foot protection may include, but is not limited to, chemically resistant, thermally shielded, metatarsal guards, *etc.*

6.2.1 Leather Protective Toe Safety Shoes

Leather protective toe safety shoes may be used in place of chemical resistant footwear when an employee will be working in a clean or uncontaminated work area with no liquid contamination. Generally, when the employee desires to use safety footwear other than the company provided standard chemical resistant footwear (*e.g.*, rubber boots), the company considers it the responsibility of the employee to provide such protective footwear and ensure that it meets ASTM F2412-05 (including a defined heel and protective toe cap). Company supervision will enforce the use of appropriate protective footwear per the requirements of the site-specific Health and Safety Plan.

Under the limited circumstances where the company will provide safety shoes, such purchases must be approved by the project or appropriate department/local manager. In those limited cases whereby the project approves such purchases, the local or project Environmental Health and Safety representative should be consulted to assist and verify that the safety shoes meet ASTM requirements. The employee will be reimbursed for the actual purchase price of the shoes up to a maximum of $90.00 following the verification that they meet applicable ASTM requirements.

Athletic-style safety shoes ("safety sneakers") are prohibited for all field operations due to the difficulties created by these styles in supervising proper use of protective footwear. Employees in fixed

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laboratory operations may wear athletic-style safety shoes with the prior approval of the Laboratory Director or local Health and Safety Manager.

6.3 Head Protection

Hard hats meeting ANSI Z89.1 shall be provided, by the employees' home departments, to protect employees from impact, penetration, falling objects, and/or limited electrical shock and burn, as appropriate for work site hazards.

6.4 Respiratory Protection

Respirators shall be provided, in accordance with Shaw E&I Procedure No. HS601, "Respiratory Protection Program."

6.5 Hearing Protection

Hearing protection shall be provided, in accordance with Shaw E&I Procedure No. HS402, "Hearing Conservation Program."

6.6 Body Protection

Protective clothing, gloves, boots, and other protective equipment shall be provided as appropriate for the hazards associated with the tasks being performed. For example, safety chaps and face shields shall be provided for chainsaw operations.

6.7 Providing Personal Protective Equipment to Noncompany Personnel

The following PPE may be provided to noncompany personnel:

- Hard hats
- Chemical goggles
- Safety glasses (nonprescription)
- Face shields
- Chemical resistant boots
- Chemical resistant gloves
- Hearing protectors
- Disposable chemical resistant personal protective clothing

6.8 Management Duties

It is the responsibility of the Health and Safety Department to specify safety equipment requirements for each job as reflected in the HASP, AHA or JSA.

It is the responsibility of project managers or location managers to provide adequate quantities of safety equipment required for their job(s) or project(s).

It is the responsibility of supervisors to verify that required safety equipment is properly used and to ensure that any employee provided protective equipment is adequate, properly maintained, and in a sanitary condition.

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7. ATTACHMENTS

- Attachment 1, Personal Protective Equipment Responsibility Matrix
- Attachment 2, AIRGAS Prescription Safety Eyewear Order/Authorization Form

8. FORMS

- None.

9. REVISION HISTORY AND APPROVAL

Revision Level / Revision Date	Revision Description	Responsible Manager
03 04/12/2010	• Updated protective footwear reference to reflect change from ANSI to ASTM requirements. • Referenced chainsaw operation as an example task for the selection of body protection in Section 6.6. • Contact lenses are no longer prohibited. • Sunglasses are not permitted for indoor use. • The AIRGAS prescription safety eyewear form has been included as an attachment. • Written approval, from Health and Safety, is no longer required for special tints or dark lenses on prescription eyewear. • Supervisors are now responsible for the coordination of employee reimbursement for PPE purchases.	Allen, Troy

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Attachment 1
Personal Protective Equipment
Responsibility Matrix

Action	Procedure Section	Responsible Party			
		Senior Director of H&S	Local HS Department	Project/ Location Managers	Supervisors
Issue, revise, and maintain this procedure.	5.1	X			
Approve all personal protective equipment prior to use.	6.0		X		
Coordinate reimbursement to employee for personal protective equipment purchases.	6.1.1, 6.2.1				X
Provide adequate quantities of safety equipment as required.	6.8			X	
Verify that required safety equipment is properly used.	6.8				X

Attachment 2
AIRGAS Prescription Safety Eyewear Order/Authorization Form

Shaw E & I

PRESCRIPTION SAFETY EYEWEAR Order/Authorization Form

The requesting Shaw Employee will obtain authorization from their supervisor for Shaw subsidized prescription safety eyewear. After authorization is obtained, this form will be filled out by their optometrist and returned to their supervisor for processing.

The Shaw employee can choose the Basic Program or Available Options as listed below. After the employee's supervisor has agreed that the employee needs prescription eyewear on the job, the supervisor authorizes Shaw to pay for the approved eyewear. Should the employee desire to upgrade from what the supervisor has authorized the employee the employee can choose those desired upgrades from the list found below in "Available Options". The employee will be responsible for paying for any additional options not authorized by the supervisor but listed below.

Anything not listed below cannot be ordered. Fees for additional Available Options NOT paid by Shaw must be paid with a credit card.

Fax this form to Marsha Musgrave or Hailey Dier. Your request will be forwarded to Airgas. Airgas will ship the eyewear to you. Any additional fees, should they arise are the responsibility of the employee.

Attach the prescription, from your optometrist, in lieu of ordering frames.

BASIC PROGRAM

LENS MATERIAL:	Polycarbonate	
LENS STYLE:	Single Vision, ST28, ST35, 7x28	
FRAMES:	SW06	
SIDESHIELDS:	Permanent……	Required on all glasses
TINTS:	No tints will be allowed unless a supervisor authorizes it. The supervisor's signature must be in the box provided on the order form.	

AVAILABLE OPTIONS

FRAMES:	OG 143, OG 146, OG 322……		$36.00
TINTS/COATINGS:			
Solid Tint 5%……	$ 6.00	Transitions……	$50.00
Supertough……	$27.00	Scratchcoat……	$10.00
PROGRESSIVE LENSES:	Life 2, Adaptar, Solamax, VIP…		$ 53.00
	Comfort, SolaOne, Panamic……		$105.00

Any questions regarding the eyewear or order processing will be answered through Airgas / Protective Optics Customer Service Ph: **800-245-3665** Fx:**800-782-5753**

Activation: 01/22/08 P/L: 20054

Customer #	Order Date:	NAME:	CONTACT PERSON(S):
764236		SHAW E & I	MARCIA MUSGRAVE / HAILEY DIER PH: 419-425-6160 / PH: 225-987-6855

SHIP TO ADDRESS:

EMPLOYEE NAME:

EMPLOYEE PH#:

LENS STYLE: (circle one) SV ST28 ST35 7X28 PROGRESSIVE _____

	SPHERE	CYLINDER	AXIS	PRISM	DIST PD	NR PD
R						
L						

	ADD	SEG HT
R		
L		

SEG HEIGHT FOR SW06
ST28 OR ST35 BIFOCAL - 13MM
7X28 TRIFOCAL ------- 17MM

LENS MATERIAL: POLYCARBONATE

___SUPPLY FRAME **___FRAME ENCL**

LENS COLOR: ☐ Clear

☐ This employee may have tinted lenses, but must pay for It.
☐ The company will pay for this employee's tint.

☐ Transitions ☐ Solid Grey 5%

_____
SUPERVISOR'S SIGNATURE

FRAME: _____ **FRAME COLOR**_____

EYE SIZE _____ DBL_____ TEMP_____

COATING:
___Supertough (1 year/1 time replace)
___Scratchcoat (no warranty)

THIS EMPLOYEE IS ELIGIBLE FOR ONE PAIR OF GLASSES.

_____
SUPERVISOR'S PRINTED NAME

_____
SIGNATURE

_____
PHONE #

_____
DATE

ACCOUNT #

Credit Card Info:

NOTE: AIRGAS SAFETY WILL APPEAR ON YOUR STATEMENT

MasterCard Visa Am Express Discover

CardNumber

_____

Expiration Date_____CID_____

_____
Signature

_____
Print Cardholder's Name

Phone:

1. PURPOSE

The purpose of this procedure is to prescribe the requirements of the company Respiratory Protection Program (RPP). This procedure provides information and guidance on the proper selection, medical evaluation, training, use, and care of respiratory protective equipment and complies with the requirements of 29 CFR 1910.134 (1998).

2. SCOPE

All operations which require the use of respiratory protection are subject to the provisions of this procedure.

2.1 Exception Provisions

Variances and exceptions may be requested pursuant to the provisions of Procedure EIG-HS-013, Health and Safety Procedure Variances.

3. REFERENCES

3.1 Internal References

- EIG-HS-013 Health and Safety Procedure Variances
- EIG-HS-040 Stop Work Authority
- EIG-HS-050 Training Requirement
- EIG-HS-052 Health and Safety Plans
- EIG-HS-102 Management of Employee Exposure and Medical Records
- EIG-HS-104 Employee Notification of Industrial Hygiene Monitoring Records
- EIG-HS-300 Confined Spaces
- EIG-HS-304 Compressed Gas Cylinders
- EIG-HS-600 Personal Protective Equipment

3.2 External References

- Title 29, Code of Federal Regulations, Section 1910.134.
- AIHA, *Respiratory Protection, A Manual and Guideline*, 1980.
- American National Standards Institute Practices for Respiratory Protection Z88.2-1992 (or most recent publication)
- NIOSH, *Certified Equipment List* (most recent version)

4. DEFINITIONS

- **Action Level (AL)**—Airborne contaminant concentration which is one-half of the Permissible Exposure Guideline (PEG).

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- **Air Purifying Respirator (APR)**—Negative pressure respirator (also referred to as a cartridge respirator) which filters contaminated air through chemical or mechanical filter elements. APRs include: cartridge, canister, gas masks, and single-use respirators (single-use respirators are not approved for use by the company).

- **Approved Respirator**—Any respirator, identified by manufacturer and model, that has been approved by NIOSH 42 CFR Part 84 and has been incorporated into the List of Approved Respiratory Protective Equipment (Attachment 2).

- **Assigned Protection Factor (APF)**—A term that is reserved in the OSHA Standard 1910.134 (January, 1998). Attachment 3 provided PFs for the respiratory protective equipment based upon type of device and method of fit testing. The company will continue to use the PFs established by NIOSH until OSHA issues their definition of APF.

- **Company**—All wholly-owned subsidiaries of Shaw Environmental & Infrastructure, Inc. (Shaw E & I).

- **Contractor Personnel**—A group of persons hired to perform a specific activity based on their expertise and ability to operate independent of direct supervision. Contractor personnel are supervised by their management group which reports to an employee of the company for project direction.

- **End-of-Service-Life Indicator (ESLI)**—A system that warns the respirator user of the approach of the end of adequate respiratory protection, for example, that the sorbent is approaching saturation or is no longer effective.

- **Emergency**—Emergency means any occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment that may or does result in an uncontrolled significant release of an airborne contaminant.

- **Exposure Limit**—Several published airborne contaminant concentration values exist which are used in establishing acceptable personnel exposures to contaminants. OSHA publishes the Permissible Exposure Limit (PEL), NIOSH publishes the Recommended Exposure Limit (REL), and the ACGIH publishes the Threshold Limit Value (TLV). All of these exposure limits are based on an 8-hour work shift, 40-hour work week, and 40-year work life. The values may vary from contaminant to contaminant as well as between publishing bodies.

- **Field Office**—Any office or satellite office performing field activities which may require the use of respiratory protection.

- **Filtering Facepiece (Dust Mask)**—A negative pressure particulate respirator with a filter as an integral part of the facepiece or with the entire facepiece composed of the filtering medium.

- **Fit Factor (FF)**—This term means a quantitative estimate of the fit of a particular respirator to a specific individual and typically estimates the ratio of the concentration of a substance in ambient air to its concentration inside the respirator when worn. The FF incorporates a safety factor of 10 because protection factors in the workplace tend to be much lower than the fit factors achieved during fit testing. Acceptable fit factors are 100 for a tight-fitting half facepiece and 500 for a tight-fitting full facepiece respirators.

- **HASP**—Health and Safety Plan.

- **Health and Safety Representative**—A member of the company Health and Safety Functional Resource Group who, through credentials, training, or experience, has the necessary qualifications and authority to specify respiratory protection and evaluate respiratory protection program elements.

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- **Immediately Dangerous to Life or Health (IDLH)**—An atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere.
- **Labor Pool Personnel**—Temporary personnel hired for a given expertise or ability. Labor pool personnel report directly to an employee of the company.
- **Nuisance Level**—Level of airborne contaminants which is below one-half the action level for that contaminant and presents no other health or safety hazard.
- **Permissible Exposure Guideline (PEG)**—This term designates a specific exposure limit and is based on the best available information. The PEG will be the lower (more protective) of the values for the PEL and TLV. However, the REL shall take precedence for Hazardous Waste Operations (subject to 29 CFR 1910.120 or 1926.65) if no PEL exists, or for contaminants where no PEL or TLV exists. If there is no PEL, TLV, or REL, a Health and Safety Representative shall determine an appropriate permissible exposure guideline.
- **Permissible Exposure Limit (PEL)**—An occupational exposure index promulgated by OSHA which carries the force of law. This value represents the allowable concentration to which it is believed an employee may be exposed to 8 hours a day, 40 days a week, for a 40-year working life without experiencing adverse health effects.
- **Positive Pressure Respirator**—A respirator in which the pressure inside the respirator exceeds the ambient air pressure outside the respirator.
- **Powered Air Purifying Respirator (PAPR)**—A positive pressure APR which incorporates a fan an battery pack unit. The system pulls contaminated air through the filter elements before delivery to the facepiece under positive pressure. Air pressure in the mask must remain above ambient pressure.
- **Qualitative Fit Test**—A procedure for assuring that the respirator provides adequate protection based on a pass/fail fit test that relies on the individual's response to the test agent. Standard fit test protocol will utilize the irritant smoke methods as described in Attachment 4.
- **Quantitative Fit Test**—A fit test that provides an assessment of the adequacy of respirator fit by numerically measuring the amount of leakage into the respirator.
- **Respiratory Protection Program Coordinator (RPP Coordinator)**—A person designated by the Health and Safety Representative to administer and supervise the respiratory program at a local facility or project location. This person will have the necessary training or credentials to execute this task.
- **Recommended Exposure Limit (REL)**—An occupational exposure index published by NIOSH which is a recommended guideline for employee protection. This value represents the allowable concentration to which it is believed an employee may be exposed to 10 hours a day, 40 hours a week, for a 40-year working life without experiencing health effects.
- **Supplied Air Respirator (SAR)**—Positive pressure respirator which supplies an independent source of breathing air to the user. Two types of SARs are available: self-contained breathing apparatus (SCBA) and airline.
- **Threshold Limit Value (TLV)**—An occupational exposure index published by ACGIH which is recognized as an industry guideline and represents the concentration to which it is believed that nearly all employees may be exposed to 8 hours a day, 40 hours a week without experiencing adverse health effects.

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5. RESPONSIBILITIES

5.1 Procedure Responsibility

The Vice President, Health and Safety is responsible for the issuance, revision, and maintenance of this procedure.

5.2 Action/Approval Responsibilities

Program responsibilities are detailed throughout this procedure. The Responsibility Matrix summarizes these items and can be found as Attachment 1.

6. PROCEDURE

The company will employ engineering controls (e.g., enclosure, ventilation, material substitution, etc.) as the primary method to limit employee exposure. However, for those situations where engineering and administrative controls are ineffective at controlling employee exposure, the use of respiratory protective equipment may be required.

This RPP provides specific requirements for selection, assignment, training, and medical evaluation for persons expected to wear respiratory protection.

6.1 Assignment of Equipment to Contractor/Labor Pool Personnel

Contractor personnel shall provide their own respiratory protective equipment and shall also confirm meeting all other requirements of their own RPP and that of the company's RPP (i.e., medical clearance, training, etc.).

The company may provide the following respiratory protective equipment to Contractor Personnel:

- Disposable equipment such as filter elements.
- Hardware for airline systems (up to, but not including, the airline and facepiece) which employees are sharing.

The company will not provide the following respiratory protective equipment to Contractor Personnel:

- APR or PAPR facepieces.
- SCBAs, SAR respirators, or airline.

The company may provide respiratory protective equipment to Labor Pool Personnel if the following have been established:

- The labor pool personnel have successfully completed training as required by 29 CFR 1910.134 and other applicable regulations.
- The labor pool personnel have been fit tested in relation to projected exposure levels and contaminants to be encountered.
- The labor pool personnel have been medically approved to wear respirators.
- All other RPP requirements have been met.

6.2 Approval, Selection, and Purchase of Respiratory Protective Equipment

The following requirements are designed to guide correct selection of respiratory protective equipment.

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6.2.1 Approval

The Vice President, Health and Safety has approved respirators manufactured by Survivair as the primary respirators for use by employees. For employees who cannot achieve a satisfactory fit or comfort factor in Survivair respirator, Mine Safety Appliance (MSA) respirators will be selected. The list of approved model respirators is included in Attachment 2. Contractor personnel may select any respiratory protective equipment that has received approval from NIOSH.

6.2.2 Selection

The Health and Safety Representative shall base the selection of respiratory protective equipment upon an assessment of potential respiratory hazards that may be encountered. This assessment may utilize a variety of written information such as the NIOSH Pocket Guide to Chemical Hazards, Material Safety Data Sheets, analytical data, air monitoring results, or other applicable information. The selection process shall incorporate the following guidelines:

- Respiratory protection is to be selected by Health and Safety Representatives only. Full facepiece respirators are the usual preference because of superior protection factor and the face/eye protection afforded. Half facepiece respirators can only be used in situations where less than one-half the PEG is expected. The type of respirator selected will be documented in the Project HASP.
- Selection of the appropriate respiratory protective equipment shall include factors such as the chemical state and physical form of the chemical contaminant, atmospheric concentration during routine and emergency events, potential physical hazards, expected job task requirements, and the performance of the respirator in providing the appropriate level of protection against these hazards.
- Consideration shall be given to the nature of the hazardous operation, location of the hazardous area relative to nonhazardous breathing air supply, duration of wear, activities to be performed, and characteristics and function of the respiratory protective equipment to be worn.
- Selected respirators (i.e., Survivair or MSA) shall be NIOSH certified and used in compliance with the conditions of its certification when employees are exposed to toxic materials or other hazardous atmospheres.
- Respirators must provide adequate face and eye protection for the expected task.
- If an APR or PAPR is used, the respirator shall be equipped with an end-of-service life-indicator (ESLI) certified by NIOSH for the contaminant. If an ESLI is not available for the contaminant, a cartridge element change schedule shall be implemented which is based on objective information or data that will ensure that canisters and cartridges are changed before the end of their service life. This information will be described in the HASP.
- The PF for the respirator selected (Attachment 3) shall be used according to the following relationship with the PEG to establish justification for selection:

  PF x PEG > Maximum anticipated contaminant concentration

  If this equation is false, a respirator with a greater PF must be selected. Also review Attachment 3 to determine the required fit testing for the expected maximum anticipated contaminant concentration. The Health and Safety Representative may determine that a more conservative approach (e.g., 50 percent PF) may be needed. Decision to do so should be documented in the Project HASP.

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- Manufacturer-established limitations of the APR filter elements relative to the contaminants of concern shall be used to establish further justification for the selected respirator should the APR s FF not disqualify its use (e.g., maximum anticipated contaminant concentration).

6.2.3 Purchase

The purchase request of respiratory protective equipment (including cartridges, airlines, compressed air) should be reviewed by a Health and Safety Representative to indicate that the ordered material meets established requirements. **Under no circumstances may anyone (purchasing, warehouse, project manager, etc.) purchase or provide other than the specific respiratory protection equipment selected by the Health and Safety Representative.**

6.3 Medical Evaluation

No employee shall be assigned to a task that requires the use of a respirator unless it has been determined that he/she is physically able to perform the work while using the required respirator. The medical evaluation must be conducted prior to fit testing and work requiring the use of respiratory equipment.

The medical evaluation shall be performed by a physician typically in conjunction with a physical examination meeting the requirements of 29 CFR 1910.120 (f) *Medical Surveillance*. The physician will be informed of the type of work expected of the employee, the types of respiratory protection and personal protective equipment required, and other information indicating the expected stresses of the task. The company medical director shall be given a copy of the company RPP and a copy of 1910.134 (e) *Medical Evaluation.*

The company medical director shall provide a written recommendation regarding the employee's ability to use respiratory protection. The company shall ensure that the company medical director supplies the employee with a copy of this recommendation.

Additional medical evaluations will be provided to the employee if:

- Any medical signs or symptoms due to respirator use are reported by the employee, supervisory, or health and safety personnel.
- A change in workplace conditions (e.g., physical work effort, protective clothing, temperature) that may result in a substantial increase in the physiological burden placed on an employee.

6.4 General Program Requirements

6.4.1 Responsibilities.

The following information describes the responsibilities for the selection, use, and maintenance of respiratory protective equipment based upon job function:

6.4.1.1 Management

- Management shall take necessary and cost-effective measures to reduce, where possible, the need for respiratory protective equipment (e.g., enclosed cabs on heavy equipment to reduce airborne dust, operations performed upwind, etc.)
- Respiratory protective equipment shall be provided by management whenever it is determined that such equipment is necessary to protect the health of the employee or when requested by an employee and approved by the Health and Safety Representative.
- Management shall assign work tasks requiring the use of respiratory protective equipment to only those employees who are medically qualified to wear respiratory protective equipment.

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- Management shall ensure that employees are trained in the use of respiratory protection prior to being assigned to an activity that requires its use.
- Management shall provide the means for the maintenance of respiratory protection as required.

6.4.1.2 Health and Safety Representative

- Health and Safety Representatives shall determine appropriate respiratory protection for each job. The decision logic for this selection shall be documented in the Project HASP.
- Health and Safety Representatives shall monitor compliance with the various aspects of this program, provide technical assistance regarding respirator selection and use, evaluate the effectiveness of the RPP, and support respirator training and fit testing at locations under their control.
- Health and Safety Representatives shall conduct regular audits to determine compliance with this procedure. This audit can include a review of maintenance, training, medical and air monitoring records, and review the status of this procedure with regard to current regulatory requirements.
- Health and Safety Representatives shall maintain or oversee maintenance of all other records required by this RPP and shall provide for the training and fit testing of personnel assigned respiratory protective equipment.
- Health and Safety Representatives shall appoint a RPP Coordinator for each location which uses or may have a need to use respiratory protection. The Health and Safety Representative must assure the RPP Coordinator has the necessary training to fulfill his/her responsibilities.

6.4.1.3 RPP Coordinator

- The RPP Coordinator shall be responsible for cleaning, maintenance, and storage of all respirators not routinely used or not individually assigned.
- The RPP Coordinator shall maintain respirator supplies, including spare parts; submit purchase requests for new equipment; and assure that sufficient quantities of cartridges are available for each field office/project.
- The RPP Coordinator shall assure that air supply and emergency respiratory protection is properly inspected and maintained.
- Respirators shall be repaired by either qualified personnel under the direction of the RPP Coordinator, or by contracted supplier.
- The RPP Coordinator shall maintain models and sizes of respirators available for selection and fitting.
- The RPP Coordinator shall conduct fit testing.

6.4.1.4 Training Department

- Records pertaining to training and fit testing will be maintained by the Training Department.

6.4.1.5 Employee

- The employee shall use the provided respiratory protective equipment when instructed to do so in accordance with training received.

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- The employee shall clean, disinfect, and properly store the assigned respirator, unless other arrangements are made on a project level.
- The employee shall guard against damage to the assigned respirator.
- The employee shall inspect the respirator before each use and after cleaning.
- The employee shall report any malfunction of the respirator immediately to their supervisor and/or the RPP Coordinator.
- The employee shall report to their supervisor any change in their medical status that may impact their ability to wear a respirator safely.

6.4.2 Use of Corrective Lens Eyewear

In general, contact lenses are permitted to be worn when respiratory protection is used. Although in certain instances, client- or project-specific rules may not allow for their use.

If an employee chooses not to wear contact lenses, management shall assure that the appropriate frames or ophthalmic device attachments are obtained and provided at no cost to the employee.

6.4.3 Obstruction of Face Seal

Employees who wear respirators are required to be clean shaven to the extent that there is no obstruction between the wearer's skin and the facepiece. Trimmed mustaches and facial hair which does not interfere with the seal are allowable.

In addition, respirators shall not be worn when conditions prevent a good face-to-facepiece seal such as corrective lenses or goggles, or other personal protective equipment.

6.5 Instruction, Training, and Fit Test

6.5.1 Instruction and Training

The Training Department shall provide a standard respiratory protective equipment training program for use by qualified personnel such as the Health and Safety Representative or RPP Coordinator. The Training Department will support training at the project location if the project does not have the qualified personnel and/or the equipment to support its own program. As an alternative, the project location may use a respiratory manufacturer's training program if the program meets company requirements, a competent person conducts the training, adequate equipment is available for demonstration, and fit testing is conducted along guidelines established in this procedure. The Training Department must approve all alternative training methods.

The basic respirator training program shall include, as a minimum, the following:

- Training and annual retraining of employees in the selection, use, maintenance, and limitation of each respirator type used.
- Instruction on the nature of the respiratory hazards and potential health effects resulting from exposure.
- Opportunity for "hands on" experience with the respiratory protective equipment.
- Proper fitting, including demonstrations and practice in wearing, adjusting, and determining the fit of the respirator. A selection of respirators shall be available to determine the most comfortable respirator and the best fit.
- Instruction on how to test the face-to-facepiece seal.

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- A familiarization period of wear in ambient air.
- For APRs, wearing the respirator in a test atmosphere (typically irritant smoke) for qualitative fit testing. The qualitative fit test shall follow the guidelines outlined in Section 5.5.2.
- Training to recognize and cope with emergency situations (including respirator failure).
- Training and fit testing shall be repeated annually, unless specific OSHA regulations require a more frequent time period (e.g., asbestos, lead operations). Each person receiving training shall complete the Respirator Fit Test Form (Attachment 5).
- Training records will be maintained by the Training Department and the location Health and Safety Representative. On-site records of training and fit testing will be maintained as required by specific regulation (e.g., asbestos work) (refer to Section 5.8).
- It is the responsibility of the RPP Coordinator to verify that all project personnel meet the requirements of this RPP.

6.5.2 Fit Testing

Prior to the use of any negative or positive pressure tight-fitting facepiece, the employee must be fit tested.

- All employees assigned to operations requiring the use of respiratory protective equipment shall have been fit tested within 12 months, or as required by specific regulations (e.g., asbestos, lead operations). Fit test and qualification cards (or a copy of the completed Attachment 5) must be available during operations.
- The employee shall be fit tested with the same size and model as they are expected to wear.
- Qualitative fit test (QLFT) shall be used when a protection factor of 10 or less is required for a negative pressure respirator.
- Quantitative fit test (QNFT) shall be used when a protection factor of greater than 10 is required for a negative pressure respirator. When executing the QNFT, the acceptable test result is 100 for tight fitting half-facepiece respirators and 500 for full-facepiece respirators.
- Fit testing for tight-fitting atmosphere supplying respirators and tight-fitting APRs shall be in a negative pressure mode regardless of the mode of operation that is used for respiratory protection.
- Assessment of comfort shall be made after allowing adequate time for this evaluation. This evaluation shall include reviewing the following points with the employee: positioning of the mask on nose, room for eye protection if required, room to talk, and positioning of the mask on the face and cheeks.
- The following criteria shall be used to help determine the adequacy of the respirator fit: chin properly placed, strap tension, fit across the nose bridge, and tendency to slip.
- If physical obstruction (e.g., facial hair, eyeglasses) interferes with the face-to-facepiece seal, then it shall be altered or removed so as to eliminate any interference and allow for a satisfactory fit. If the employee refuses to alter the physical obstruction, then they shall be denied a satisfactory fit report and referred to his/her supervisor for consideration.
- The fit test protocol (Attachment 4) shall be followed. The Health and Safety Representative and Training Department shall determine which fit test protocol shall be followed depending upon the situation.

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6.6 Maintenance Program

Each RPP Coordinator is responsible for verifying the respirator maintenance program is implemented in an effective manner for the facility or project site, the working conditions, and the potential hazards involved. As a minimum, the following aspects must be implemented:

- Inspection
- Cleaning and sanitizing
- Repair
- Respirator storage
- Inspection and repair documentation, as required
- Compliance with manufacturer recommendations.

Detailed information regarding cleaning, inspection, maintenance, and storage is found in Attachment 7. The RPP Coordinator shall verify compliance with the maintenance program by periodic inspections and field audits.

6.6.1 Inspection

- All respiratory protective equipment systems shall be inspected by the wearer for defects and/or deterioration immediately prior to and after each use.
- Any defects shall be reported to their supervisor immediately and the respirator removed from use until it can be repaired or replaced.
- Respiratory protective equipment systems not used routinely (including all SCBAs and equipment designated only for emergency use) shall be inspected before and after each use and at least every 30 days. Cylinders shall be recharged whenever the pressure falls below 90 percent of the manufacturer's recommended pressure level. This inspection shall be documented by some method on the unit (i.e., tag). Records of inspections shall be kept through appropriate documentation. Attachment 6 provides an example of inspection documentation for SCBAs. At a minimum, these records will include: date, inspector, and any unusual finding or condition. Any repairs or modifications shall be documented in detail.
- General field inspection shall include a check of the following: tightness of all connections, facepiece, valves, and any connecting tubes or filtering elements.
- Employees who are manufacturer-qualified repair technicians shall be used for all maintenance beyond field inspections, tests, and user-performed cleaning.
- Air supplied respiratory systems shall be inspected by a manufacturer's authorized representative at the manufacturer's recommended schedule. Manufacturers typically require an annual flow test and a complete overhaul every 5 to 7 years.
- **Specific inspection procedures are outlined in Attachment 7.**

6.6.2 Cleaning and Sanitizing

Employees maintaining their own respirators shall be thoroughly briefed on how to clean and disinfect them. On projects where employees clean their own respirator, the generally accepted procedure involves washing with detergent and warm water using a soft brush, submersion in sanitizing agent, thoroughly rinsing in clean water, drying in a clean place, and storage in sealed

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plastic bags or equivalent. Precautions to be taken to prevent damage from rough handling during this procedure are detailed in Attachment 7.

At locations where employees share respirators, a centralized cleaning and maintenance facility with specialized equipment and/or materials and personnel trained in respirator maintenance must be established. Cleaning and inspection is primarily the responsibility of the user.

6.6.3 Repair

The company will only use respiratory protective equipment that is physically sound.

- If defects are found during any inspection, two remedies are possible. If parts and trained personnel are available, repair and/or adjustment may be made immediately. If parts or trained repair people are unavailable, the device shall be removed from service until it can be repaired. Under no circumstances shall a device that is known to be defective remain in service.
- Replacement or repair shall be done by adequately trained personnel. For negative pressure respirators, the Health and Safety Representative or RPP Coordinator may train or supervise personnel in the replacement of items such as inhalation/exhalation valves, head harness, cartridge adapters, and lenses. For air-supplied respirators, field repairs are limited to replacement of head harness and lenses. All other work must be completed by a factory-certified repair person.

Repair shall only be made with parts designed for the respirator. Substitution of parts from a different brand or type invalidates the respirator's approval and is prohibited.

6.6.4 Storage

- Respirators must be stored to protect against dust, sunlight, heat, extreme cold, excessive moisture, damaging chemicals, and mechanical damage.
- Respirators shall be stored in such a manner that the facepiece, exhalation valve, and straps are not distorted.
- Respirators shall be stored in sealable containers (e.g., ziplock bags) after cleaning and disinfecting.
- The storage location of emergency respiratory protection shall be readily accessible and prominently identified.
- Respirators shall be stored in an area free of contamination.

6.7 Field Use

The following guidelines for the use of respirators (or equivalent) shall be incorporated into the Project HASP as appropriate. Additional guidelines may be required based on working conditions and hazards involved. Each location where respiratory protective equipment is required or worn shall include in the Project HASP justification for the selected respiratory protective equipment systems worn as outlined in Section 5.2 of this procedure.

6.7.1 General Requirements

The following general requirements shall be followed whenever respiratory protection is used:

- Employees shall be allowed to leave the regulated area to readjust the facepiece or to wash their faces and to wipe clean the facepieces of their respirators in order to minimize potential skin irritation associated with respirator use.

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- Respiratory protective equipment shall not be passed on from one person to another until it has been cleaned and sanitized, per program requirements.
- Respirators will be inspected, and a positive/negative pressure test performed prior to each use.
- Entry into oxygen-deficient (< 19.5 percent O2) atmospheres, Immediately Dangerous to Life and Health (IDLH) atmospheres, or areas requiring EPA Level A protection is prohibited without the prior approval of the Vice President, Health and Safety or the CIH assigned to the business line.
- Head coverings such as Tyvek hoods shall not be allowed to pass between the face-to-facepiece seal.
- The harness straps of tight-fitting respirators shall not be positioned or worn over hard hats.

6.7.2 Specific Requirements

The following information details specific requirements by respirator class:

6.7.2.1 Air Purifying Systems

- When APRs are worn, new filter elements shall be installed at the beginning of operations. The filter elements shall be changed whenever the ESLI (color indicators) indicates that cartridge life has expired (e.g., mercury cartridges). When no ESLIs are available, filter replacement will be based on the calculations performed by the Health and Safety Representative. Additionally, the cartridges will be replaced if “breakthrough” is perceived or whenever an increase in breathing resistance is detected. In most cases, the cartridges will be replaced a minimum of once daily, usually at the end of the work shift.

6.7.2.2 Powered Air Purifying Systems

- When PAPRs are worn, employees shall change filter elements after each day’s activities. The filter elements shall be changed whenever the ESLI (color indicators) indicates that cartridge life has expired (e.g., mercury cartridges). When no ESLIs are available, filter replacement will be based on the calculations performed by the Health and Safety Representative. Additionally, the cartridges will be replaced if “breakthrough” is perceived or when airflow through filter elements decreases to an unacceptable level as indicated by the manufacturer’s test device.

6.7.2.3 Compressed Air

- Compressed air used for breathing shall meet at least the requirements of the specification for Grade D breathing air or better (D, E, or G; not A, K, or L) as described in the American National Standard Commodity Specification for Air, ANSI/CGA G-7.1-1989. Further information is provided in Attachment 7, Guide to Respiratory Protective Equipment Cleaning, Inspection, Maintenance, and Storage.
- Breathing air suppliers must provide certification of analysis stating conformance, as a minimum, to Grade D breathing air standards as previously referenced for each cylinder and/or air lot.
- Air delivered in bulk, e.g., tube trailers, shall have each tube or unit, or a representative number of tubes or units verified as to oxygen content prior to using that tube.
- Pure oxygen shall NOT be used at any time in open-circuit SCBAs or airline respirators.
- Breathing air cylinders shall be legibly identified with the word “AIR” by means of stenciling, stamping, or labeling as near to the valve end as practical.

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- Breathing air cylinders may be stored on their sides provided the valve caps are in place.

6.7.2.4 Supplied Air Breathing Systems

- Airline couplings shall be incompatible with outlets for other gas systems to prevent inadvertent servicing of airline respirators with nonrespirable gases or oxygen.
- Standard airline couplings for breathing air systems are Foster quick connect fittings with locking dots. Hansen quick connect fitting may also be used, but must not be used where they can be inadvertently actuated and disconnected. For example, Hansen fittings could be used at the regulator connection, but not on the airline unless protected from disconnection by some other means.
- The hose line length shall not exceed 300 feet from the air bank regulator to the user.
- No more than three connections, excluding the connection to the regulator and final connection to the respirator, shall be between the breathing air cylinders and the user.
- Breathing air hose shall be protected from direct contact with chemical materials which may permeate the hose. Acceptable methods of protection include suspension of the hose from the surface or covering with a commercially available sleeve or visqueen. Breathing air hose which has become contaminated will be removed from service and disposed of properly.
- The breathing air regulator shall be adjusted to provide air pressure as per the manufacturer's recommendations. For Survivair units, this pressure shall be between 80 to 125 psi pressure.
- Cascade systems shall be equipped with low pressure warning alarms or similar warning devices to indicate air pressure in the manifold below 500 psi.
- When a cascade system is used to supply breathing air, a worker outside the Exclusion Zone shall be assigned as safety standby within audible range of the low pressure alarm.
- When a cascade system is used to recharge SCBA air cylinders, it shall be equipped with a high-pressure supply hose and coupling rated at a capacity of at least 3,000 psi. The supply hose and coupling shall be relatively short ($\leq$ 3 feet) and secured to prevent whipping when pressurized.
- Large supplied air cylinders shall be stored and handled to prevent damage to the cylinder or valve. Cylinders shall be stored upright with the protective valve cover in place and in such a way (e.g., supported with substantial rope or chain in the upper one-third of the cylinder, or in racks designed for the purpose) as to prevent the cylinder from falling. Cylinders shall not be dropped, dragged, rolled, or allowed to strike each other or to be struck violently. Cylinders shall never be exposed to temperatures exceeding 125 degrees F. Cylinders with visible external damage, evidence of corrosion, or exposure to fire shall not be accepted or used.
- Only cylinders within current hydrostatic test periods shall be used. For fiber wrapped bottles designated by the DOT-E label, hydrostatic testing shall be completed every 3 years. Maximum service life for these cylinders is 15 years. Steel or aluminum cylinders shall be hydrostatically tested every 5 years. No maximum service life is established for steel or aluminum cylinders.
- SCBAs shall only be used in the positive pressure mode when in the Exclusion Zone.
- Standby SCBA equipment must be present when air supply systems are used in IDLH or potentially IDLH atmospheres.

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6.7.2.5 Escape/Egress Units

- These respirators are intended for use in areas where escape with a short-term (5 minute) air supply is necessary. They may be used as adjuncts to airline respirators as a backup air supply, or as independent emergency devices in areas where respiratory protective equipment is not normally required.
- Appropriate training shall be accomplished and documented prior to assigning employees to tasks or locations subject to the use of these respirators.
- Escape/egress units (5-minute air supply) shall never be used as primary standby respirators for confined space entry.
- Escape/egress units shall never be used to enter, or continue working in, a hazardous atmosphere.

6.7.3 IDLH Atmospheres

For all IDLH atmospheres, the company shall ensure that:

- One employee or, when needed, more than one employee is located outside the IDLH atmosphere.
- Visual, voice, or signal line communication is maintained between the employee(s) in the IDLH atmosphere and the employee(s) located outside the IDLH atmosphere.
- The employee(s) located outside the IDLH atmosphere are trained and equipped to provide effective emergency rescue.
- The employer or designee is notified before the employee(s) located outside the IDLH atmosphere enter the IDLH atmosphere to provide emergency rescue.
- The employer or designee authorized to do so by the employer, once notified, provides necessary assistance appropriate to the situation.
- Employee(s) located outside the IDLH atmosphere are equipped with:
  - Pressure demand or other positive pressure SCBAs, or a pressure demand or other positive pressure supplied air respirator with escape/egress unit.
  - Appropriate retrieval equipment for removing the employee(s) who enter(s) these hazardous atmospheres where retrieval equipment would contribute to the rescue of the employee(s) and would not increase the overall risk resulting from entry. Equivalent means of rescue can be considered.

6.8 Recordkeeping

The following documents must be part of the site recordkeeping program:

- Employees' medical clearances for respirator use
- Respirator training and fit testing forms.

6.9 Program Evaluation

This RPP shall be reviewed annually at the direction of the Vice President, Health and Safety.

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7. ATTACHMENTS

- Attachment 1, Responsibility Matrix
- Attachment 2, List of Approved Respiratory Protective Equipment
- Attachment 3, Respirator Type, Protection Factor, and Fit Testing Method
- Attachment 4, Mandatory Respirator Fit Test Protocol
- Attachment 5, Respirator Fit Test Form
- Attachment 6, Emergency Respiratory Protective Equipment Monthly Inspection Checklist
- Attachment 7, Guide to Respiratory Protective Equipment Cleaning, Inspection, Maintenance, and Storage

8. FORMS

9. RECORDS

- Respirator Fit Test Form
- Emergency Respiratory Protective Equipment Monthly Inspection Checklist

10. REVISION HISTORY AND APPROVAL

Revision Level Revision Date	Revision Description	Responsible Manager
00 04/25/2002	Initial issue	Troy Allen
01 12/1/2011	Modified format only to align with Governance Management framework.	Andrew Johnson

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Attachment 1
Respiratory Matrix

Action	Procedure Section	*Responsible Party*					
		Employee	**Health and Safety Representative**	**Project/ Location Management**	**VP, Health and Safety**	**Training**	**RPP Coordinator**
Issue, Revise, and Maintain Procedure	3.1				X		
Assure Proper Selection of Respirators	5.2.2		X				
Review Purchase Requests for Respiratory Equipment	5.2.3		X				
Conduct Fit Testing	5.4		X				X
Assure Compliance with RPP	5.4		X	X			X
Assure Training	5.4		X	X			X
Audit Program Compliance	5.4		X		X		X
Assist/Approve Local Training Program	5.4					X	
Maintenance Program	5.6	X	X	X			X
Field Use	5.7	X	X	X			X
Recordkeeping	5.8	X	X			X	X
Program Evaluation	5.9				X		

Attachment 2
List of Approved Respiratory Protective Equipment

AIR PURIFYING RESPIRATORS (APR)					
Respirator Class	**Respirator Type**	**Respiratory Performance**	**Manufacturer**	**Model Name**	**Model Number**
Standard APR	Half-Face	Negative Pressure	Survivair	Blue 1	2100-10 S 2200-10 M 2300-10 L
			MSA	Comfo II	479529 S 479428 M 479530 L
	Full-Face	Negative Pressure	Survivair	20/20	202062 S 202072 M 202082 L
			MSA	Ultra Twin	480263 S 480259 M 480267 L
Powered APR	Hood	Continuous Positive Pressure	Survivair	PAPR	5200-15
			MSA	Optimair 6	480251 S 480247 M 480255 L

SUPPLIED AIR RESPIRATORS (SAR)					
Respirator Class	**Respirator Type**	**Respiratory Performance**	**Manufacturer**	**Model Name**	**Model Number**
Airline SAR	Full-Face	Positive Pressure Demand	Survivair	Panther	P968455
			MSA	Premaire	497291
SCBA SAR	Full-Face	Positive Pressure Demand	Survivair	Cougar	P 9643310
			MSA	MMR WorkMask 2216	Varies on Components
Emergency	Escape/Egress Unit	Continuous Flow	Survivair	5 min. EEGA	9750870
			MSA	Custom Air V	484353

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Attachment 3
Respirator Type, Protection Factor, and Fit Testing Method

Respirator Type	Protection Factor	QLFT	QNFT
Half-Face, Negative Pressure (<100 Fit Factor)[1]	10	Yes	Yes
Full-Face, Negative Pressure (<100 Fit Factor) Used in Atmosphere up to 10 Times the PEG	10	Yes	Yes
Full-Face, Negative Pressure (<100 Fit Factor) Used in Atmosphere Over 10 Times the PEG[2]	50	No	Yes
PAPR	100	Yes	Yes
SCBA/SAR Used in Positive Pressure (Pressure Demand Mode)	10,000	Yes	Yes

Footnotes:

1. If quantitatively fit tested, the device must demonstrate a fit factor of at least 100.

2. If quantitatively fit tested, the device must demonstrate a fit factor of at least 500.

Attachment 4
Mandatory Respiratory Fit Test Protocol

OSHA-Accepted Fit Test Protocols

A. Fit Testing Procedures - General Requirements

The company shall conduct fit testing using the following procedures. The requirements in this attachment apply to all OSHA-accepted fit test methods, both QLFT and QNFT. There are several OSHA-accepted fit test protocols for QLFT. This procedure includes only the irritant smoke protocol since it requires less equipment and is more practical for field use.

1. The test subject shall be allowed to pick the most acceptable respirator from a sufficient number of respirator models and sizes so that the respirator is acceptable to, and correctly fits, the user.

2. Prior to the selection process, the test subject shall be shown how to put on a respirator, how it should be positioned on the face, how to set strap tension, and how to determine an acceptable fit. A mirror shall be available to assist the subject in evaluating the fit and positioning of the respirator. This instruction may not constitute the subject's formal training on respirator use, because it is only a review.

3. The test subject shall be informed that he/she is being asked to select the respirator that provides the most acceptable fit. Each respirator represents a different size and shape, and if fitted and used properly, will provide adequate protection.

4. The test subject shall be instructed to hold each chosen facepiece up to the face and eliminate those that obviously do not give an acceptable fit.

5. The more acceptable facepieces are noted in case the one selected proves unacceptable; the most comfortable mask is donned and worn at least five minutes to assess comfort. Assistance in assessing comfort can be given by discussing the points in the following Item A.6. If the test subject is not familiar with using a particular respirator, the test subject shall be directed to don the mask several times and to adjust the straps each time to become adept at setting proper tension on the straps.

6. Assessment of comfort shall include a review of the following points with the test subject and allowing the test subject adequate time to determine the comfort of the respirator:

   a) Position of the mask on the nose;

   b) Room for eye protection;

   c) Room to talk; and

   d) Position of mask on face and cheeks.

7. The following criteria shall be used to help determine the adequacy of the respirator fit:

   a) Chin properly placed;

   b) Adequate strap tension, not overly tightened;

   c) Fit across nose bridge;

   d) Respirator of proper size to span distance from nose to chin;

   e) Tendency of respirator to slip; and

   f) Self-observation in mirror to evaluate fit and respirator position.

8. The test subject shall conduct a user seal check, either the negative and positive pressure seal checks. Before conducting the negative and positive pressure checks, the subject shall be told to seat the mask on the face by moving the head from side-to side and up and down slowly while taking in a few slow deep breaths. Another facepiece shall be selected and retested if the test subject fails the user seal check tests.

9. The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface, such as stubble beard growth, beard, mustache, or sideburns which cross the respirator sealing surface. Any type of apparel which interferes with a satisfactory fit shall be altered or removed.

10. If a test subject exhibits difficulty in breathing during the tests, he/she shall be referred to a physician or other licensed health care professional, as appropriate, to determine whether the test subject can wear a respirator while performing his/her duties.

11. If the employee finds the fit of the respirator unacceptable, the test subject shall be given the opportunity to select a different respirator and to be retested.

12. *Exercise Regimen*: Prior to the commencement of the fit test, the test subject shall be given a description of the fit test and the test subject's responsibilities during the test procedure. The description of the process shall include a description of the test exercises that the subject will be performing. The respirator to be tested shall be worn for at least 5 minutes before the start of the fit test.

13. The fit test shall be performed while the test subject is wearing any applicable safety equipment that may be worn during actual respirator use which could interfere with respirator fit.

14. *Test Exercises*: The following test exercises are to be performed for all fit testing methods prescribed in this attachment, except for the controlled negative pressure (CNP) method. A separate fit testing exercise regimen is contained in the CNP protocol.

    Each test exercise shall be performed for one minute, except for the grimace exercise which shall be performed for 15 seconds. The test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become unacceptable, another model of respirator shall be tried. The respirator shall not be adjusted once the fit test exercises begin. Any adjustment voids the test, and the fit test must be repeated.

    The test subject shall perform exercises, in the test environment, in the following manner:

    a) *Normal Breathing*: In a normal standing position, without talking, the subject shall breathe normally.

    b) *Deep Breathing*: In a normal standing position, the subject shall breathe slowly and deeply, taking caution so as not to hyperventilate.

    c) *Turning Head Side to Side*: Standing in place, the subject shall slowly turn his/her head from side to side between the extreme positions on each side. The head shall be held at each extreme momentarily so the subject can inhale at each side.

    d) *Moving Head Up and Down*: Standing in place, the subject shall slowly move his/her head up and down for 1 minute. The subject shall be instructed to inhale in the up position (i.e., when looking toward the ceiling). After the moving head up and down exercise, the subject shall hold his/her head full up and hold his/her breath for 10 seconds during test measurement. Next, the subject shall hold his/her head full down and hold his/her breath for 10 seconds during test measurement.

    e) *Talking*: The subject shall talk out loud slowly and loud enough so as to be heard clearly by the test conductor. The subject can read from a prepared text such as the Rainbow Passage, count backward from 100, or recite a memorized poem or song for 1 minute. After the talking exercise, the

subject shall hold his/her head straight ahead and hold his/her breath for 10 seconds during the test measurement.

Rainbow Passage:

When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow.

f) *Grimace*: The test subject shall grimace by smiling or frowning. (This applies only to QNFT testing; it is not performed for QLFT.)

g) *Bending Over*: The test subject shall bend at the waist as if he/she were to touch his/her toes. Jogging in place shall be substituted for this exercise in those test environments such as shroud type QNFT or QLFT units that do not permit bending over at the waist.

h) *Normal Breathing*: Same as Item A.14.a.

B. Qualitative Fit Test (QLFT) Protocols

1. General:

   a) The employer shall ensure that persons administering QLFT are able to perform tests properly, recognize invalid tests, and ensure that test equipment is in proper working order.

   b) The employer shall ensure that QLFT equipment is kept clean and well maintained so as to operate within the parameters for which it was designed.

2. Irritant Smoke (Stannic Chloride) Protocol: This qualitative fit test uses a person's response to the irritating chemicals released in the "smoke" produced by a stannic chloride ventilation smoke tube to detect leakage into the respirator.

   a) General Requirements and Precautions:

      1. The respirator to be tested shall be equipped with high efficiency particulate air (HEPA) or P100 series filter(s).

      2. Only stannic chloride smoke tubes shall be used for this protocol.

      3. No form of test enclosure or hood for the test subject shall be used.

      4. The smoke take precautions to minimize the test subject's exposure to irritant smoke. Sensitivity varies, and certain individuals may respond to a greater degree to irritant smoke. Care shall be taken when performing the sensitivity screening checks that determine whether the test subject can detect irritant smoke to use only the minimum amount of smoke necessary to elicit a response from the test subject.

      5. The fit test shall be performed in an area with adequate ventilation to prevent exposure of the person conducting the fit test or the buildup of irritant smoke in the general atmosphere.

b) Sensitivity Screening Check: The person to be tested must demonstrate his/her ability to detect a weak concentration of the irritant smoke.

1. The test operator shall break both ends of a ventilation smoke tube containing stannic chloride, and attach one end of the smoke tube to a low flow air pump set to deliver 200 milliliters per minute, or an aspirator squeeze bulb. The test operator shall cover the other end of the smoke tube with a short piece of tubing to prevent potential injury from the jagged end of the smoke tube.

2. The test operator shall advise the test subject that the smoke can be irritating to the eyes, lungs, and nasal passages and instruct the subject to keep his/her eyes closed while the test is performed.

3. The test subject shall be allowed to smell a weak concentration of the irritant smoke before the respirator is donned to become familiar with its irritating properties and to determine if he/she can detect the irritating properties of the smoke. The test operator shall carefully direct a small amount of the irritant smoke in the test subject's direction to determine that he/she can detect it.

c) Irritant Smoke Fit Test Procedure:

1. The person being fit tested shall don the respirator without assistance, and perform the required user seal check(s).

2. The test subject shall be instructed to keep his/her eyes closed.

3. The test operator shall direct the stream of irritant smoke from the smoke tube toward the face seal area of the test subject, using the low flow pump or the squeeze bulb. The test operator shall begin at least 12 inches from the facepiece and move the smoke stream around the whole perimeter of the mask. The operator shall gradually make two more passes around the perimeter of the mask, moving to within 6 inches of the respirator.

4. If the person being tested has not had an involuntary response and/or detected the irritant smoke, proceed with the test exercises.

5. The exercises identified in Item A.14 of this attachment shall be performed by the test subject while the respirator seal is being continually challenged by the smoke, directed around the perimeter of the respirator at a distance of six inches.

6. If the person being fit tested reports detecting the irritant smoke at any time, the test is failed. The person being retested must repeat the entire sensitivity check and fit test procedure.

7. Each test subject passing the irritant smoke test without evidence of a response (involuntary cough, irritation) shall be given a second sensitivity screening check, with the smoke from the same smoke tube used during the fit test, once the respirator has been removed, to determine whether he/she still reacts to the smoke. Failure to evoke a response shall void the fit test.

8. If a response is produced during this second sensitivity check, then the fit test is passed.

C. Quantitative Fit Test (QNFT) Protocols

The following quantitative fit testing procedures have been demonstrated to be acceptable: quantitative fit testing using a nonhazardous test aerosol (such as corn oil, polyethylene glycol 400 [PEG 400], di-2-ethyl hexyl sebacate [DEHS], or sodium chloride) generated in a test chamber, and employing instrumentation to quantify the fit of the respirator; quantitative fit testing using ambient aerosol as the test agent and appropriate instrumentation (condensation nuclei counter) to quantify the respirator fit; quantitative fit testing using controlled

negative pressure and appropriate instrumentation to measure the volumetric leak rate of a facepiece to quantify the respirator fit.

1. General:

    a) The employer shall ensure that persons administering QNFT are able to calibrate equipment and perform tests properly, recognize invalid tests, calculate fit factors properly, and ensure that test equipment is in proper working order.

    b) The employer shall ensure that QNFT equipment is kept clean, and is maintained and calibrated according to the manufacturer's instructions so as to operate at the parameters for which it was designed.

2. Ambient Aerosol Condensation Nuclei Counter (CNC) Quantitative Fit Testing Protocol:

    The ambient aerosol CNC quantitative fit testing (Portacount®) protocol quantitatively fit tests respirators with the use of a probe. The probed respirator is only used for quantitative fit tests. A probed respirator has a special sampling device, installed on the respirator, that allows the probe to sample the air from inside the mask. A probed respirator is required for each make, style, model, and size that the employer uses and can be obtained from the respirator manufacturer or distributor. The CNC instrument manufacturer, TSI Inc., also provides probe attachments (TSI sampling adapters) that permit fit testing in an employee's own respirator. A minimum fit factor pass level of at least 100 is necessary for a half-mask respirator and a minimum fit factor pass level of at least 500 is required for a full facepiece negative pressure respirator. The entire screening and testing procedure shall be explained to the test subject prior to conducting the screening test.

    a) Portacount® Fit Test Requirements:

        1. Check the respirator to make sure the sampling probe and line are properly attached to the facepiece and that the respirator is fitted with a particulate filter capable of preventing significant penetration by the ambient particles used for the fit test (e.g., NIOSH 42 CFR 84 Series 100, Series 99, or Series 95 particulate filter) per manufacturer's instruction.

        2. Instruct the person to be tested to don the respirator for five minutes before the fit test starts. This purges the ambient particles trapped inside the respirator and permits the wearer to make certain the respirator is comfortable. This individual shall already have been trained on how to wear the respirator properly.

        3. Check the following conditions for the adequacy of the respirator fit: chin properly placed; adequate strap tension, not overly tightened; fit across nose bridge; respirator of proper size to span distance from nose to chin; tendency of the respirator to slip; and self-observation in a mirror to evaluate fit and respirator position.

        4. Have the person wearing the respirator do a user seal check. If leakage is detected, determine the cause. If leakage is from a poorly fitting facepiece, try another size of the same model respirator, or another model of respirator.

        5. Follow the manufacturer's instructions for operating the Portacount® and proceed with the test.

        6. The test subject shall be instructed to perform the exercises in Item A.14 of this attachment.

        7. After the test exercises, the test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become unacceptable, another model of respirator shall be tried.

b) Portacount® Test Instrument:

1. The Portacount® will automatically stop and calculate the overall fit factor for the entire set of exercises. The overall fit factor is what counts. The Pass or Fail message will indicate whether or not the test was successful. If the test was a Pass, the fit test is over.

2. Since the pass or fail criterion of the Portacount® is user programmable, the test operator shall ensure that the pass or fail criterion meet the requirements for minimum respirator performance in this attachment.

3. A record of the test needs to be kept on file, assuming the fit test was successful. The record must contain the test subject's name; overall fit factor; make, model, style, and size of respirator used; and date tested.

3. Controlled Negative Pressure (CNP) Quantitative Fit Testing Protocol—The CNP protocol provides an alternative to aerosol fit test methods. The CNP fit test method technology is based on exhausting air from a temporarily sealed respirator facepiece to generate and then maintain a constant negative pressure inside the facepiece. The rate of air exhaust is controlled so that a constant negative pressure is maintained in the respirator during the fit test. The level of pressure is selected to replicate the mean inspiratory pressure that causes leakage into the respirator under normal use conditions. With pressure held constant, air flow out of the respirator is equal to air flow into the respirator. Therefore, measurement of the exhaust stream that is required to hold the pressure in the temporarily sealed respirator constant yields a direct measure of leakage air flow into the respirator. The CNP fit test method measures leak rates through the facepiece as a method for determining the facepiece fit for negative pressure respirators. The CNP instrument manufacturer, Dynatech Nevada, also provides attachments (sampling manifolds) that replace the filter cartridges to permit fit testing in an employee's own respirator. To perform the test, the test subject closes his/her mouth and holds his/her breath, after which an air pump removes air from the respirator facepiece at a pre-selected constant pressure. The facepiece fit is expressed as the leak rate through the facepiece, expressed as milliliters per minute. The quality and validity of the CNP fit tests are determined by the degree to which the in-mask pressure tracks the test pressure during the system measurement time of approximately five seconds. Instantaneous feedback in the form of a real-time pressure trace of the in-mask pressure is provided and used to determine test validity and quality. A minimum fit factor pass level of 100 is necessary for a half-mask respirator and a minimum fit factor of at least 500 is required for a full facepiece respirator. The entire screening and testing procedure shall be explained to the test subject prior to conducting the screening test.

a) CNP Fit Test Requirements:

1. The instrument shall have a non-adjustable test pressure of 15.0 mm water pressure.

2. The CNP system defaults selected for test pressure shall be set at 15 mm of water (-0.58 inches of water) and the modeled inspiratory flow rate shall be 53.8 liters per minute for performing fit tests.

   (Note: CNP systems have built-in capability to conduct fit testing that is specific to unique work rate, mask, and gender situations that might apply in a specific workplace. Use of system default values, which were selected to represent respirator wear with medium cartridge resistance at a low-moderate work rate, will allow inter-test comparison of the respirator fit.)

3. The individual who conducts the CNP fit testing shall be thoroughly trained to perform the test.

4. The respirator filter or cartridge needs to be replaced with the CNP test manifold. The inhalation valve downstream from the manifold either needs to be temporarily removed or propped open.

5. The test subject shall be trained to hold his/her breath for at least 20 seconds.

6. The test subject shall don the test respirator without any assistance from the individual who conducts the CNP fit test.

7. The QNFT protocol shall be followed according to Item C.1 of this attachment with an exception for the CNP test exercises.

b) CNP Test Exercises:

1. Normal Breathing: In a normal standing position, without talking, the subject shall breathe normally for 1 minute. After the normal breathing exercise, the subject needs to hold head straight ahead and hold his/her breath for 10 seconds during the test measurement.

2. Deep Breathing: In a normal standing position, the subject shall breathe slowly and deeply for 1 minute, being careful not to hyperventilate. After the deep breathing exercise, the subject shall hold his/her head straight ahead and hold his/her breath for 10 seconds during test measurement.

3. Turning Head Side to Side: Standing in place, the subject shall slowly turn his/her head from side to side between the extreme positions on each side for 1 minute. The head shall be held at each extreme momentarily so the subject can inhale at each side. After the turning head side to side exercise, the subject needs to hold head full left and hold his/her breath for 10 seconds during test measurement. Next, the subject needs to hold head full right and hold his/her breath for 10 seconds during test measurement.

4. Moving Head Up and Down: Standing in place, the subject shall slowly move his/her head up and down for 1 minute. The subject shall be instructed to inhale in the up position (i.e., when looking toward the ceiling). After the moving head up and down exercise, the subject shall hold his/her head full up and hold his/her breath for 10 seconds during test measurement. Next, the subject shall hold his/her head full down and hold his/her breath for 10 seconds during test measurement.

5. Talking: The subject shall talk out loud slowly and loud enough so as to be heard clearly by the test conductor. The subject can read from a prepared text such as the Rainbow Passage, count backward from 100, or recite a memorized poem or song for 1 minute. After the talking exercise, the subject shall hold his/her head straight ahead and hold his/her breath for 10 seconds during the test measurement.

6. Grimace: The test subject shall grimace by smiling or frowning for 15 seconds.

7. Bending Over: The test subject shall bend at the waist as if he/she were to touch his/her toes for 1 minute. Jogging in place shall be substituted for this exercise in those test environments such as shroud-type QNFT units that prohibit bending at the waist. After the bending over exercise, the subject shall hold his/her head straight ahead and hold his/her breath for 10 seconds during the test measurement.

8. Normal Breathing: The test subject shall remove and re-don the respirator within a one-minute period. Then, in a normal standing position, without talking, the subject shall breathe normally for 1 minute. After the normal breathing exercise, the subject shall hold his/her head straight ahead and hold his/her breath for 10 seconds during the test measurement. After the test exercises, the test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become unacceptable, another model of a respirator shall be tried.

c) CNP Test Instrument:

1. The test instrument shall have an effective audio warning device when the test subject fails to hold his/her breath during the test. The test shall be terminated whenever the test subject failed to hold his/her breath. The test subject may be refitted and retested.

2. A record of the test shall be kept on file, assuming the fit test was successful. The record must contain the test subject's name; overall fit factor; make, model, style, and size of respirator used; and date tested.

Attachment 5
Respiratory Fit Test Form

NAME (Please Print): _____ SIGNATURE: _____
SSN: _____- _____-_____ HOME DEPT: _____ DATE: _____
CONDUCTED BY: _____ LOCATION: _____

FIT TEST PROTOCOL

QUANTITATIVE:
Fit Factor _____

QUALITATIVE:
Irritant Smoke:
Other (specify): :

TYPE OF RESPIRATOR
(Circle Appropriate One)

APR/HF APR/FF SCBA
SAR/EGS PAPR OTHER

Respirator Manufacturer: _____
Model: _____
Size _____

		INITIAL:
1.	I understand why respiratory protection is needed and where and when it should be used.	
2.	I know how to use this respirator properly.	
3.	I know how to clean and inspect this respirator.	
4.	I understand the limitations and restrictions of this respirator.	
5.	I wore this respirator in normal air and performed the user seal.	
6.	I wore this respiratory equipment in a test atmosphere.	
7.	I understand that a good gas-tight faceseal cannot be achieved with obstructions such as facial hair or glasses.	
8.	I understand that corrective lenses compatible with the full facepiece are available by my manager.	

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Attachment 6
Emergency Respiratory Protective Equipment
Monthly Inspection Checklist

INSPECTED BY (Print): _____ DATE: _____

BACKPACK #: _____ AIR CYLINDER #: _____

	Protection Factor	QLFT	PASS	FAIL
A Backpack and Harness Assembly	1. Straps	Inspect for complete set	☐	☐
		Inspect for damaged straps	☐	☐
	2. Buckles	Inspect for mating ends	☐	☐
		Check locking function	☐	☐
	3. Backplate and Cylinder Lock	Inspect backplate for cracks, missing screws/rivets	☐	☐
		Inspect cylinder hold down strap	☐	☐
		Inspect strap tightener	☐	☐
B Cylinder and Cylinder Valve Assembly	1. Cylinder	Cylinder tight to backplate	☐	☐
		Current Hydrostatic Test	☐	☐
		Inspect cylinder for dents, gouges	☐	☐
		Is cylinder at least 90% filled?	☐	☐
	2. Head and Valve Assembly	Inspect cylinder valve lock for presence	☐	☐
		Inspect cylinder gauge for condition	☐	☐
		Proper function of cylinder valve lock	☐	☐
		Test for cylinder leakage	☐	☐
C Regulator and High Pressure Hose	1. High Pressure Hose and Connector	Leakage in hose	☐	☐
		Leakage in hose to cylinder connector	☐	☐
	2. Regulator and Low Pressure Alarm	Read regulator gauge (at least 1,000 psi)	☐	☐
		Low pressure alarm sounds at 500 psi	☐	☐
		Test integrity of diaphragm	☐	☐
		Test for positive pressure	☐	☐
		Test bypass system	☐	☐
D Facepiece and Corrugated Breathing Tube	1. Facepiece	Inspect harness for deterioration	☐	☐
		Inspect facepiece body for deterioration	☐	☐
		Inspect lens	☐	☐
		Inspect exhalation valve	☐	☐
	2. Breathing Tube and Connector	Inspect breathing tube for deterioration	☐	☐
		Inspect connector for threads and gasket	☐	☐
	3. Leak Test and Cleaning	Perform negative pressure test on facepiece/ breathing tube	☐	☐
		Clean and sanitize facepiece	☐	☐

NOTE: Any item marked “Fail” will place the equipment out of service until repaired or replaced.

Attachment 7
Guide to Respiratory Protective Equipment:
Cleaning, Inspection, Maintenance, and Storage

A program for the maintenance of respirators shall include the following:

- Cleaning and sanitizing
- Inspection for defects
- Maintenance and repair
- Storage
- Assurance of breathing air quality.

The following maintenance, inspection, and storage program is recommended.

1. **Cleaning and Sanitizing**.

   Respirators issued to an individual shall be cleaned and sanitized regularly. Each respirator shall be cleaned and sanitized before being worn by different individuals. Respirators intended for emergency use shall be cleaned and sanitized after being used. The following shall be completed in addition to the manufacturer's instruction for cleaning:

   a) Remove, when necessary, the following components of respiratory inlet covering assemblies before cleaning and sanitizing:

      1. Filters, cartridges, canisters
      2. Speaking diaphragms
      3. Valve assemblies
      4. Any components recommended by the respirator manufacturer.

   b) Wash respiratory inlet covering assemblies in warm (43 degrees C or 110 degrees F maximum temperature) cleaner sanitizer solution. A stiff bristle (not wire) brush may be used to facilitate removal of dirt or other foreign material.

   c) Rinse the respirator inlet covering assemblies in clean, warm (43 degrees C or 110 degrees F maximum temperature) water.

   d) Drain all water, and air dry the respiratory inlet covering assemblies.

   e) Clean and sanitize all parts removed from the respiratory inlet covering assemblies as recommended by the manufacturers

   f) If necessary to remove foreign material, hand wipe respiratory inlet covering assemblies, all parts, and all gasket-and valve-sealing surfaces with damp, lint-free cloth.

   g) Inspect parts and replace any that are defective.

   h) Reassemble parts on respirator inlet covering assemblies.

   i) Visually inspect and, where possible, test parts and respirator assemblies for proper function.

   j) Place assembled respirators in appropriate containers for storage.

Machines may be used to expedite the cleaning, sanitizing, rinsing, and drying of large numbers of respirators. Extreme care shall be taken to ensure against tumbling, agitation, or exposure to temperatures above those recommended by the manufacturer (normally 43 degrees C or 100 degrees F maximum), as these conditions are likely to result in damage to the respirators.

Ultrasonic cleaners, clothes washing machines, dishwashers, and clothes dryers have been specially adapted and successfully used for cleaning and drying respirators.

Cleaner sanitizers that effectively clean the respirator and contain a bactericidal agent are commercially available. The bactericidal agent frequently used is a quaternary ammonium compound. Strong cleaning and sanitizing agents and many solvents can damage rubber or elastomeric respirator parts. These materials must be used with caution.

Alternatively, respirators may be washed in a detergent solution and then sanitized by immersion in a sanitizing solution. Some sanitizing solutions that have proven effective are:

a) a hypochlorite (bleach) solution (50 parts per million chlorine), 2-minute immersion;

b) an aqueous iodine solution (50 parts per million of iodine), 2-minute immersion; or

c) a quaternary ammonium solution (200 parts per million of quaternary ammonium compounds in water with less than 500 parts per million total hardness), 2-minute immersion.

Inflammation of the skin of the respirator user (dermatitis) may occur if the quaternary ammonium compounds are not completely rinsed from the respirator. The hypochlorite and iodine solutions are unstable and break down with time; they may cause deterioration of rubber or other elastomeric parts and may be corrosive to metallic parts. Immersion times should not be extended beyond the mentioned time periods, and the sanitizers shall be thoroughly rinsed from the respirator parts.

Respirators may become contaminated with toxic materials. If the contamination is light, normal cleaning procedures should provide satisfactory decontamination; otherwise, separate decontamination steps may be required before cleaning.

2. Inspection

The user shall inspect the respirator immediately prior to each use to ensure that it is in proper working condition. After cleaning and sanitizing, each respirator shall be inspected to determine if it is in proper working condition, if it needs replacement parts or repairs, or if it should be discarded. Each respirator stored for emergency or rescue use shall be inspected at least monthly.

Respirator inspection shall include a check for tightness of connections; for the condition of the respiratory inlet covering, head harness, valves, connecting tubes, harness assemblies, hoses, filters, cartridges, canisters, end-of-service indicators, electrical components, and shelf-life date(s); and for the proper function of regulators, alarms, and other warning systems. Each rubber or other elastomeric part shall be inspected for pliability and signs of deterioration. Each air and oxygen cylinder shall be inspected to ensure that it is fully charged according to the manufacturer's instructions.

A record of inspection dates shall be kept for each respirator maintained for emergency or rescue use. Respirators that do not meet applicable inspection criteria shall be immediately removed from service (a temporary replacement assigned) and repaired or permanently replaced.

Inspection of hoop-wrapped air cylinders will follow the recommendations set forth in the Compressed Gas Association, Inc. publication CGA C-6.2-1988, "Guidelines for Visual Inspection & Requalification of Fiber Reinforced High Pressure Cylinders," and will be examined for the following five types of damage:

- Abrasion is damage caused by wearing, grinding, or rubbing away by friction. Abrasions less than 0.005 inch (0.127 mm) deep are acceptable and should have no adverse effects on the safety of the cylinder. Abrasions with isolated groups of fibers exposed or flat spots with a depth greater than 0.005 inch (0.127 mm) but less than 0.0075 inch (0.191 mm) are acceptable if the damage is repaired. Cylinders abraded in excess of 0.0075 inch (0.191 mm) should be taken out of service until professionally inspected.

- Cuts are damage inflicted by a sharp object. Cuts or scratches less than 0.005 inch (0.127 mm) deep are acceptable regardless of length, number, or direction. For cuts greater than 0.005 inch (0.127 mm) deep and up to a depth of 0.015 inch (0.038 mm) with a maximum 1- or 2-inch (25.4 mm or 50.8 mm) length transverse to the fiber direction, the cylinder should be removed from service until repaired. Cylinders with cuts greater than 0.015 inch (0.038 mm) with a maximum greater than 2 inches (50.8 mm) length transverse to the fiber direction or with bare metal showing through must be condemned.

- Impact damage is caused by a cylinder striking or being struck by another object. Impact damage is considered slight if a frosted area is noted in the impact area. These cylinders may be returned to service. Impact damage is severe if evidence of fiber cutting, delamination, and possible structural damage is apparent. Cylinders sustaining severe impact damage should be evaluated using the guidelines for cuts and structural damage.

- Structural damage is damage which causes a visual change in original cylinder configuration. This change can include any evidence of bulges, a cocked end fitting, concave areas on the domes or on the cylinder section, or, if by visual inspection of the cylinder interior, there is evidence of damage involving deformation of the liner. Structurally damaged cylinders must be immediately removed from service and condemned.

- Heat or fire damage to a cylinder is evident by discoloration, charring, or burning of the composite, labels, paint, or plastic components of the valve. Such damage would cause a cylinder to be removed from service and condemned. Note: If the cylinder is only soiled from smoke or other debris and is found to be intact underneath, it may be returned to service.

3. Maintenance and Repair

Replacement of parts or repairs shall be done only be persons trained in proper respirator maintenance and assembly. Replacement parts shall be only those designated for the specific respirator repaired. Reducing or admission valves, regulators, and alarms shall be adjusted or repaired by the respirator manufacturer or a technician trained by the manufacturer. Instrumentation for valve, regulator, and alarm adjustments and tests should be calibrated to a standard traceable to the National Institute of Standards and Technology (NIST), at a minimum of every 3 years.

4. Storage

Respirators shall be stored in a manner that will protect them against physical and chemical agents such as vibration, shocks, sunlight, heat, extreme cold, excessive moisture, or damaging chemicals. Respirators shall be stored to prevent distortion of rubber or other elastomeric parts. Respirators shall not be stored in such places as lockers and tool boxes, unless they are protected from contamination, distortion, and damage. Emergency and rescue respirators that are placed in the work areas shall be quickly accessible at all times, and the storage cabinet or container in which they are stored shall be clearly marked.

5. Assurance of Breathing Air Quality

Compressed gaseous air, compressed gaseous oxygen, liquid air, and liquid oxygen used for respiration shall be of high purity. Compressed gaseous air shall meet at least the requirements of the specification for Type I-Grade D breathing air, and liquid air shall meet at least the requirements for Type II-Grade B breathing air as described in ANSI/CGA G-7.11989.

The CGA designation for Grade D and Grade E breathing air is as follows:

- Grade D breathing air, as per ANSI/CGA G-7.1-1989, shall contain between 19.5 and 23.5 percent oxygen with the balance predominantly nitrogen, a maximum of 5 mg/m^3 oil (condensed), a maximum of 10 ppm carbon monoxide, no pronounced odor, and a maximum of 1,000 ppm carbon dioxide.
- Grade E breathing air, as per ANSI/CGA G-7.1-1989, shall contain between 20 and 22 percent oxygen with the balance predominantly nitrogen, a maximum of 5 mg/m^3 oil (condensed), a maximum of 10 ppm carbon monoxide, no pronounced odor, a maximum of 500 ppm carbon dioxide, and 25 ppm total hydrocarbon content (as methane).
- Note: The quality verification for oil is not required for synthesized air whose oxygen and nitrogen components are produced by air liquefaction. Carbon monoxide quality verification is not required for Grade D breathing air if synthesized air when nitrogen component was previously analyzed and meets National Foundry (NF) specification and when the oxygen component was produced by air liquefaction and meets United States Pharmacopeia (USP) specification.

Compressed gaseous air may contain low concentrations of oil introduced from equipment during processing or normal operation. If high-pressure oxygen passes through an oil- or grease-coated orifice, an explosion or fire may occur. Therefore, compressed gaseous oxygen shall not be used in supplied air respirators or in open-circuit type self-contained breathing apparatus that have previously used compressed air. Oxygen concentrations greater than 23.5 percent shall be used only in equipment designed for oxygen service or distribution.

The dew point of air used to recharge self-contained breathing apparatus shall be –65 degrees F or lower (less than 25 ppm water vapor). The driest air obtainable (dew point of –100 degrees F or lower) should be used for recharging SCBA cylinders to be used in environments with ambient temperatures below –25 degrees F. The dew point of breathing air used with supplied air respirators should be lower than the lowest ambient temperature to which any regulator or control valve on the respirator or air-supplied system will be exposed.

Breathing air couplings shall be incompatible with outlets for nonrespirable plant air or other gas systems to prevent inadvertent servicing of supplied air respirators with nonrespirable gases. **It is recommended that Foster or Hansen fittings be reserved for breathing air systems.** Breathing air outlets shall be labeled.

Breathing air may be supplied to supplied air respirators from cylinders or air compressors. Cylinders shall be tested and maintained in accordance with applicable DOT specifications for shipping containers (49 CFR 173 and 178). Breathing gas containers shall be marked in accordance with ANSI/CGA C-4-1990. Specific test recommendations for purchased breathing air are given in the following table.

Method of Preparation	Analysis Recommended
Compression: Supplier does not fill cylinders with any other gases.	Check 10% of cylinders from each lot for ppm CO and odor.
Compression: Supplier fills cylinders with gases other than air.	Analyze all cylinders for percent oxygen. Check 10% of cylinders from each lot for ppm CO and odor.
Reconstitution.	Analyze all cylinders for percent oxygen. Check 10% of cylinders from each lot for ppm CO and odor.

A compressor shall be constructed so as to avoid entry of contaminated air. For all air compressors, including portable types, the air intake location shall be carefully selected, and monitored closely to ensure continued quality of air supply to the compressor. The system shall be equipped as necessary with a suitable in-line air-purifying sorbent bed and filter to further assure breathing air quality. Maintenance and replacement/refurbishment of compressor and associated air-purifying/filter media shall be performed periodically, by trained personnel following manufacturer's recommendations and instructions.

As part of acceptance testing, and prior to initial use, representative sampling of the compressor air output shall be performed to ensure that it complies with the requirements in Paragraph 1 of this section. To ensure a continued high-quality air supply, and to account for any distribution system contaminant input, a representative sample should be taken at distribution supply points. Samples should be collected on a periodic basis, as directed by the Program Coordinator. Specific test recommendations are given in the following table.

Type/Sample	Oil Lubricated	Non-Oil Lubricated	Combustion Engine Powered
Water Vapor	☒	☒	☒
Carbon Monoxide	☒		☒
Condensed Hydrocarbon	☒		☒
Carbon Dioxide			☒
Odor	☒	☒	☒

NOTES:

1. When using air compressors, intake location shall be carefully selected and monitored closely to ensure air supplied to the compressor is of adequate quality.
2. No frequency for periodic checks of air quality is specified, due to wide variation in equipment types, use, working environments, and operating experience.
3. Continuous monitoring of temperature and carbon monoxide are not required.
4. For non-oil lubricated compressors that operate at less than 35 psi, no sampling for water is required.
5. These requirements apply to systems designed for breathing air, other air-supply systems need to be evaluated on a case-by-case basis for the type and frequency of testing.

Further details on sources of compressed air and its safe use can be found in CGA G-7-1988.

1. PURPOSE

This procedure prescribes the general requirements for the operation of motor vehicles on company business. All operators of company owned, leased, and rented vehicles, as well as personal vehicles used on company business, are covered by this procedure. U.S. Department of Transportation (DOT) regulated personnel must also comply with the guidelines contained in Shaw Environmental & Infrastructure, Inc. (Shaw E&I) Procedure No. EIG-HS-810, "Commercial Motor Vehicle Regulations and DOT Compliance." Key elements of this procedure include:

- All employees who drive or may drive on company business must be familiar with the requirements of this procedure and certify their acceptance of the Company Rules for Motor Vehicle Operation (Attachment 1). This certification will be evaluated via the established point system to determine driving privilege status.
- All new hire candidates shall complete and be familiar with the Company Rules for Motor Vehicle Operation (Attachment 1). This certification will be evaluated via the established point system to determine driving privilege status.
- Employees must report all vehicular citations incurred while on company business to their supervisor as soon as possible, but not longer than 24 hours after the occurrence. Once reported, the established evaluation criteria in Section 6.4 will be used to determine corrective actions.
- Employees have the responsibility to keep track of their non-work related vehicular citations and utilize the established evaluation criteria found in Section 6.3 to determine if their overall Motor Vehicle Records (MVR) citations exceed the Overall Driving Record limits (see Section 6.3.2).
- Employees utilizing vehicles while on company business are required to review this procedure and attend a company-designated driver training class at least once every two years.
- Requests for the reinstatement of denied or revoked driving privileges can be made to the appropriate business line President and the Senior Director of Health and Safety.

2. SCOPE

This procedure applies to all employees who operate company owned, leased and rented vehicles, as well as personnel vehicles used on company business.

2.1 Exception Provisions

Variances and exceptions, not explained herein, may be requested pursuant to the provisions of Shaw E&I Procedure No. EIG-HS-013, "Health and Safety Procedure Variance."

3. REFERENCES

- Shaw E&I Procedure No. HR207, "Employee Discipline"
- Shaw E&I Procedure No. EIG-HS-013, "Health and Safety Procedure Variance"
- Shaw E&I Procedure No. EIG-HS-020, "Accident Prevention Program: Reporting, Investigation, and Review"

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- Shaw E&I Procedure No. EIG-HS-810, "Commercial Motor Vehicle Regulations and DOT Compliance"

4. DEFINITIONS

Chargeable Vehicle Accident – Any at fault vehicle accident meeting any one of the following criteria:

- An individual other than an employee of the company is a party in the accident.
- Property owned by a person or entity other than the company is damaged.
- When only company employees, company owned or leased (not rented) vehicles, and property is involved and damage exceeds $2,500.00.

Company – Shaw E & I and its subsidiaries and affiliates.

Motor Vehicle – Any passenger vehicle, including trucks, used upon the highway or in private facilities for transporting passengers and/or property. This includes personal vehicles operated on company business. For the purpose of this procedure, off-road vehicles, such as all-terrain vehicles (four wheelers) earthmoving equipment, forklifts, nonhighway use trucks, etc., are not considered vehicles.

Project Assigned Employees – Any employee that is assigned to a field operations project position. This designation includes Project Managers, Site Managers/Supervisors, Foremen, Technicians, Scientists, Geologists, Project Business Accountants, etc. This does not include employees that are typically assigned to an office but are visiting a site for brief periods of time, such as to provide technical assistance, perform audits, perform program reviews, etc.

5. RESPONSIBILITIES

5.1 Procedure Responsibility

The Senior Director of Health and Safety is responsible for the issuance, revision, and maintenance of this procedure.

5.2 Action/Approval Responsibilities

The responsibility requirements are included in Attachment 1, "Motor Vehicle Operation: General Requirements, Responsibility Matrix."

6. PROCEDURE

6.1 Company Rules for Motor Vehicle Operation

All employees who will or may be required to operate a company owned, leased, or rented motor vehicle or a personal vehicle used on company business shall acknowledge acceptance of the Company Rules for Motor Vehicle Operation (Attachment 1) prior to such operation. The signed form shall be retained by the Baton Rouge, Louisiana Health and Safety Records Department. Each year, the company shall reserve the right to require covered employees to sign a copy of the most current Company Rules for Motor Vehicle Operation.

FAILURE OF EMPLOYEES TO COMPY WITH COMPANY RULES FOR MOTOR VEHICLE OPERATION OR THIS POLICY SHALL BE SUBJECT TO DISCIPLINARY ACTION UP TO AND INCLUDING (BUT NOT LIMITED TO) REVOCATION OF DRIVING PRIVILEGES FOR COMPANY BUSINESS AND TERMINATION OF EMPLOYMENT.

Those employees who are assigned to use an Employer vehicle, which they take home with them, must meet the following conditions:

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- The Employee's supervisor signs an Authorization for Assignment Form (EIG-HS-800.02).
- The Employee signs and agrees to be bound to a Vehicle Usage Agreement (EIG-HS-800.03).
- The Employee provides proof of insurance on the Employee's personal vehicle, which lists the Employee as an insured driver on the insurance and such insurance contains minimum coverage required by law and acknowledges that the Employee's personal insurance will provide primary coverage of the Employee's use of a Company owned vehicle when such use is not in the course and scope of employment. The authorizing supervisor shall attach a copy of the proof or personal insurance to EIG-HS-800.03 for future reference.

The Vehicle Usage Agreement is an agreement by the Employee that his own personal vehicle insurance will be primary as to any claims arising from the Employee's **NON COMPANY** use of Company Vehicles.

Employees operating Company Vehicles without compliance with these requirements, as well as any supervisor who allowed or granted such use, will be deemed to be in violation of Company policy and will be subject to discipline up to and including termination from employment.

6.1.1 Project Assigned Employee Vehicle Use Requirements

The following requirements are set forth as it pertains to Project Assigned Employees.

- Project-assigned employees are not permitted to operate a company vehicle (owned, leased, or rented) on noncompany business after 10:00 p.m. without written authorization from the Project Manager or the appointed Site Manager/Supervisor with jurisdiction over the vehicle. In those cases where there is shift work, a non-traditional workday (i.e., 3 p.m. to 11 p.m. workday, etc.) or other non-typical circumstances, it is understood that the after 10:00 p.m. restriction would not be appropriate.
- Only authorized Shaw personnel will be allowed to operate company owned, leased or rented vehicles unless non-Shaw personnel have met criteria set forth in section 6.7 of this procedure
- Project assigned personnel that are residing in temporary housing/hotels are granted permission to drive to and from the temporary residence and work. Additionally, the Project Manager, or the appointed Site Manager/Supervisor his/her designee (Site Manager, Supervisor, etc.) is required to evaluate and optimize the potential of carpooling of project assigned personnel in an effort to reduce the number of company vehicles being driven to and from the project site.
- Project assigned employees shall not use company vehicles for sight seeing or any other personal/recreational activities.
- Vehicles may be used in support of "daily life activities" such as going to restaurants for dinner, laundromats, local retail stores, grocery stores, etc., that are in reasonable proximity to the temporary housing in which an employee resides.
- For normal routine travel to and from work, employees shall utilize their own personal transportation.
- If an employee is assigned to a project site that is located within driving distance from the employee's permanent residence, but is too far away to allow for a daily commute, that employee shall utilize their own personal transportation to drive to and from their permanent residence and the project site (i.e., for initial assignment arrival to the project, trips home on rotation, etc.). Upon arrival to the site, employees shall be allowed to use a company vehicle as required to perform project activities. In these cases, the employee will also be required to

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drive their personal vehicle to and from the project site from their temporary housing/hotel residence, for personal "daily life activities," etc.

- Employees may drive a Shaw-owned, -leased, or –rented vehicle home during off hours only when authorized in writing by a business line manager, who must hold a position at least one level above the Site/Project Manager to whom the authorized employee reports. In making vehicle use decisions the authorizing manager shall consider the risk of vehicle accidents, Shaw's liability risks, client and project specific needs, distances to be traveled, employee driving history, and any other relevant factors. Attachments 3 and 4 shall be used to facilitate this process.

6.2 Pre-Employment Evaluation

Human Resources shall distribute a copy of this procedure to all new hire candidates for the completion of EIG-HS-800.04, "Driving Record Certification." Information provided should be evaluated via the point system in Section 6.3. Human Resources and the hiring manager will be advised regarding any hiring or driving privilege restrictions that may apply. Hiring of persons with regular driving duties (e.g., field technicians and leadmen, sales persons, or others with assigned company motor vehicles) may only proceed after the information contained in EIG-HS-800.04 is evaluated.

Once EIG-HS-800.04 is completed, it is to be faxed to the Baton Rouge, Louisiana Corporate Health and Safety Records Department. The driving status of the prospective employee will be reported to the appropriate Human Resources Department. Health and safety will notify the appropriate Human Resources Manager when the attachments are not returned.

Discrepancies between the certified driving record report and EIG-HS-800.04 shall be reviewed with the prospective employee. Deliberate falsification of driving record information will disqualify prospective employees from being hired.

6.3 Driving Record Point System

The following point system will be used to evaluate the driving record of all existing employees and new hire candidates that can reasonably be expected to operate a motor vehicle during their employment. This data is to be collected through MVR search and by the employee completing EIG-HS-800.04 of this procedure. The Company Rules for Motor Vehicle Operation Acknowledgement (EIG-HS-800.01) is to be completed by the new hire candidate.

Driving Record Point System	
Description of Violation	**Assigned Point Value**
Non-Moving: vehicular equipment deficiency, no seatbelt use, failure to secure load, etc.	1
Moving: speeding (less than 15 miles per hour [mph] over limit), disobey traffic control signal, failure to signal, tailgating, etc.	2
At-fault accident	3
Major citations: speeding (15 mph or more over limit), reckless driving, suspended license for driving violation, speed contest, open alcohol container (Non-Work Related), etc.	6
Driving under the influence, hit and run (leaving the scene of an accident), or work related open alcohol container.	8
Open Alcohol Container (Work Related)	8

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6.3.1 Pre-Employment Driving Record Point System Evaluation

If a new hire candidate has accumulated three points or less in the last 12 months or five points or less in the last 24 months, they will be given the privilege to drive motor vehicles on company business without restrictions.

If a new hire has accumulated four to six points in the last 12 months or six to eight points in the last 24 months, they will be placed on probation for a period of 12 months. They will be afforded the privilege to drive motor vehicles on company business during this probationary period. Any driving infractions (i.e., speeding tickets, at-fault accidents, citations, etc.) accumulated during this probationary period will result in termination of the privilege to drive a motor vehicle on company business.

If the new hire candidate has accumulated seven to 11 points in the last 12 months or nine to15 points in the last 24 months, they will not be eligible for company driving privileges. Employment can only be offered with the strict understanding of denial of the privilege to drive motor vehicles on company business. After the first 12 months of employment, the employee can petition the appropriate business line President and the Senior Director of Safety and Health for reconsideration of driving privileges.

If a new hire candidate is expected to drive a vehicle, to fulfill the responsibilities of his/her role, and there has been an accumulation of 12 points or more in the last 12 months or 16 points or more in the last 24 months, the candidate shall not be hired. See table below:

Candidate's Driving Privilege Status Description	Past 12 Months	Past 24 Months
Can drive without restriction.	0 to 3 points	0 to 5 points
Can drive with understanding of probationary status.	4 to 6 points	6 to 8 points
Not eligible for company driving privileges for first 12 months of employment.	7 to 11 points	9 to 15 points
Candidate not eligible for hire.	12 points or more	16 points or more

6.3.2 Existing Employee Driving Record Point System

An acceptable traffic record is one requirement for continued driving privileges. Accordingly, each affected employee's MVR traffic record is subject to periodic and annual review to ensure compliance with state and federal regulations, as well as company policy.

6.3.2.1 Work Related Traffic Violations

It is the responsibility of all affected employees to provide verbal notice to their supervisor of any work related traffic violations that have occurred as soon as practicable but not longer than 24 hours after the occurrence. This verbal notice shall be followed by the employee completing an updated Company Rules for Motor Vehicle Operation Acknowledgement (EIG-HS-800.01), and Notification of Work-Related Citation Form (EIG-HS-800.05). Both Forms EIG-HS-800.01 and EIG-HS-800.05 shall then be immediately forwarded to the Baton Rouge, Louisiana Health and Safety Records office.

6.3.2.2 Non-Work Related Traffic Violations

Employees have the responsibility to keep track of their non-work related vehicular citations and utilize the established evaluation criteria, as described below, to determine if their overall traffic citations exceed acceptable company limits. It is not necessary for employees to report non-work related citations to their supervisor as they occur. However, if an employee's overall MVR record (work related or not) exceeds the company's established points system criteria, the employee

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must verbally inform their supervisor as soon as practical but no longer than the following business day after the occurrence. This verbal notice shall be followed by the employee completing an updated EIG-HS-800.01, and it shall then be immediately forwarded to the Baton Rouge, Louisiana Health and Safety Records office.

6.3.2.3 Overall Driving Record Evaluation

If it is determined that an employee has accumulated three points or less in the last 12 months or five points or less in the last 24 months, they will be allowed to continue with the privilege to drive motor vehicles on company business without restrictions.

If an employee has accumulated four to six points in the last 12 months or six to eight points in the last 24 months, the employee will be placed on probation for a period of 12 months. The employee can continue to drive motor vehicles on company business during this probationary period.

If the employee has accumulated seven to11 points in the last 12 months or nine to15 points in the last 24 months, they will not be eligible for company driving privileges. Continued employment may only be extended with the strict understanding of denial of the privilege to drive company owned, eased, or rented motor vehicles on company business. After the first 12 months following driving privilege revocation, the employee can petition their respective Business Line President and the Senior Director of Safety and Health for reconsideration of driving privileges. See table below:

Employee's Driving Privilege Status Description	Past 12 Months	Past 24 Months
Can drive without restriction.	0 to 3 points	0 to 5 points
Can drive with understanding of probationary status.	4 to 6 points	6 to 8 points
Company driving privileges are revoked.	7 to 11 points	9 to 15 points

6.3.2.4 Non Driving Related License Suspension

Any employee with a currently suspended license is prohibited from driving any Shaw owned and/or rented or leased vehicle. This includes the use of a personal vehicle to conduct Shaw company business. Although no points will be assessed for a non driving related license suspension, the employee will be placed on a revoked driving privileges status. Once the suspension has been lifted and proof has been provided by the employee, the employee has the right at that time to request reinstatement of his/her driving privileges. Refer to Section 6.6, "Reinstatement of Driving Privileges." Before driving privileges are reinstated a new MVR must be evaluated to ensure no other violations have occurred.

6.4 Employee Evaluation Criteria

All employees who may operate a motor vehicle on company business will become familiar with the requirements of this procedure, complete the currently-designated company driver training class, and complete Attachment 5 prior to such operation. The employee driving evaluation criteria is based upon all infractions including those incurred while on company business and during off-work hours. It is imperative that employees notify their supervisors immediately as possible, and no later than 24 hours following a work-related citation/accident. Once notified, the supervisor will ensure the completion of the Driving Record Certification Form (EIG-HS-800.04), forward it to the Baton Rouge, Louisiana Health and Safety Records Office, and initiate one of the following corrective actions as required. Additionally, as it relates to non-work related and work related traffic violations, it is the employee's responsibility to ensure that their overall driving record does not allow for the exceeding of the driving records points system. Should the employee's driving record points exceed the system limits, they must notify their supervisor immediately, complete an updated Company Rules for Motor Vehicle Operation

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Acknowledgement (EIG-HS-800.01) and the employee Driving Record Certification Form (EIG-HS-800.04), and forward it to the Baton Rouge, Louisiana Health and Safety Records Department.

6.4.1 Work-Related Minor Citation

When an employee is given a work related minor citation (i.e., speeding ticket, moving violation, failure to signal turn, loss of load, etc.), the employee's supervisor will meet with the employee to discuss the corrective action that must be taken so that further violations do not occur. At a minimum, the supervisor shall require the employee to attend a recognized course in defensive driving on his/her own time and the cost of this training will be borne by the employee. This course shall be pre-approved by the Division Health and Safety Manager. The supervisor will provide written direction to the employee regarding the assigned corrective action(s). The supervisor shall forward a copy of an updated Company Rules for Motor Vehicle Operation Acknowledgement (EIG-HS-800.01) and the employee Driving Record Certification Form (EIG-HS-800.04) and a form of verification showing the employee's successful completion of an approved defensive driving course to the appropriate regional Human Resources Department for inclusion in the employee's personnel file. These documents shall also be forwarded to the Baton Rouge, Louisiana Health and Safety Records Department.

6.4.2 Work Related Major Citation

When an employee is given a work related major citation (i.e., reckless driving, tailgating, suspended license, speed contest, etc.), the supervisor will hold a meeting with the employee, at which time the supervisor will complete the company Disciplinary Action Form (Shaw E&I Procedure No. HR207, "Employee Discipline") thereby informing the employee that any additional infractions will lead to more severe disciplinary action. In addition, the employee will be required to attend a recognized defensive driving course on his/her own time, as described in Section 6.4.1, and will be suspended from work for one day without pay. A copy of the Disciplinary Action Form shall be forwarded to the appropriate Human Resources Department for their information and inclusion in the employee's personnel file.

6.4.3 Failure to Notify

Should an employee fail to notify his/her supervisor of any work or non-work related citation or accident within the required reporting time, his/her company driving privilege may be revoked. The supervisor will also take disciplinary action that is appropriate for the unreported event. If the unreported event is work related and is either an at-fault accident, driving under the influence case or a hit and run violation, the termination process will be initiated. All disciplinary actions shall be documented to the employee by the supervisor. This copy, and any written response by the employee, shall be forwarded to the appropriate Human Resources Department for their information and inclusion in the employee's personnel file.

6.4.4 At-Fault Accident

Whenever an employee is operating a company owned/leased/rented vehicle or their personal vehicle on company business and is involved in an at-fault vehicle accident, an Accident Review Board shall be convened and will recommend the corrective action to be taken. At a minimum, the action shall include the completion of a recognized driver safety course on their time and at their expense, as described in Section 6.4.1.

Depending upon the circumstances and severity of the accident, termination of the employee can be considered. As above, this must be approved by the appropriate Human Resources Department. All communication to the employee regarding the accident and resulting action shall be in writing with a copy to the appropriate Human Resources Department for their information and inclusion in the employee's personnel file.

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6.4.5 Driving Under the Influence, Hit and Run (Leaving the Scene), and Open Container

If an employee is charged with Driving Under the Influence, Hit and Run, or an Open Alcohol Container violation, he/she will have their driving privileges temporarily suspended pending final resolution of the charge. If the charge is resolved in the employee's favor, with a final adjudication holding no penalty, driving privileges may be re-instated. However, if any penalty is attached, such as probation, license restrictions, etc., the employee may be considered unqualified to drive for the company. Whenever an employee is convicted or pleads no contest to a company-related driving under the influence, hit and run, or open container charge, he/she will be immediately terminated.

In a case that is not work related, and an employee is convicted or pleads no contest to a hit and run or driving under the influence charge, the employee shall notify his supervisor. Accordingly, the employee's company driving privileges will then be revoked for 12 months. After the first 12 months following driving privilege revocation, the employee can petition their respective Business Line President and the Senior Director of Safety and Health for reconsideration of driving privileges.

6.5 Training

All employees who will, or may reasonably be expected to, drive a company owned/leased/rented vehicle or their personal vehicle on company business shall review this procedure and complete the currently-designated company driver training class prior to such operation. This class is designed to be taught either via the company's Web-based training program or by local Health and Safety personnel and must include the following elements:

- Federal/state/local driving rules
- Company driving rules
- Emergency/accident procedures
- Defensive driving techniques.

Specific information on the vehicle to be operated will be provided locally. Personnel conducting this class shall provide the Knoxville Health and Safety Training Department with a copy of the course attendance sheet for inclusion in individual training records. All affected employees shall complete a driver safety training class at least once every two years.

6.6 Reinstatement of Driving Privilege

Any employee who has had his/her privilege to drive a motor vehicle on company business revoked or denied, and who desires to reinstate this privilege, must apply to the Business Line President and the Senior Director of Health and Safety for reinstatement. The Director of Health and Safety, or his designee, shall specify rehabilitation program (if applicable), an external safe driving course, and any other requirements in which he/she deems appropriate. Once the employee completes the program, documentation of successful completion must be formally presented to the appropriate President and the Senior Director of Health and Safety. If the documentation is accepted, the driving privilege may be reinstated. Copies of all documents shall then be forwarded, by the responsible Health and Safety Manager, to Human Resources and to the Baton Rouge, Louisiana Health & Safety Records Department.

Reinstatement of the driving privilege may occur one time, at the discretion of the Director of Health & Safety and the responsible Business Line Vice President. If employee driving performance leads to a subsequent revocation of this privilege, such revocation shall be permanent.

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6.7 Non-Shaw Employee Vehicle Use Requirements

Only approved non-Shaw employees (client, subcontractor, or temporary/temp agency employees) who have completed and signed the "Non-Shaw Employee Driver Questionnaire" (EIG-HS-800.06) will be allowed to drive a Shaw owned, leased, or rented vehicle. Upon completing the questionnaire and prior to the driver operating a Shaw vehicle, the subject questionnaire must be signed, dated, and placed on file at the job site. The primary vehicle operator or the Shaw Project Management representative shall review the questionnaire and determine whether the non-Shaw employee satisfies the driver qualification requirements of this procedure. The driver qualification point system can be found in Section 6.3 of this procedure.

In addition to the above requirement, it is also a requirement of the responsible Shaw Project Manager to forward a fully executed, company-specific version of the correspondence that is found in EIG-HS-800.07, "Memorandum Template for Employers of Non-Shaw Drivers," to the employer of the non-Shaw driver. This correspondence should not be modified except for the fields that specify the name and address of the subcontractor or client to whom the letter is being written. This written correspondence will serve to notify that any employee that is assigned by their company to a Shaw project, and is required to operate/drive a Shaw-owned, -leased, or –rented vehicle will be subject to either meeting or exceeding the operator requirements for Shaw employees.

As the employer of individuals who are assigned to a Shaw project, the authorized non-Shaw employer representative shall sign and return EIG-HS-800.07 to the respective Shaw Project Manager. By signing Attachment 8, the non-Shaw employer is acknowledging that they are either adopting the requirements set forth in this procedure or have developed a similar policy that meets or exceeds these requirements. Failure of a non-Shaw employer to comply with the requirements set forth in this procedure shall result in the prohibition of their employees driving any Shaw-owned, -leased, or –rented vehicles.

6.8 Driver Safety Notification Sticker

A safety notification bumper sticker shall be applied to all Shaw owned/leased vehicles in an effort to ensure continued compliance with driving safety regulations. The notification service will be managed by a third party fleet safety management company and will serve as the recipient of all calls that are placed concerning unsafe driving behavior. The Findlay, Ohio Equipment Services Group will serve as the first point of contact as it pertains to notifications that are received from the third party company who administers the bumper sticker safety call in service. Upon receiving a report from the third party administrator, the equipment division shall determine what business line the vehicle/driver is located within and then contact the respective business line Health and Safety Manager. The Health and Safety Manager will then contact the affected employee and the employee's supervisor for a counseling/discussion meeting, concerning the complaint. Upon conclusion of the meeting, the information will be reviewed by the supervisor and the Divisional Health and Safety Manager for determination of corrective or disciplinary action.

The company shall endeavor to ensure that all company owned/leased fleet vehicles shall have a safety notification bumper sticker applied to the rear of the vehicle. It is the responsibility of the driver, who is deemed the primary/responsible operator of the vehicle, to ensure that the sticker remains on the vehicle and remains legible and in no way defaced. If the vehicle is project or program assigned and there is no designated primary operator, then the Project Manager will be considered the primary/responsible operator. The primary / responsible operator shall contact the Equipment Division in Findlay, Ohio, at 1-800-225-6464 ext. 6051 or direct dial at 419-425-6051, immediately upon recognizing that the sticker is defaced or removed such that a new one can be re-applied. Failure, on the part of the primary operator, to ensure that a legible sticker remains on the vehicle shall result in disciplinary action, up to and including vehicle usage being revoked, in addition to possible termination of employment.

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6.9 Cellular Telephones, iPod/Walkmans, and Pagers

Cellular telephones, Blackberry's, and other 2-way communication devices have been proven as distractions while driving. Based on the findings of the National Highway Transportation Safety Administration and other sources, the Company recommends not using these devices while operating a motor vehicle of any type. If, against better judgment, a driver engages in the use of these devices, the following is required:

- External speaker and microphone or a Bluetooth style earpiece must be used to allow hands-free operation.
- Telephone number memory and programming capabilities are to be included and used.
- Drivers are to refrain from responding to pagers while the vehicle is in motion.
- Incoming calls should be limited to two minutes or less.
- For any cellular telephone that does not meet the above equipment specifications, use of the telephone/pager is authorized only when the vehicle is safely parked.
- Employees are prohibited from using an iPod/Walkman or similar device while operating a motor vehicle.
- Text messaging of any kind, while driving, is strictly forbidden.

6.10 Global Positioning System Speed Data

In the interest of safety and risk reduction, Global Positioning System (GPS) speed and location gathering devices have been installed in many company-owned vehicles. The company intends to utilize data generated by these devices to increase awareness and address instances in which employees choose to exceed established speed limits.

In the event a speed limit infraction is identified, an investigation will be conducted to evaluate the circumstances related to the event. Once determined, appropriate action will be taken depending upon the severity of the event. The employee may be subject to disciplinary action up to and including termination of employment.

7. ATTACHMENTS

- Attachment 1, Motor Vehicle Operation: General Requirements, Responsibility Matrix

8. FORMS

- EIG-HS-800.01 Company Rules for Motor Vehicle Operation Acknowledgement
- EIG-HS-800.02 Authorization for Assignment Form
- EIG-HS-800.03 Vehicle Use Agreement Form
- EIG-HS-800.04 Driving Record Certification Form
- EIG-HS-800.05 Notification of Work-Related Citation Form
- EIG-HS-800.06 Non-Shaw Employee Driver Questionnaire
- EIG-HS-800.07 Memorandum Template for Employers of Non-Shaw Drivers

9. RECORDS

- EIG-HS-800.01 Company Rules for Motor Vehicle Operation Acknowledgement

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- EIG-HS-800.02 Authorization for Assignment Form
- EIG-HS-800.03 Vehicle Use Agreement Form
- EIG-HS-800.04 Driving Record Certification Form
- EIG-HS-800.05 Notification of Work-Related Citation Form
- EIG-HS-800.06 Non-Shaw Employee Driver Questionnaire
- EIG-HS-800.07 Memorandum Template for Employers of Non-Shaw Drivers

10. REVISION HISTORY

Revision Level / Revision Date	Revision Description	Responsible Manager
0 2/13/2004	Initial issue	Troy Allen
1-3 N/A	Revision 1-3 information is unavailable	N/A
4 11/14/2005	Revision 4 information is unavailable.	Troy Allen
5 N/A	Revision 5 was inadvertently skipped.	N/A
6 10/28/2009	Several of the assigned point values for specific violations have been revised, see Section 6.3. Driving record requests require a charge code for processing (see Attachment 5). The fax number for the Baton Rouge, Louisiana Health and Safety Records Department is 225-213-1271. Driving rules 13 and 15 have been modified. Disciplinary actions resulting from at-fault vehicle accidents no longer have to be reviewed for consistency by the appropriate Safety Council. Project Managers are no longer required to execute written authorizations for use of company vehicles when shift work or non-traditional workdays have been scheduled. Section 6.3.2.4 has been added to address non driving related license suspensions. Section 6.9 has been added to address cellular telephones, iPods, Walkmans, and pagers. The phrase “improper lane usage” was deleted from in the Driving Record Point System table in Section 6.3. Section 6.1. "Employees may drive a Shaw-owned, leased, or rented vehicle home during off hours only when authorized in writing by a business line manager, who holds a position at least one level above the Site/Project Manager whom the authorized employee reports. Change: In other words, the approval must be signed by the employee's supervisor or a higher level manager.” This change did not warrant a revision update. The phrase “improper lane usage” was deleted from category 2 in the Driving Record Point System table in Section 6.3. Section 6.1. "Employees may drive a Shaw-owned, leased, or rented vehicle home during off hours only when authorized in writing by a business line manager, who holds a position at least one level above the Site/Project Manager whom the authorized employee reports. Change: In other words, the approval must be signed by the employee's supervisor or a higher level manager.” This	Troy Allen Troy Allen

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Revision Level Revision Date	Revision Description	Responsible Manager
	change did not warrant a revision update.	
7 5/4/2011	Section 6.1.1 Added bullet: Only authorized Shaw personnel will be allowed to operate company owned, leased or rented vehicles unless non Shaw personnel have met criteria set forth in section 6.7 of this procedure Attachment I paragraph 6 added clarification on drugs and OTC and prescriptions Attachment 1 paragraph 2 operator inst. For ensuring proper vehicle for job	David Quinn
8 9/15/2011	Attachment 1 paragraph 2 – driver load evaluation to ensure that the vehicle is loaded properly and that the payload is secured within the parameters prescribed by the manufacturer. Securing of the load comply with DOT, local and federal legal load limits. Modified format to align with Governance Management framework. Changed 7 attachments to forms, updated appropriate references to new forms in procedure. GPS tracking was added to Section 6.	Andrew Johnson
9 11/23/2011	Revised Section 6.1.1 to clarify that vehicles used for "daily life activity" must be kept within reasonable proximity to the temporary housing in which an employee resides. In Attachment 1, changed Item 24 references from Attachments 7 & 8 to EIG-HS-800.06 Non-Shaw Employee Driver Questionnaire and EIG-HS-80.07 Memorandum Template for Employers of Non-Shaw Drivers respectively.	Andrew Johnson

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Motor Vehicle Operation: General Requirements
Responsibility Matrix

Action	Procedure Section	Responsible Party					
		Health & Safety Assistant	Business Line Health and Safety Manager	Supervisor	Accident Review Board	Human Resources	Senior Director of H&S
Issue, Revise, and Maintain This Procedure	3.1						X
Ensure Employees Complete Attachment 1	5.1			X		X	
Distribute Shaw E&I Procedure No. EIG-HS-800 to New Hire Candidates for Completion of Attachment 1	5.2					X	
Request Evaluation of New Hire Driving Record	5.2	X		X		X	
Obtain Driving Record and Determine Driving Status	5.2	X					
Initiate Corrective Actions	5.4			X		X	
Ensure Completion and Distribution of Attachment 5	5.4	X					
Accident Review	5.4.4				X		
Ensure Drivers Meet Training Requirements	5.5		X	X			
Specify Program for Reinstatement of Driving Privilege	5.6						X
Reinstatement of Driving Privilege	5.6						X
Non-Shaw Employee Vehicle Use Requirements	5.7			X			
Contact Employee to discuss report from Safety Notification Sticker Service	5.8		X	X			

Company Rules for Motor Vehicle Operation Acknowledgement

1. Prior to motor vehicle operation, all motor vehicle operators are required to provide the company with current documentation of licensing for the motor vehicle(s) to be operated. Supervisors shall review and approve said documentation.

2. The motor vehicle operator is responsible for the vehicle, and for conducting a pre-trip, walk around inspection prior to use (including load evaluation, if applicable). Driver Load Evaluation will ensure that the vehicle is loaded and that the payload is secured within the parameters proscribed by the manufacturer. The load and method of securing the load will comply with all DOT, local and federal legal load limits. No vehicle with any mechanical defect, which endangers the safety of the driver, passengers, or the public, shall be used. The motor vehicle operator is also responsible for the Driver Safety Notification sticker (Section 6.8). Operator is responsible for ensuring that the vehicle deployed to specific task is of proper size, weight, and rating Gross Vehicle Weight Rating (GVWR) for intended job scope.

3. All company owned/leased trucks should have small convex mirrors attached to the side mirrors.

4. The operator shall drive defensively at all times and is responsible for complying with all state and local traffic laws, as well as customer regulations concerning motor vehicle operation.

5. The operator and all passengers shall use seat belts at all times when the vehicle is in motion.

6. No employee shall operate a motor vehicle when abnormally tired, temporarily disabled, or under the influence of alcohol , illegal drugs or certain over the counter (OTC) and/or prescription medications that may impair motor functions/driving skills

7. No employee shall allow a company owned, leased, or rented motor vehicle to be operated by an unauthorized employee or non-employee (see also unauthorized personal use of company vehicles) (Section 6.7).

8. The operator shall not allow for any open alcoholic beverage containers within a company vehicle or within a personal vehicle while it is being utilized for company business.

9. No employee shall drive beyond any barricades or into any area with designations such as HAZARDOUS, DO NOT ENTER, etc.

10. Use caution when driving through congested areas, or near where personnel and equipment are working.

11. Whenever possible, a spotter shall be used for backing all vehicles. This may be a fellow company employee, or a non-company employee who is willing to help.

12. Unless required, such as on a client's property, keys shall not be left in an unattended vehicle.

13. Employees shall not leave the driver's seat of a vehicle while the motor is running. Exemption: Vehicles equipped with a power take-off device with parking brake set and chocks in place and vehicles operated in Arctic conditions (i.e., less than 0 degrees Fahrenheit).

14. No motorcycles are to be operated on company business.

15. Radar/laser detectors are prohibited in all company owned, leased, or rented vehicles or in personal vehicles while being used for company business.

16. Analytical samples will be transported in accordance with Title 49 Code of Federal Regulations. Regulated hazardous substances shall not be transported in personal vehicles.

17. In case of an accident, the following steps shall be taken:

    A. Stop

    B. Call for medical assistance in case of injuries

C. Notify police

D. Complete Vehicle Accident Report and submit to your supervisor as soon as possible.

18. Whenever a vehicle is stopped upon the traveled portion of a highway or the shoulder of a highway, for any cause other than necessary traffic stops, the driver shall, as soon as possible, place or activate the warning devices with which the vehicle is equipped.

19. Employee must notify the supervisor as soon as possible, but not longer than 24 hours after occurrence, for work related citations, accidents, and license expiration, suspension, or revocation.

20. No employee is authorized to operate a company vehicle (including rentals) after having been on duty for a period of 16 hours. No employee may drive for more than 12 hours in any single on-duty period. Once either of these criteria has been met, a period of eight consecutive hours off duty is required before driving duties may be resumed. These are maximum, not minimum, requirements and employees may be unfit to drive after shorter on-duty periods. Commercial U.S. Department of Transportation drivers are subject to the more restrictive hours of service regulations described in Shaw E&I Procedure No. HS810.

21. Project-assigned employees are not permitted to operate company owned, leased, or rented vehicles after 10:00 p.m. without written authorization from their supervisor (see Section 6.1.1).

22. Employees shall not operate company vehicles for any type of personal use, no exceptions. Personal use includes any usage that is not directly related to company business. See Section 6.1.1 for definitions concerning “daily life activities” for Project Assigned Employees.

23. Employees shall not use a company vehicle to visit an establishment that has a primary function of providing nighttime entertainment including the dispensing of alcoholic beverages.

24. Temporary or non-Shaw employees shall be allowed to utilize Shaw company vehicles only after the driver has completed Form EIG-HS-800.06, Non-Shaw Employee Driver Questionnaire and has satisfied the point system requirements set forth in Section 6.3 of this policy. In addition, the employer of that driver shall have satisfied the requirement set forth in Section 6.7 of this policy and signed a copy of the memo set forth in Form EIG-HS-900.07, Memorandum Template for Employers of Non-Shaw Drivers . This includes clients or subcontractors.

25. Employees shall not transport family members, friends, or any other unauthorized guest passenger unless it is arising out of course and scope of company business.

26. Employees may not drive company owned, leased, or rented vehicles home when off of duty except when authorized in writing by a designated business line manager and in accordance with Section 6.1.1.

27. Employees needing to use a mobile telephone or engage in other potentially distracting activity while operating a Motor Vehicle are advised to pull off the road when safe to do so for the duration of the activity.

I have read and understand company Procedure No. EIG-HS-800 and the company rules for Motor Vehicle Operation and agree to abide by all requirements

Employee’s Name (Printed)	Employee Signature	Date

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Authorization for Assignment Form

I, the hereby undersigned Supervisor / Manager, give my consent and approval for the Employee listed below to be assigned a company owned and/or rented vehicle ("Company Vehicle") as specified herein and in accordance with the Company Motor Vehicle Use Policy and the Company Rules for Motor Vehicle Operation. I have given a copy of the rules and the procedure to the Employee listed below and the Employee has signed and agreed to be bound by the Vehicle Usage Agreement.

Employee Name _____

VIN Number of Vehicle _____

Company Vehicle ID Number _____

Period of Allowance _____

Phone: _____

Company by which employed: _____

I, the undersigned Supervisor, personally attest that the following things have been done and are in proper order *(Please check off when complete and attach appropriate documents)*:

- ☐ Employee Driving Record Complete within the last six months
- ☐ Employee Driving Record rating allows operation of motor vehicle in accordance with policy (*List Rating* _____ *Date Completed*_____*)*
- ☐ Employee has presented a valid driver's license (*attach a copy)*
- ☐ Employee has signed the Vehicle Use Agreement and a copy has been obtained by the Company (*attach a copy)*
- ☐ Employee has been given a copy of Motor Vehicle Use Policy and Company Rules for Motor Vehicle Operation
- ☐ Employee has provided sufficient proof of insurance as required by the Procedure (*attach a copy)*

SUPERVISOR SIGNATURE: _____

Printed Name: _____

Date: _____

Phone Number: _____

FAX A COPY OF THIS FORM TO THE EQUIPMENT DIVISION IN FINDLAY, OHIO @ 419-425-6295. ALSO NOTE THAT THE AUTHORIZED EMPLOYEE AND THE AUTHORIZING MANAGER IS RESPONSIBLE FOR MAINTAINING COPIES OF THIS FORM FOR FUTURE REFERENCE AND AUDITING.

DO NOT FAX THIS FORM TO THE BATON ROUGE HEALTH AND SAFETY RECORDS DEPARTMENT.

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Vehicle Use Agreement

THIS VEHICLE USE AGREEMENT made and entered into this _____day of _____, _____, between the undersigned Employee listed below ("Employee") and the undersigned Company below ("Company").

WITNESSETH:

WHEREAS, Employee has been granted permission to be assigned a Company owned/leased vehicle ("Company Vehicle") as is set forth and approved on the AUTHORIZATION FOR ASSIGNMENT FORM.

In consideration of being assigned use of a Company Vehicle, Employee agrees to the following:

1. Employee will not use the Company Vehicle for personal use.
2. Employee will follow all rules and requirements set forth in the Company's Motor Vehicle Use Policy, a copy of which Employee has received.
3. Employee certifies that Employee has automobile insurance on a personal vehicle of Employee, Employee has provided to Company a copy of such insurance, and a copy is attached to this agreement;
4. Employee agrees that for any claims for damage, injury, or death related to Employee's operation of the Company Vehicle while operating the vehicle on non-company business (personal use), that Employee's own personal automobile liability insurance will be primary and will pay the claim **FIRST AND BEFORE** any insurance of Company. In the event that Employee fails to secure and maintain personal automobile insurance coverage and there is a claim for damage or injury related to Employee's operation of the vehicle for personal use, the Employee will then be responsible and accepts liability for any claims paid by Company up to the minimum limits of insurance required in the state of the Employee's permanent residence.
5. Employee understands that violation of this Agreement or any policy or provision or rule contained in the Motor Vehicle Use Policy or any other Policy of the Company will subject the Employee to discipline including the potential loss of driving privileges for the Company or suspension or termination.

I am a person who is able to read in English and I have read this document and agree to all of its terms and conditions. I understand that the privilege to be assigned a Company Vehicle to take home can be withdrawn by the Company at any time for any reason (and without cause) with notice to me. I agree to comply with return of the vehicle when requested by the Company.

Employee_____

_____

Date:_____

_____

Address:_____

_____

Phone:_____

_____

COMPANY Supervisor / Manager:

Name (Print & Sign): _____ Date: _____

FAX A COPY OF THIS FORM TO THE EQUIPMENT DIVISION IN FINDLAY, OHIO @ 419-425-6295. ALSO NOTE THAT THE AUTHORIZED EMPLOYEE AND THE AUTHORIZING MANAGER IS RESPONSIBLE FOR MAINTAINING COPIES OF THIS FORM FOR FUTURE REFERENCE AND AUDITING.

DO NOT FAX THIS FORM TO THE BATON ROUGE HEALTH AND SAFETY RECORDS DEPARTMENT.

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Driving Record Certification Form

Fair Credit Reporting Act Disclosure Statement

In accordance with the provisions of Section 604 (b)(2)(A) of the Fair Credit Reporting Act, Pubic Law 91-508, as amended by the Consumer Credit Reporting Act of 1996 (title II, Subtitle D, Chapter I, of Pubic Law 104-208), you are being informed that reports verifying your driving record may be obtained on you for employment purposes. These reports are required by Sections 382.413, 391.23 and 391.25 of Federal Motor Carrier Safety Regulations. You have the right to receive a copy of the reports and have the prescribed allotment of time by law to have any errors corrected and the reports obtained after corrections have been posted.

	Assigned Point Value
Overweight, loss of load, vehicular equipment infraction, etc.	1
Moving violation: speeding, failure to stop, failure to signal turn, etc.	2
At-fault accident	3
Major citation: speeding in excess of 15 mph, reckless driving, tailgating, suspended license, speed contest, improper lane usage, open container, etc.	6
Driving under the influence or Hit and Run (Leaving the Scene)	8

In the space provided below, please list all violations and accidents currently listed on your driving record by the state issuing your driver's license (include all states for which you have held a driver's license during the last two years). Determine the number of points assigned from the table above, and write in column labeled Points. Finally, write the sum total of all points where indicated.

Violations/Accidents	**Driver License #/State**	**Date (mo/yr)**	**Points**

Total Points _____

I hereby certify that the information provided is a complete and accurate statement of my driving record for the previous 24 months. I authorize the company to obtain a copy of my driving record from the state of issuance of my license(s). I understand that falsification of data will disqualify me from being hired or may result in revocation of my company driving privileges.

Driver's License No. _____ Driver's Lic. State of Issuance _____

Expiration Date _____ Date of Birth _____

_____ _____

Print Name Social Security Number

_____ _____

Signature Date

PLEASE FAX THIS FORM TO THE BATON ROUGE H & S RECORDS DEPARTMENT AT (225) 213-1271.

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Notification of Work-Related Citation Form

This form is to be completed by employees incurring a work-related vehicular citation. Once complete, it is to be signed by the employee's supervisor and forwarded to the appropriate Human Resources Department for inclusion in the employee's personnel file.

Employee Name _____ Employee No. _____ Date _____

Nature of Citation _____

_____

Location of Citation (City, State) _____

Date/Time Citation Received _____

Is Citation Being Contested? ☐ No ☐ Yes Details _____

_____

_____

Employee Signature _____ Date _____

Corrective Action Being Taken _____

_____

_____

Supervisor Signature _____ Date _____

PLEASE FAX THIS FORM TO THE BATON ROUGE H & S RECORDS DEPARTMENT AT (225) 213-1271.

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Non-Shaw Employee Driver Questionnaire

_____ _____

Date *Time*

_____ _____

Vehicle is assigned to what Shaw employee? *Signature of Shaw Employee*

_____

Non-Shaw Driver's Name

Do you have a valid driver's license? ☐ Yes ☐ No

State in which license was issued, DL Number and Exp Date _____

Have you had any citations or accidents in the past 24 months? ☐ Yes ☐ No

If yes, please list type of citations and the associated dates below:

_____

_____

_____

_____

(Refer to EIG-HS-800, Section 5.3, to determine driver eligibility based on the points system provided.)

By signing below, I, the temporary driver, am acknowledging that the above information is true and accurately represents my driving record. I understand and agree that any misrepresentation or omission of material fact on this questionnaire will constitute sufficient grounds for your removal from the project site and will restrict the future use of Shaw vehicles.

I have read and fully understand the above:

_____ _____

Signature of Non-Shaw Driver? *Date*

Memorandum Template for Employers of Non-Shaw Drivers

Address
Address
Phone
Fax:

Memorandum

Date:

To:

CC:

From:

RE: Requirements for Motor Vehicle Operation

Attached is Shaw Environmental & Infrastructure, Inc. (Shaw E&I) Procedure No. EIG-HS-800, "Motor Vehicle Operation: General Requirements." As you can see, this policy applies to all operators of Shaw owned, leased, or rented vehicles, as well as personal vehicles used on Shaw business.

Accordingly, you are hereby notified that any employee that is assigned by your company to a Shaw E&I project and is required to operate/drive Shaw owned, leased, or rented vehicles, will be subject to either meeting or exceeding the operator requirements for Shaw employees. Please be aware that as the employer of individuals who are assigned to a Shaw project, you must ensure that your company either adopts the requirements set forth in Shaw E&I Procedure No. EIG-HS-800 or develop a similar policy that meets or exceeds those requirements.

Only approved non-Shaw employees, who have completed and signed the "Non-Shaw Employee Driver Questionnaire" (Shaw E&I Procedure No. EIG-HS-800, Attachment 7) will be allowed to drive a Shaw vehicle. Furthermore, prior to the driver operating a Shaw vehicle, the subject questionnaire must be completed and placed on file at the job site. The primary vehicle operator or responsible Shaw management representative shall review the questionnaire and determine whether the non-Shaw employee satisfies the driver qualification requirements of Shaw E&I Procedure No. EIG-HS-800.

Failure to comply with the requirements of this correspondence or the requirements set forth in Shaw E&I Procedure No. EIG-HS-800 shall result in disciplinary action up to and including driving privilege revocation or removal of an affected non-Shaw employee from a project site. If the duties of your employees are expected to include driving a Shaw owned, leased, or rented vehicle, please complete Attachment 7, for all of your affected personnel, and provide these to Shaw's site management. Alternatively, please be aware and make your employees aware that they are not authorized to drive a Shaw owned, leased, or rented vehicle without such compliance.

By signing this document, I, an authorized employee and agent of the subject company/employer, am acknowledging acceptance of the above information and agree to my employer's compliance with the referenced requirements stated herein.

_____ _____

Signature / Title *Date*

Attachment D-3

Medical Clearance for Key Project Safety Personnel

Physician's Written Opinion

HAZWOPER & RESPIRATOR CLEARANCE

Periodic Field Exposure Exam

Name: Jeffrey Tarr	Date: 2.29.12	Social Security Number: XXX-XX-5452

On this date, CORE Health Networks has reviewed the above employee's recent medical examination and associated medical tests in accordance to OSHA 1910.120 pertaining to workers exposed to hazardous wastes and make the following statements:

1. Are there any detected medical conditions that would place the employee at increased risk of material impairment of the employee's health while working in the above job position?
   [ ]Yes [X]No

2. Are there any recommended limitations upon the employee's assigned work?
   [ ]Yes [X]No

3. Has the employee been informed of the examination results?
   [X]Yes [ ]No

MEDICAL RECOMMENDATIONS FOR RESPIRATOR USE

On this date, CORE Health Networks has examined the above employee according to OSHA 1910.134 Federal Regulation pertaining to respiratory protection and make the following statements:

[X] No limitations have been placed on use of a respirator
[ ] Medically not able to wear a respirator
[ ] May wear a respirator for escape only
[ ] These limitations have been placed on the use of a respirator
[X] A copy of this document has been provided to the employee
[ ] A follow-up evaluation is to be scheduled on
_____

William J. Nassetta, MD, MPH

3.1.2012
Date

_____
Employee Signature

_____
Supervisor Signature

Physician's Written Opinion

HAZWOPER & RESPIRATOR CLEARANCE

Periodic Field Labor Fit for Duty UXO Exam

Name: William Wren	Date: 4.20.11	Social Security Number: XXX-XX-6090

On this date, CORE Health Networks has reviewed the above employee's recent medical examination and associated medical tests in accordance to OSHA 1910.120 pertaining to workers exposed to hazardous wastes and make the following statements:

1. Are there any detected medical conditions that would place the employee at increased risk of material impairment of the employee's health while working in the above job position?
   [ ]Yes [X]No

2. Are there any recommended limitations upon the employee's assigned work?
   [ ]Yes [X]No

3. Has the employee been informed of the examination results?
   [X]Yes [ ]No

MEDICAL RECOMMENDATIONS FOR RESPIRATOR USE

On this date, CORE Health Networks has examined the above employee according to OSHA 1910.134 Federal Regulation pertaining to respiratory protection and make the following statements:

[X] No limitations have been placed on use of a respirator
[ ] Medically not able to wear a respirator
[ ] May wear a respirator for escape only
[ ] These limitations have been placed on the use of a respirator
_____
[ ] A copy of this document has been provided to the employee
[ ] A follow-up evaluation is to be scheduled on
_____

_____ 4.21.11
William J. Nassetta, MD, MPH Date

Employer signature Employee signature

Physician's Written Opinion

HAZWOPER & RESPIRATOR CLEARANCE

Periodic Field Labor Fit for Duty Exam

Name: David Coe	Date: 2.9.12	Social Security Number: XXX-XX-8924

On this date, CORE Health Networks has reviewed the above employee's recent medical examination and associated medical tests in accordance to OSHA 1910.120 pertaining to workers exposed to hazardous wastes and make the following statements:

1. Are there any detected medical conditions that would place the employee at increased risk of material impairment of the employee's health while working in the above job position?
   [ ]Yes [X]No

2. Are there any recommended limitations upon the employee's assigned work?
   [ ]Yes [X]No

3. Has the employee been informed of the examination results?
   [X]Yes [ ]No

MEDICAL RECOMMENDATIONS FOR RESPIRATOR USE

On this date, CORE Health Networks has examined the above employee according to OSHA 1910.134 Federal Regulation pertaining to respiratory protection and make the following statements:

[ ] No limitations have been placed on use of a respirator
[ ] Medically not able to wear a respirator
[X] May wear a respirator for escape only
[ ] These limitations have been placed on the use of a respirator
_____
[ ] A copy of this document has been provided to the employee
[ ] A follow-up evaluation is to be scheduled on
_____

William J. Nassetta, MD, MPH

2.13.12
Date

_____
Employee Signature

_____
Supervisor Signature

Attachment D-4

Radiation Protection Plan for Use of X-Ray Fluorescence

(Reserved for Shaw-required RPP if XRF is to be used on site)

Attachment D-5

Site Safety and Health Plan

Attachment D-5
Site Safety and Health Plan
MEC Clearance at Open Detonation (OD) Grounds Seneca Army Depot Activity

Prepared for U.S. Army Engineering and Support Center
4820 University Square
Huntsville, Alabama 35816-1822

Prepared by Shaw Environmental & Infrastructure, Inc.
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Date

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Appendix 1 Activity Hazard Analysis

Acronyms and Abbreviations

°C	degrees Centigrade
°F	degrees Fahrenheit
ACGIH	American Conference of Government Industrial Hygienists
AEL	airborne exposure limit
AHA	Activity Hazard Analysis
ANSI/ISEA	American National Standards Institute/Industrial Safety Equipment Association
APP	Accident Prevention Plan
CAMP	Community Air Monitoring Plan
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
CPR	cardiopulmonary resuscitation
CRZ	contamination reduction zone
DA	U.S. Department of the Army
dBA	decibels, A-scale
DDESB	Department of Defense Explosives Safety Board
DEET	N,N-Diethyl-meta-Toluamide
DOD	Department of Defense
EM	engineering manual
EMR	electromagnetic radiation
EMT	emergency medical technician
ENG	engineer
EZ	exclusion zone
F-B	flash to bang
ft	foot or feet
H&S	Health and Safety
HAZWOPER	Hazardous Waste Operations and Emergency Response
HSM	Health and Safety Manager
HTRW	Hazardous, Toxic, and Radioactive Waste
ICAM	Improved Chemical Agent Monitor
ID	identification
IDLH	immediately dangerous to life or health
MEC	munitions of explosive concern
mg/kg	milligrams per kilogram
MPPEH	material potentially presenting an explosive hazard
MRS	munitions response site

Acronyms and Abbreviations *(continued)*

MSDS	Material Safety Data Sheet
NIOSH	National Institute of Occupational Safety and Health
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OB	open burn
OD	open detonation
OESS	Ordnance and Explosives Safety Specialist
OSHA	Occupational Safety and Health Administration
PEL	permissible exposure limit
PM	Project Manager
PPE	personal protective equipment
PZ	piezoelectric
SEDA	Seneca Army Depot Activity
SM	Site Manager
SOP	standard operating procedure
SSHO	Site Safety Health Officer
SSHP	Site Safety and Health Plan
STEL	short-term exposure limit
SUXOS	Senior Unexploded Ordnance Supervisor
SZ	support zone
TLV	threshold limit value
TP	technical publication
TWA	time-weighted average
USAESCH	United States Army Engineering Support Center, Huntsville
UXO	unexploded ordnance
UXOSO	Unexploded Ordnance Safety Officer
VOC	volatile organic compound
WNV	West Nile Virus
WP	white phosphorus

1.0 SITE DESCRIPTION AND CONTAMINATION CHARACTERIZATION

1.1 Site Description

A description of Seneca Army Depot Activity including location, history, former investigations, topography, and climate is provided in Section 1 of the APP and Work Plan.

1.2 Contamination Characterization

1.2.1 OD Grounds

1.2.1.0.0. The OD Grounds is located in the northwestern corner of SEDA and is designated SEDA-45. The OD Grounds, together with the Open Burning (OB) Grounds, comprise the 365-acre demolition area at SEDA. The OB Grounds were previously closed with the exception of one burn tray. One burn tray was left operational so it could be used for MEC demolition, if needed as part of the remediation of the OD Grounds. The remainder of the OB Grounds has been closed and is therefore not part of this scope of work. This scope of work includes a circular area formed by a 1,000-foot (ft) radius (approximately 72 acres) from the center of the OD Hill and closure of the Open Burning Tray.

1.2.1.0.1. Based on the Parsons Site Investigation Report the potential contaminants of potential concern at the OD Grounds consist of low level metals in soil. The maximum detections were: copper 7,310 milligrams per kilogram (mg/kg); vanadium 41.9 mg/kg; cadmium 1,100 mg/kg; mercury 9.1 mg/kg; and silver 205 mg/kg. Other metals identified were not considered contaminants of concern based on New York State unrestricted use soil cleanup objective levels. It is extremely unlikely personnel performing the OD Grounds remedial actions will be exposed to metals or explosives above regulatory occupational exposure limits. Conservative exposure levels for particulates are addressed in Section 8, Exposure Air Monitoring and Air Sampling Program.

1.2.2 Open Burn Tray

The Open Burning Tray is located within the OB Grounds (SEDA-23) in the northwestern portion of SEDA, approximately 3.5 miles northwest of SEDA's main entry gate off New York State Highway Route 96. The Open Burning Tray falls within the 1,000-ft radius covered within this scope of work. Based on the history of materials destroyed in the Burn Tray, metals are the primary contaminants of potential concern.

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2.0 HAZARD AND RISK ANALYSIS

2.1 Introduction

2.1.0.0. Personnel and visitors will be made familiar with site hazards and will strictly adhere to the appropriate safety procedures prescribed in this Site Safety and Health Plan (SSHP) including the Activity Hazard Analysis (AHA) presented in **Appendix 1**. The AHA identifies potential safety, health, biological, chemical and environmental hazards associated with specific tasks, and provides for the protection of personnel, the public, and the environment. In the event new tasks are required, additional AHAs will be developed for review and added to this SSHP.

2.1.0.1. Because of the complexity and constant change of activities associated with MEC clearance and remediation, the site must be continually inspected to identify new hazards. Changes to the AHA may be originated by the Unexploded Ordnance Safety Officer (UXOSO) but must be approved by the Health and Safety Manager (HSM), Senior Unexploded Ordnance Supervisor (SUXOS), and the USACE Ordnance and Explosives Safety Specialist (OESS). Shaw procedure HS045, Job Safety Analysis, can also be utilized to document mitigation of hazards and appropriate control measures.

2.2 Classic Safety Hazards

2.2.1 Slip, Trip, and Fall Hazards

2.2.1.0.0. Work areas may contain slip, trip, and fall hazards for workers, such as:

a. Holes, pits, cisterns or ditches;

b. Slippery surfaces;

c. Sloped and uneven surfaces;

d. Objects such as nails, metal shards, and broken glass or remnant branches and vegetative debris; or,

e. Weather conditions such as rain can make surfaces slippery and obscure visibility.

2.2.1.0.1. Site personnel will be instructed to look for these potential safety hazards and immediately inform the UXOSO or the Site Manager (SM) about any new hazards. If the hazard cannot be immediately removed, action must be taken to warn site workers about the hazard. Proper housekeeping must be maintained on site, particularly adjacent to office trailers. Small holes and pits along high foot traffic areas should be covered or barricaded to prevent injury.

2.2.2 Motor Vehicles and Heavy Equipment Operations

2.2.2.0.0. Working with motor vehicles and heavy equipment can produce significant hazards. Injuries can result from equipment hitting or running over personnel, or vehicles overturning. Vehicle and heavy equipment design and operation will be according to 29 Code of Federal Regulations (CFR) Subpart O, 1926.600 through 1926.602. The types of heavy equipment anticipated to be used on site include a backhoe, a grader, dump trucks, pick-up trucks, a soil screening unit, a loader and utility trailers.

2.2.2.0.1. Procedures for mitigation and prevention of hazards associated with motor vehicles are contained in Shaw Health and Safety (H&S) procedure EIG-HS-800, Motor Vehicle Operation. Procedures for earth moving machinery hazard mitigation are provided in the AHAs.

2.2.3 Trenching and Excavation

2.2.3.0.0. When excavations can occur greater than 4 ft deep, potential hazards include:

a. Excavation collapse;

b. Items falling or rolling into the excavation;

c. Potential confined space; and,

d. Personnel falling into the excavation.

2.2.3.0.1. All excavation and trenching will follow Shaw H&S procedure EIG-HS-307, Excavation and Trenching. Prior to employees entering excavations, the UXOSO or another excavation competent person shall verify that conditions for entry are safe.

2.2.4 Anomaly Excavation and MD Removal

2.2.4.0.0. Selected anomalies identified through geophysical data collection and processing will be intrusively investigated and removed. A small backhoe may be used if hand digging is difficult or the anomaly is at a depth where hand digging is not feasible.

2.2.4.0.1. When a backhoe is used, a safety radius will be established by extending boom/bucket to its full length and visibly marking the area. Standard hand and arm signals will be used to communicate between the operator and the unexploded ordnance (UXO) technician spotter. Machinery will be operated only by qualified personnel, in accordance with manufacturers' instructions and recommendations, and in a manner that will not endanger persons or property or the environment.

2.2.4.0.2. The hazards associated with the operation of heavy equipment are injuries to personnel, equipment damage, and property damage. The potential for injury or damage to

occur is typically associated with operator experience, the size of the equipment, limited visibility of the operator, and potential underground and overhead hazards. All personnel who are exposed to vehicle or equipment traffic shall wear ANSI Class III high-visibility apparel.

2.2.4.0.3. All heavy equipment will be used in the manner it was intended. Drivers will operate all equipment in accordance with the manufacturer instructions and within safe operating parameters as defined by the manufacturer.

2.2.4.0.4. Ground personnel should always make eye contact and wait for a signal to proceed before passing close to or in front of operating equipment or moving vehicles. When ground personnel are working in the vicinity of heavy equipment, they should inform the operator of their presence.

2.2.4.0.5. All drivers and operators will be expected to obey the speed limits, signs, and road markings. Use of cellular phones when on company time while driving or operating heavy equipment is prohibited.

2.2.4.0.6. All heavy equipment will carry a multipurpose dry chemical fire extinguisher.

2.2.5 Hazardous Energy Control

2.2.5.0.0. It is crucial to be aware of hazardous energy to prevent accidents. Stored energy associated with heavy equipment hydraulics can be released during servicing or maintenance. Accidents can occur when hazardous energy sources are not evaluated. Accidents also occur when equipment is not properly isolated, shut down, and/or de-energized.

2.2.5.0.1. Lock out/tag out activities shall follow Shaw H&S procedure EIG-HS-315, Control of Hazardous Energy and Hazardous Material Sources.

2.2.6 Underground Utilities Hazards

Although buried utilities are unlikely in most potential work areas, the statewide utility location service will be contacted (Call Before You Dig One Call 811). Prior to commencing any intrusive activities, the Site Manager must obtain a digging clearance as appropriate and document the assessment in accordance with EIG-HS-308. If the local utility service cannot access all areas of the site where utilities may be located, geophysical instruments and utility locators will be used to survey for buried utilities.

2.3 MEC And Explosives

2.3.0.0. Munitions of explosive concern (MEC) are categories of military munitions that may pose unique explosives safety risks, including UXO, discarded military munitions, or munitions constituents present in high enough concentrations to pose an explosive hazard. MEC activities will be conducted in accordance with the general guidance contained in EM 385-1-97 and DOD 6055.09M. There is a high possibility of encountering UXO during the clearance and remediation activity. Table 1-1 and 1-2 in the Work Plan identify UXO that was encountered during previous site inspections/investigations. There are also hazards associated with explosives used for UXO demolition operations.

2.3.0.1. All site personnel will be given ordnance familiarity training prior to working on site. Personnel should be alert for UXO and munitions debris. The following general precautions concerning ordnance will be observed at all times:

a. DO NOT touch or move any ordnance items, regardless of the markings or apparent condition, until a complete assessment has been made by the SUXOS and UXOSO.

b. DO NOT use radios or cellular phones near suspect ordnance items until fuzing can be examined.

c. DO NOT walk across an area where the ground cannot be seen.

d. DO NOT drive vehicles into a suspected MEC area; use clearly marked lanes.

e. DO NOT carry matches, cigarettes, lighters, or other flame-producing devices into the primary work area.

f. DO NOT rely on color code for positive identification of ordnance items or their contents.

g. Approach ordnance items from the side; avoid approaching the front or rear.

h. Always assume ordnance items contain a live charge until it can be ascertained otherwise.

2.3.0.2. The following actions will be taken when ordnance is found:

a. Personnel who are not UXO-qualified should leave the immediate vicinity and clearly mark the location from a safe distance. DO NOT touch, move, or otherwise disturb the item.

b. Notify the SUXOS and UXOSO when UXO or suspicious material is encountered.

c. Do not be misled by markings on the ordnance item stating practice bomb or inert. Even practice bombs have explosive charges that are used to mark/spot the point of impact; or the item could be mismarked.

d. U.S. Department of Defense and Shaw policy limits the exposure to ammunition and explosives (i.e., MEC), to the minimum number of persons, for the minimum amount of time necessary, consistent with safe and efficient operations.

e. Tasks not necessary to the operation will be prohibited within the immediate area of the hazard produced by the operation.

f. By their nature, MEC procedures are hazardous and certain calculated risks will be taken. Ingenuity, judgment, common sense, and above all, the mastery of UXO techniques and observance of UXO safety principles will be used at all times. Technicians will be alert at all times and be in observance of UXO safety precautions.

g. Only UXO-qualified personnel will perform MEC procedures. A UXO Technician I may assist in the performance of MEC procedures when under the supervision of a UXO Technician III or higher.

h. Prior to any action being performed on material potentially presenting an explosive hazard (MPPEH), every effort will be made to identify the item. Two UXO technicians will positively identify MEC items, independently. All fuzing will be definitively identified, if it is possible to safely do so without disturbing the ordnance item. This identification will consist of fuze type by function and condition (armed or unarmed) and the physical state/condition of the fuze (i.e., burned, broken, parts exposed/sheared, etc.). Under no circumstances will any MEC item be moved to make a positive identification. If an unknown MEC is found, the USACE OESS will be notified immediately.

i. While working on site, all personnel will use the "buddy" system.

j. MEC operations will be conducted only during daylight hours.

k. UXO are the most dangerous military munitions that may be encountered. All military munitions, regardless of their appearance or condition, will be considered dangerous and managed as UXO until assessed otherwise by a UXO-qualified individual. Military munitions that have experienced abnormal environments, such as demilitarization by open burning, open detonation, accidents, fires, or where components have been armed, are very unstable.

l. Avoid approaching the forward area of a military munition until it can be determined whether or not the item contains a shaped charge. The explosive jet, which is formed during detonation, can be lethal at great distances. Assume that all shaped-charge munitions contain a piezoelectric (PZ) fuzing system until investigation proves

otherwise. PZ fuzing systems are extremely sensitive, can function at the slightest physical change, and can remain hazardous for an indefinite period of time. In some cases, merely casting a shadow across a PZ fuze can cause it to detonate.

m. Observe electromagnetic radiation (EMR) precautions in accordance with DA Pamphlet 385-64.

n. It is preferable to move all UXO that has been determined to be safe to move to a consolidated detonation area. Items not safe to move will be blown in-place.

o. Take care not to kick or tread on MPPEH when walking.

p. Avoid impacting, jarring, or striking MPPEH.

q. Do not subject UXO to shock, rough handling, heat, or any other force.

r. Assume that a practice military munition contains a live charge until investigation proves otherwise.

s. Expended pyrotechnic and practice devices can contain red or white phosphorus (WP) residue. Due to incomplete combustion, this residue may re-ignite spontaneously if the crust is broken and exposed to air.

t. Do not approach a smoking WP munition. Burning WP may detonate the explosive burster charge at any time.

u. Projectiles containing base-detonating fuzes are to be considered armed if the round has been fired.

v. Arming wires and pop out pins on unarmed fuzes should be secured prior to moving military munitions.

w. Do not depress plungers, turn vanes, or rotate spindles, levers, setting rings, or other external fittings on military munitions. Such actions may arm or activate the items.

x. Do not attempt to remove any fuze(s) from military munitions.

y. Do not dismantle or strip components from any military munitions.

z. Military munitions will not be taken from the project property as souvenirs/training aids.

aa. While MEC procedures are being conducted, only personnel essential for the operation and authorized visitors will be allowed to enter an exclusion zone (EZ). If nonessential personnel enter the EZ, all MEC procedures will cease.

bb. All operations will be suspended immediately upon approach of an electrical storm.

cc. Use appropriate precautions and grounding procedures, recognizing hazards of EMR when working with or on electrically initiated or susceptible MEC.

dd. Avoid inhalation and skin contact with smoke, fumes, dust, vapors during detonation of MEC or burning of incendiaries.

ee. Do not attempt to extinguish any fire that might involve explosive materials.

ff. Incorporate appropriate property and personnel protective measures for shock and fragmentation when conducting MEC operations.

gg. In the event that MEC items must be transported, transport MEC items in the appropriate container and orientation to provide maximum protection for the personnel operating the vehicle. Hand-carry no more than two items (one in each hand) at a time and then only as required by the operation being performed.

2.4 Chemical Hazards

2.4.0.0. **Table D5-2.1** lists potential contaminants that may be present at the MRSs and the potential routes of exposure and symptoms for each contaminant that may be encountered. Other information such as Threshold Limit Values (TLVs), Permissible Exposure Limits (PELs), Immediately Dangerous to Life or Health (IDLH) values and health effects are also included.

2.4.0.1. Site workers will implement the following actions to reduce or prevent exposure to potential contaminants:

a. Personnel will wear PPE appropriate to the potential chemical hazard as outlined in Section 5.0, Personal Protective Equipment.

b. Personnel will position themselves upwind of intrusive operations whenever possible.

c. Dust suppression will be utilized to mitigate fugitive emissions during soil handling activities.

d. Employees will follow proper hygiene procedures.

e. Air monitoring for dust, particulate and aerosols will be performed during soil handling activities and intrusive operations.

f. Appropriate decontamination procedures shall be followed.

g. The site will be separated into standard control zones to mitigate cross contamination of contaminants of concern.

h. Smoking, eating and drinking will only be permitted in the support zone.

i. All crew personnel on site shall use the buddy system (working in pairs or teams). If noise levels impair communications, then prearranged hand signals shall be used for

communication. Visual contact shall be maintained between crew members at all times. Indications of adverse effects include, but are not limited to:

- Changes in complexion and skin coloration;
- Changes in coordination;
- Changes in demeanor; and,
- Changes in speech pattern.

j. Employees shall inform their partners or fellow team members of nonvisible effects of overexposure to toxic materials. The symptoms of such overexposure may include:

- Headaches;
- Dizziness;
- Nausea;
- Blurred vision;
- Cramps; and,
- Irritation of eyes, skin, or respiratory tract.

k. As practical, personnel should practice contamination avoidance. All solid and liquid samples should be collected in such a manner as to minimize contact with the material.

Table D5-2.1
Toxicological and Physical Effects of Chemicals

Substance [CAS]	IP[a] (eV)	Odor Threshold (ppm)	Route[b]	Symptoms of Exposure	Treatment	TWA[c]	STEL[d]	Source[e]	IDLH (NIOSH)[f]
Copper [7440-50-8]	NA	NA	Inh Ing Con	Irritating to eyes, nose, pharynx; nasal perforation; metallic taste, dermatitis in animals; lung, liver and kidney damage	Eye: Irrigate immediately Skin: Soap wash promptly Breath: Respiratory support Swallow: Immediate medical attention.	1 mg/m^3 1 mg/m^3 1 mg/m^3		PEL TLV REL	100 mg/m^3 (as Cu)
Cadmium [7440-43-9]	NA	NA	Inh Ing	Pulmonary edema, dyspnea, cough, chest tightness, substernal pain, headache, chills, muscle aches, nausea, vomiting, diarrhea, loss of sense of smell, emphysema, proteinuria, mild anemia; [carcinogenic]	Eye: Irrigate immediately Skin: Soap wash promptly Breath: Respiratory support Swallow: Immediate medical attention	1 ppm 0.01 ppm 0.1 ppm	5 ppm 2.5 ppm 1 ppm	PEL TLV REL	Ca [9 mg/m^3]
Fuel oil (diesel oil, medium) [68476-30-2]	Unknown	Unknown	Ing Inh Con	Ingestion causes nausea, vomiting, and cramps; depressed central nervous system, headache, coma, death; pulmonary irritation; kidney and liver damage; aspiration causes severe lung irritation, coughing, gagging, dyspnea, substernal stress, pulmonary edema; bronchopneumonia; excited, then depressed, central nervous system.	Eye: Irrigate promptly Skin: Soap wash Breath: Respiratory support Swallow: Immediate medical attention Aspiration: Immediate medical attention	-- 100 mg/m^3 --	-- -- --	PEL TLV REL	--

Substance [CAS]	IP[a] (eV)	Odor Threshold (ppm)	Route[b]	Symptoms of Exposure	Treatment	TWA[c]	STEL[d]	Source[e]	IDLH (NIOSH)[f]
Silver (metal dust and soluble compounds, as Ag) 7440-22-4	NA	NA	Inh Ing Con	Blue-gray eyes, nasal septum, throat, skin; irritation, ulceration skin; gastrointestinal disturbance	Eye: Irrigate immediately (15 min) Skin: Soap wash promptly Breath: Respiratory support Swallow: Immediate medical attention	0.01mg/m^3 0.01mg/m^3		PEL TLV REL	10 mg/m^3
Gasoline [8006-61-9]	Unknown	Unknown	Inh Ing Con	Intoxication, headaches, blurred vision, dizziness, nausea; eye, nose throat irritation; potential kidney and other cancers. Carcinogenic.	Eye: Irrigate immediately (15 min) Skin: Soap wash promptly Breath: Respiratory support Swallow: Immediate medical attention	-- 300 ppm Ca, lowest feasible conc. (LOQ 15 ppm)	-- 500 ppm --	PEL TLV REL	Ca 1,400 ppm [10% LEL]
Lead [7439-92-1]	NA	NA	Inh Ing Con	Weak, insomnia, facial pallor, constipated, abdominal pain, colic, anemia, irritated eyes, paralysis of wrists and ankles, encephalopathy.	Eye: Irrigate immediately Skin: Soap wash promptly Breath: Respiratory support Swallow: Immediate medical attention	0.05 mg/m 0.05 mg/m <0.1 mg/m	-- -- --	PEL TLV REL	100 mg/m
Mercury [7439-97-6]	NA	NA	Inh Abs Ing Con	Irritation of eyes, skin; dizziness, chest pain, bronchitis nausea, Tremor, pneumonitis fatigue; indecision, headache, weakness, GI disorders	Eye: Irrigate immediately Skin: Water flush Breath: Respiratory support Swallow: Immediate medical attention	0.01 mg/m^3 0.025 mg/m^3 0.01 mg/m^3	0.1 mg/m^3 0.1 mg/m^3	PEL TLV REL	2 mg/m^3
Vanadium [1314-62-1]	NA	NA	Inh Ing Con	Irritating to eyes, skin and throat; green tongue, metallic taste, eczema; cough; fine rales, wheezing, bronchitis, dyspnea	Eye: Irrigate immediately Skin: Soap wash promptly Breath: Respiratory support Swallow: Immediate medical attention		C 0.05 mg V_2O_5/m^3	TLV PEL REL	35 mg/m^3

Substance [CAS]	IP[a] (eV)	Odor Threshold (ppm)	Route[b]	Symptoms of Exposure	Treatment	TWA[c]	STEL[d]	Source[e]	IDLH (NIOSH)[f]
Motor Oil [NA]	Unknown	Unknown	Inh Ing	Irritated eyes, skin, respiratory system; usually only a problem if misted or ingested.	Eye: Irrigate immediately (15 min) Skin: Soap wash immediately Swallow: Immediate medical attention	-- -- --	500 ppm 500 ppm 500 ppm	PEL TLV REL	None
Nitric acid [7697-37-2]	11.95	0.3-1	Inh Ing Con	Irritated eyes, mucous membranes, and skin; delayed pulmonary edema, pneumonitis, bronchitis; dental erosion.	Eye: Irrigate immediately Skin: Water flush promptly Breath: Respiratory support Swallow: Immediate medical attention	2 ppm 2 ppm 2 ppm	-- 4 ppm 4 ppm	PEL TLV REL	25 ppm
Portland cement	NA	NA	Inh	Fine gray powder that can be irritating if inhaled or in eyes.	Eye: Irrigate immediately Skin: Soap wash immediately Breath: Respiratory support Swallow: Immediate medical attention	1 mg/m^3 10 mg/m^3/ total dust 5 mg/m^3 respirable fraction 50 mppcf	-- -- --	TLV REL PEL	5,000 mg/m^3

[a]IP = Ionization potential (electron volts).
[b]Route = Inh, Inhalation; Abs, Skin absorption; Ing, Ingestion; Con, Skin and/or eye contact.
[c]TWA = Time-weighted average. The TWA concentration for a normal work day (usually 8 or 10 hours) and a 40-hour work week, to which nearly all workers may be repeatedly exposed, day after day
without adverse effect.
[d]STEL = Short-term exposure limit. A 15-minute TWA exposure that should not be exceeded at any time during a workday, even if the TWA is not exceeded.
[e]PEL = Occupational Safety and Health Administration (OSHA) permissible exposure limit (29 CFR 1910.1000, Table Z).
AEL = Airborne Exposure Limit.
TLV = American Conference of Governmental Industrial Hygiene (ACGIH) threshold limit value-TWA.
REL = National Institute for Occupational Safety and Health (NIOSH) recommended exposure limit.
[f]IDLH (NIOSH) = Immediately dangerous to life or health (NIOSH). Represents the maximum concentration from which, in the event of respirator failure, one could escape within 30 minutes without a
respirator and without experiencing any escape-impairing or irreversible health effects.
NE = No evidence could be found for the existence of an IDLH (NIOSH Pocket Guide to Chemical Hazards, Pub. 2010).
C = Ceiling limit value which should not be exceeded at any time.
Ca = Carcinogen.
NA = Not applicable.
LEL = Lower explosive limits.
LC_{50} = Lethal concentration for 50 percent of population tested.
LD_{50} = Lethal dose for 50 percent of population tested.
NIC = Notice of intended change (ACGIH).

References:

American Conference of Governmental Industrial Hygienists Guide to Occupational Exposure Values, 2011, compiled by the American Conference of Governmental Industrial Hygienists.
Amoore, J. E. Hautula, "Odor as an Aid to Chemical Safety," Journal of Applied Toxicology, 1983.

2.5 Physical Hazards

2.5.1 Severe Weather

2.5.1.0.0. During the course of clearance and remediation operations, severe weather may be encountered, including thunderstorms, rainstorms, and other unsafe weather conditions (i.e., high winds and tornados). Criteria indicating that severe weather conditions may exist include:

a. High winds (greater than 40 miles per hour – depending on the tree cover and other site specific conditions);

b. Tornado watch or warning in place for an area including the site;

c. Visible lightning or audible thunder;

d. Extreme temperatures (e.g., greater than 100 degrees or less than 0 degrees Fahrenheit [°F]);

e. Heavy rainfall that can create poor ground conditions and make visibility difficult; or,

f. Muddy or soft ground that can affect medical support and emergency vehicles.

2.5.1.0.1. The UXOSO is solely responsible for deciding if field activities should cease due to severe weather. The OESS will be consulted prior to the cessation of operations.

2.5.1.0.2. If work is suspended, the UXOSO will notify field team leaders who have radios or cellular telephones. These individuals will be responsible for relaying the work suspension to other personnel in their areas. All personnel will render the work place temporarily closed and move to designated assembly areas in the support zone (SZ) for further instruction.

2.5.1.0.3. Once the severe weather hazard has passed, the UXOSO in consultation with the SUXOS and SM will notify personnel that work may resume. The UXOSO will monitor weather forecasts and reports of current weather conditions both before and during field activities to determine if severe weather is forecast or imminent.

2.5.1.0.4. Inclement weather may also create conditions that restrict access due to muddy or soft ground condition. The Shaw UXOSO in conjunction with the SUXOS and SM will evaluate environmental conditions and take appropriate action for worker safety.

2.5.2 Hurricanes

2.5.2.0.0. Hurricane season extends from June through November. Although unlikely SEDA would be affected by hurricanes, the site personnel need to be aware of secondary

effects. Thunderstorms, with lightning, torrential rains and tornadoes, can accompany a hurricane. The main hazards associated with hurricanes are:

a. **High Winds** – Hurricane force winds can cause significant property damage. Airborne debris such as signs, roofing material, glass and small items left outside can become extremely hazardous. Extensive damage to trees, utilities and power lines are common;

b. **Inland Flooding** – While storm surge is always a potential threat, more people have died from inland flooding in the last 30 years. Intense rainfall is not directly related to the wind speed of tropical cyclones.

c. **Tornadoes** – Hurricanes can also produce tornadoes that add to the storm's destructive power. Tornadoes are most likely to occur in the right-front quadrant of the hurricane, but are often found embedded in the rain bands, well away from the center of the hurricane.

2.5.2.0.1. The National Weather Service issues two types of hurricane notifications:

a. **Hurricane Watch** – A watch is issued for an affected area that indicates the possibility that hurricane conditions may occur within 36 hours. This warning should trigger an established disaster plan and protective measures to be initiated; and

b. **Hurricane Warning** – A warning is issued for an affected area that indicates sustained winds of 74 miles per hour or higher will occur within 24 hours or less. Once this warning has been issued, the evacuation of all personnel to an approved shelter or safe location should commence.

2.5.2.0.2. During field work, a weather radio or smart phone application will be utilized to monitor for weather alerts. If a hurricane or tornado watch is issued, all work will cease and preparations will be made including moving equipment to shelter and securing loose articles.

2.5.2.0.3. In the event that a hurricane is projected to impact the location of the jobsite, several advance measures will be taken. If the hurricane's projected path is forecasted to move through the area within 72 hours, the site and all equipment will be secured. If the hurricane's projected path is forecasted to move through the area within 24 hours, personnel will be demobilized if time allows. If there is no time for demobilization, personnel will evacuate to a designated shelter or safe room in hotels.

2.5.3 Lightning

2.5.3.0.0. Lightning's distance from you can be estimated noting the time from its flash to the bang of associated thunder. For each five-second count from flash to bang (F-B),

lightning is one mile away. Thus, an F-B of 10 means that lightning is 2 miles away and an F-B of 15 means that lightning is 3 miles away, and so on. Because the distance from Strike A to Strike B to Strike C can be 0.5 to 1.5 miles apart, the lightning safety evacuation plan will be implemented at a count of 30 (7 miles), or as soon as lightning is observed or thunder is heard. This is commonly referred to as the 30/30 rule.

2.5.3.0.1. If a lightning storm is expected or observed, all outdoor site activities must cease. Personnel should seek shelter indoors. A safe shelter may consist of:

a. Fully enclosed metal vehicles with windows up;

b. Enclosed buildings; or,

a. Low ground away from trees.

2.5.3.0.2. Unsafe shelter areas include all nearby outdoor metallic objects such as flag poles, fences, high mast light poles, gates, etc. Avoid trees, water, open fields, and avoid using the telephone.

2.5.3.0.3. Feeling one's hair standing on end and/or hearing "crackling noises" are signs of being in lightning's electric field. Individuals experiencing these signs will immediately remove objects containing metal or metal parts (including baseball caps), place their feet together, duck their head, and crouch down with their hands on their knees. A waiting period of at least 15 minutes from the last nearby lightning strike will be observed before resuming activities.

2.5.3.0.4. People who have been struck by lightning do not carry an electrical charge in their bodies and are safe to handle. Cardiopulmonary resuscitation (CPR) will be performed immediately on victims of a lightning strike by someone qualified to do so. Additionally, emergency help will be immediately sought. Shaw H&S procedure EIG-HS-014, Severe Weather Policies and Procedures, shall be followed.

2.5.4 Hazardous Noise

2.5.4.0.0. Planned activities will involve the use of heavy equipment, such as excavation and screening equipment. The unprotected exposure of site workers to this noise during activities can result in noise-induced hearing loss.

2.5.4.0.1. Shaw personnel working on this project will participate in a Hearing Conservation Program in accordance with Shaw H&S procedure EIG-HS-402, Hearing Conservation Program. The HSM or UXOSO will verify these requirements have been met for each Shaw site worker. The UXOSO will ensure that ear protection such as disposable earplugs, are made available and used by all personnel near operating heavy equipment or

other sources of high intensity noise. Hearing protection is required any time the noise level reaches 85 decibels, A-scale (dBA) or greater. This will be confirmed by taking sound level measurements with a calibrated sound pressure meter when all equipment is mobilized to the site. Hearing protection will be required for equipment and personnel working in close proximity to screening operations.

2.5.5 Heat Stress

A discussion of heat stress symptoms and heat stress mitigation and prevention is provided in Section 10 of the Accident Prevention Plan (APP).

2.5.6 Cold Stress

A discussion of cold stress symptoms and cold stress mitigation and prevention are provided in Section 10 of the APP.

2.6 Ionizing Radiation

It is unlikely workers will be exposed to levels of ionizing radiation that require special precautions or monitoring devices.

2.7 Biological Hazards

2.7.1 Snakes

2.7.1.0.0. There are 17 species of snakes common to New York. Three types are venomous snakes but rarely seen. Venomous snakes include the copperhead, pygmy rattler and timber rattlesnake. The degree of toxicity resulting from snake bites depends on the potency of the venom, the amount of venom injected, and the size of the person bitten. Poisoning may occur from injection or absorption of venom through cuts or scratches. About 8,000 people are bitten by venomous snakes a year in the United States; however, only 5-10 people die. In contrast, 15,000 to 20,000 die every year from the side effects of aspirin. Venomous snake bites are medical emergencies and they can be deadly if not treated quickly. However, the chances of being envenomed are extremely low. Getting the victim to an emergency room as soon as possible is the very best treatment.

2.7.1.0.1. All three venomous snake species (copperhead, pygmy rattler and timber rattlesnake) are pit vipers. The "pit" in pit-viper refers to the heating sensing pit located between the eye and the nostrils on the snake's head. In addition to the heat sensing pit, all three venomous snakes have vertical pupils. All harmless snakes have round pupils and lack the heat sensing pits. Another characteristic of venomous snakes is the single row of scales on the underside of the tail after the anal plate (vent). While close inspection of a snake's face and/or its tail is a definitive way to distinguish a venomous snake from a harmless species, it requires one to get dangerously close to a potently dangerous animal. It is far

better to learn the pattern and coloration of a few snakes so that a specimen may be identified from a safe distance.

2.7.1.0.2. The most effective way to prevent snake bites is to avoid snakes in the first place. To minimize the threat of snake bites, all personnel will be aware of the potential for encountering snakes and will avoid actions that increase the likelihood of encounters (e.g., turning over logs). Personnel should avoid walking at night or in high grass and underbrush. Visual inspection of work areas should be performed prior to activities taking place. The use of leather boots and long pants will be required since more than half of all bites are on the lower part of the leg. Use of snake chaps is also recommended when working in areas where it is difficult to see the ground terrain due to dense vegetation. No attempt at killing snakes should be made; many people are bitten in such an attempt. Long handled shovels should be used to manipulate debris that can harbor snakes.

2.7.1.0.3. If someone is bitten by a potentially poisonous snake, treatment should be initiated:

a. Keep the patient calm.

b. Notify emergency medical services.

c. Mark the place of the bite and write the time of the bite on the person with a marker.

d. Wash the wound and keep the affected body part still, if time permits. Wear nitrile or non-latex rubber gloves when rendering first aid to minimize potential contact with venom and bodily fluid.

e. Follow Universal Precautions as outlined in Shaw Procedure EIG-HS-512, Handling of Blood or Other Potentially Infectious Material.

f. Apply direct pressure to the site of the bite if bleeding is extreme.

g. Keep the affected area lower than the heart when possible.

h. Carry or have him/her walk slowly to the nearest vehicle and immediately transport to the nearest medical facility or hospital.

2.7.2 Black Bear

2.7.2.0.0. The black bear is New York's second largest land mammal; only the moose is larger. An average adult male weighs about 300 pounds while females average about 170 pounds. The largest bear reported from New York weighed approximately 750 pounds. Black bears are omnivorous, eating grasses, berries, fruit, nuts, seeds, insects, grubs, and carrion, as well as human sources of food like corn, honey, bird seed, trash, and pet food when available.

2.7.2.0.1. Once thought to inhabit only large forests, over the past two decades, black bears have been expanding their range throughout New York and can now be found in a variety of habitats including developed areas. As recently as the mid-1990s, black bears occupied three relatively distinct ranges: Adirondack, Catskill, and Allegany. Currently, bears occupy habitat across the Southern Tier and it is now more appropriate to refer to Northern and Southern Bear Ranges. New York's 6,000-7,000 black bears are great travelers and occasionally pass through virtually every upstate county of the state. Points to note about bears are as follows:

a. Bears are Curious - They spend a great deal of time exploring for food, and this can bring them close to humans.

b. Bears are Intelligent - Bears learn from experience. If an activity results in food, they will repeat that activity. If an encounter with a human is negative, they learn to avoid humans. Also if an encounter with a human doesn't result in a reward (food), they will not have any reason to have contact with humans.

c. Feeding Bears Creates "Bad" Bears - When bears learn to obtain food from humans, they can become bold and aggressive.

d. Feeding Bears is Bad for Bears - Bear's natural foraging habits and behavior can be changed. Usually solitary, bears can be concentrated in areas causing stress, injuries from physical conflicts, and the spread of diseases. Often when feeding on garbage or camper's supplies, bears will eat unhealthy materials such as soap, shaving cream, insect repellant, food packaging, etc.

2.7.2.0.2. Never deliberately feed bears and avoid unintentionally feeding bears. If you avoid attracting and rewarding bears, you, your property and the bears will all benefit.

2.7.3 Insect and Arachnid Bites and Stings

2.7.3.0.0. Poisonous insects and insect-like creatures that may be encountered include the following:

a. Spiders;

b. Bees (honeybees, bumble bees, wasps, and hornets);

c. Chiggers; and,

d. Ticks.

2.7.3.0.1. If insect bites become red or inflamed, or if symptoms such as nausea, dizziness, shortness of breath, etc., appear, medical care will be sought. Immediate care is needed if a person is allergic to insect bites/stings. Personnel with insect sting allergies

should inform the SM, SUXOS and UXOSO. Personnel who have significant reactions from insect stings should carry appropriate medication prescribed by their physician. If an allergic person receives a spider bite or insect bite/sting, seek immediate medical attention, keep the victim calm, and check vital signs frequently. Rescue breathing should be given if necessary to supply oxygen to the victim.

2.7.3.1 Spiders

2.7.3.1.0.0. The two poisonous spiders likely to be encountered are the Brown Recluse and the Black Widow, shown on **Figure D5-2.1**. The Brown Recluse is up to one inch long with a violin or "fiddle" shaped mark on the top of the head. The Black Widow is a smaller, bulbous black spider with a red hourglass-shaped mark on the underside.

2.7.3.1.0.1. Workers involved in brush clearing, surveying, and other similar activities should avoid spiders and webs.

2.7.3.1.0.2. Persons who are believed to have been bitten by a Brown Recluse or Black Widow spider should be immediately transported to the occupational clinic or hospital. The spider should be collected (if possible) for confirmation of the species. Reactions to a Brown Recluse spider bite include mild to severe pain within two to eight hours, and a star shaped area around the bite within three to four days. Significant tissue death and loss accompanies a Brown Recluse spider bite. Reactions to a Black Widow spider include intense pain at the site of the bite after approximately 15 to 60 minutes, followed by profuse sweating, rigid abdominal muscles, muscle spasms, breathing difficulty, slurred speech, and poor coordination, dilated pupils, and generalized swelling of face and extremities.

Figure D5-2-1
Arachnid Illustrations

Brown Recluse

Black Widow

2.7.3.2 Ticks

2.7.3.2.0.0. Ticks are vectors of many different diseases, including Rocky Mountain Spotted Fever, Q fever, Tularemia, Colorado Tick Fever, and Lyme Disease. Ticks attach to their host's skin and intravenously feed on its blood creating an opportunity for disease transmission. The first symptoms of either disease are flu-like chills, fever, headache, dizziness, fatigue, stiff neck, and bone pain. If immediately treated by a physician, most individuals recover fully in a short period of time. If not treated, more serious symptoms can occur. Recently, Lyme disease has been the most prevalent type of disease transmitted by ticks in the United States.

2.7.3.2.0.1. If a site employee believes they have been bitten by a tick, or if any of the signs and symptoms appears, the employee will contact the UXOSO, who will notify the HSM. An evaluation will be made to visit a physician for an examination and possible treatment.

2.7.3.2.0.2. Such precautions should be taken when working in areas that might be infested with ticks:

a. Cover your body as much as possible. Wear long pants and long-sleeved shirts. Light color clothing makes spotting of ticks easier.

b. Try to eliminate possible paths by which the tick may reach unprotected skin. For example, tuck bottoms of pants into socks or boots and sleeves into gloves (duct tape may be used to help seal cuffs and ankles). If heavy concentrations of ticks or insects are anticipated or encountered, Tyvek® coveralls may be used for added protection.

c. Conduct periodic and frequent (e.g., hourly) surveys of your clothing for the presence of ticks. Remove any ticks and insects that become attached to clothing.

d. Spray outer clothing, particularly your pant legs and socks, but not your skin, with an insect repellent that contains permethrin or permanone, or use a repellent with N,N-diethyl-meta-toluamide (DEET), which can be applied to the skin.

e. When walking in wooded areas, avoid contact with bushes, tall grass, or brush as much as possible.

f. Tuck pant legs into boot tops or tape pants to boot tops to prevent ticks from crawling up the pant leg (this may not be an option at sites where extreme heat stress is anticipated).

2.7.3.2.0.3. If a tick is discovered, such procedures should be used to remove it:

a. Do not detach a tick with your bare fingers; bacteria from a crushed tick may be able to penetrate even unbroken skin. Fine-tipped tweezers should be used.

b. Grip the tick as close to your skin as possible and gently pull it straight away from you until it releases its hold.

c. Do not twist the tick as you pull and do not squeeze its bloated body. That may actually inject bacteria into your skin.

d. If the tick resists, cover the tick with salad oil for about 15 minutes to asphyxiate it, and then remove it with tweezers.

e. Do not use matches, a lit cigarette, nail polish or any other type of chemical to "coax" the tick out.

f. Be sure to remove all parts of the tick's body, thoroughly wash your hands and the bite area with soap and water, and disinfect the area with alcohol or a similar antiseptic after removal.

g. For several days to several weeks after removal of the tick, look for the signs of the onset of Lyme Disease, such as a rash that looks like a bulls-eye or an expanding red circle surrounding a light area.

h. Look for the signs of the onset of Rocky Mountain Spotted Fever, such as a rash-like inflammation consisting of red spots under the skin that appear 3 to 10 days after the tick bite.

i. Notify the UXOSO of any tick bites as soon as possible.

2.7.3.3 Chiggers

2.7.3.3.0.0. Chiggers are red, six-legged arachnids. Chiggers are barely visible to the naked eye (their length is less than 1/150th of an inch). Chiggers do not burrow into the skin. They generally attach to those areas of the body where clothing fits tightly, such as at the sock line and waistline, and they feed at the base of a hair follicle or in a pore. Chiggers usually dislodge within several hours of attachment. The bites commonly cause itching in about 3 to 6 hours and dermatitis develops in about 10 to 16 hours. Some people experience allergic reactions to the bites and develop blister-like lesions. They most commonly live in forests, grassy fields, gardens, parks, and in moist areas around lakes or rivers. Most of the larvae that cause chigger bites are found on plants that are relatively close to the ground surface, because they require a high level of humidity for survival.

2.7.3.3.0.1. For personal protection, apply insect repellent to clothing and exposed skin.

2.7.3.4 Mosquitoes

2.7.3.4.0.0. Mosquito's are vectors for West Nile Virus (WNV) Infection, a condition that can vary in presentation in different individuals. Most persons who become infected with WNV develop no clinical illness or symptoms.

2.7.3.4.0.1. West Nile Fever – Of the approximately 20 percent of infected people who develop symptoms, most develop what has been termed West Nile Fever. Symptoms include fever, headache, fatigue, skin rash on the trunk of the body (occasionally), swollen lymph glands (occasionally) and eye pain (occasionally). The incubation period for the development of these symptoms is between 2 to 14 days.

2.7.3.4.0.2. **West Nile Meningitis/Encephalitis.** Severe infections involve the central nervous system resulting in aseptic meningitis and encephalitis. Characteristic symptoms for meningitis include fever, headache, stiff neck, and changes in the white cells of the spinal fluids (Pleocytosis) with a predominance of lymphocytes. Characteristic symptoms for encephalitis include fever, headache, alteration of consciousness, lethargy, confusion, coma, limb paralysis, and cranial nerve palsies and tremors.

2.7.3.4.0.3. West Nile Poliomyelitis is a flaccid paralysis syndrome associated with WNV infection and is less common than meningitis or encephalitis. This syndrome is generally characterized by the acute onset of asymmetric limb weakness or paralysis in the absence of sensory loss. The paralysis can occur in the absence of fever, headache or other common symptoms associated with WNV. Paralysis of the respiratory muscles leading to respiratory failure can sometimes occur (fatal).

2.7.3.4.0.4. WNV infection can be suspected in a person based on geographical location, clinical symptoms and patient history but laboratory testing is required for a confirmed diagnosis. The most efficient diagnostic method is the detection of specific antibodies to WNV in serum collected within 8 to 14 days of illness onset or cerebral spinal fluid collected within 8 days of illness onset.

2.7.3.4.0.5. WNV Treatment – There is no specific treatment for WNV infection. The more severe infections may require hospitalization and supportive care to prevent secondary infections.

a. The best way to prevent infections with WNV and other mosquito-borne diseases is to avoid getting mosquito bites. Cover up by wearing shoes, socks, long-sleeved shirts, and long pants.

b. Consider using a mosquito repellant that contains DEET on exposed skin. Carefully read and follow directions on the container and wash treated skin when mosquito exposure has ended.

c. All mosquitoes need standing water for the first stages of development. Eliminate stagnant water around the work areas, where mosquitoes can lay eggs, by disposing of old tin cans, jars, tires, and any other container that can hold water. Stack tubs, buckets, barrels, etc. upside down so that water cannot accumulate in them.

2.7.3.5 Bees, Wasps, Hornets, and Other Insects

2.7.3.5.0.0. Contact with stinging insects like bees, yellow jackets, hornets, and wasps may result in site personnel experiencing adverse health effects that range from being mild discomfort to life threatening. Therefore, stinging insects present a serious hazard to site personnel, and extreme caution must be exercised whenever site and weather conditions increase the risk of encountering stinging insects.

2.7.3.5.0.1. Nests and hives for bees, wasps, hornets, and yellow jackets often occur in ground, trees, and brush. The area will be checked for obvious nests and hives before it is cleared. If a nest or hive is found, the UXOSO will be contacted before the nest is disturbed or removed. Bites and stings can be painful and may elicit an allergic reaction.

2.7.3.5.0.2. Individuals with life threatening allergies will not work in areas where there is a great potential for insect stings. If simple first aid measures do not alleviate the symptoms, the victim will be taken to the nearest medical center. An attempt will be made to kill the offending insect and take it to the emergency room with the victim if this can be done quickly and without endangering personnel.

2.7.3.5.0.3. Some of the factors related to stinging insects that increase the degree of risk associated with accidental contact are:

a. The nests for these insects are frequently found in remote, wooded, grassy areas.

b. The nests can be situated in trees, rocks, bushes, or in the ground, and are usually difficult to see.

c. Accidental contact with these insects is highly probable, especially during warm weather conditions when the insects are most active.

d. If a site worker accidentally disturbs a nest, the worker may be inflicted with multiple stings, causing extreme pain and swelling which can leave the worker incapacitated and in need of medical attention.

e. Some people are hypersensitive to the toxins injected by a sting, and when stung, experience a violent and immediate allergic reaction resulting in a life-threatening condition known as anaphylactic shock.

f. Anaphylactic shock manifests itself very rapidly and is characterized by extreme swelling of the body, eyes, face, mouth, and respiratory passages.

g. The hypersensitivity needed to cause anaphylactic shock, can in some people, accumulate over time and exposure; therefore, even if someone has been stung previously, and has not experienced an allergic reaction, there is no guarantee that they will not have an allergic reaction upon receipt of another sting.

2.7.3.5.0.4. With these things in mind and with the high probability of contact with stinging insects, all site personnel shall comply with safe work practices:

a. If a worker knows that he is hypersensitive to bee, wasp, or hornet stings, they must inform the UXOSO of this condition prior to participation in site activities. The UXOSO will question all site personnel concerning allergies or sensitivities prior to initiating work on site.

b. All site personnel will be watchful for the presence of stinging insects and their nests, and shall advise the UXOSO if a stinging insect nest is located or suspected in the area.

c. Any nests located on site shall be flagged off and site personnel shall be notified of its presence.

d. If stung, site personnel shall immediately notify the UXOSO to obtain treatment and allow the UXOSO to observe them for signs of allergic reaction.

e. Site personnel with a known hypersensitivity to stinging insects shall keep required emergency medication on or near their person at all times.

2.7.3.5.0.5. Stings of bees, wasps, and hornets are responsible for more deaths in the United States than bites and stings of all venomous creatures. This is due to the sensitization by the victim to the venom from repeated stings, which can result in anaphylactic reactions. The stinger may remain in the skin and should be removed by teasing or scraping rather than pulling. An ice cube placed over the sting will reduce pain. An analgesic-corticosteroid lotion is often used. People with known hypersensitivity to such stings should carry a kit containing antihistamine and epinephrine. Acquisition and maintenance of these kits is the responsibility of the individual.

2.7.4 Poisonous Plants

2.7.4.0.0. Poison Ivy (*Rhus radicans*), Poison oak (*Rhus diversiloba*), and poison sumac (*Rhus vernex*) are identified by three or five leaves radiating from a stem. The plant tissues have an oleoresin, which is active in live, dead, and dried parts and produces a delayed allergic hypersensitivity. The oleoresin may be carried through smoke, dust, contaminated articles, and the hair of animals. The best antidote for poisonous plants is recognition and avoidance.

2.7.4.0.1. Poison Ivy has three almond-shaped leaflets ranging from light green (usually the younger leaves) to dark green (mature leaves), turning bright red in fall. The leaflets of mature leaves are somewhat shiny. The leaflets are 3 to 12 cm long, rarely up to 30 cm. Each leaflet has a few or no teeth along its edge, and the leaf surface is smooth. Leaflet clusters are alternate on the vine, and the plant has no thorns. Vines growing on the trunk of a tree become firmly attached through numerous aerial rootlets. Flowering occurs from May to July. The yellowish- or greenish-white flowers are typically inconspicuous and are located in clusters up to 8 cm above the leaves. The berry-like fruit, a drupe, mature by August to November with a grayish-white color.

2.7.4.0.2. Atlantic Poison Oak is an upright shrub that can grow to 1 meter (3 ft) tall. The leaves are 15 cm (6 inches) long; alternate, with three leaflets on each. The leaflets are usually hairy, and are variable in size and shape, but most often resembling white oak leaves; they usually turn yellow or orange in autumn. The fruit is small, round, and yellowish or greenish.

2.7.4.0.3. Poison Sumac is a shrub or small tree, up to 20 ft in height, with 7-13 leaflets per leaf. These are oval to oblong; acuminate (tapering to a sharp point); cuneate (wedge-shaped) at the base; undulate (wavy-edged); underside is glabrous (hair-less) or slightly pubescent (down-like hair) beneath, and are usually 2-4 inches long. Its flowers are greenish, in loose axillary panicles (clusters) 3-8 inches long. The fruits are subglobose (not quite spherical), gray, flattened and about 0.2 inches across.

2.7.4.0.4. The allergic reaction associated with exposure to these plants will generally cause such signs and symptoms:

a. Blistering at the site of contact, usually occurring within 12 to 48 hours after contact;

b. Reddening, swelling, itching, and burning at the site of contact;

c. Pain, if the reaction is severe; and/or,

d. Conjunctivitis, asthma, and other allergic reactions if the person is extremely sensitive to the poisonous plant toxin.

2.7.4.0.5. Crusting and scaling occurs within a few days. Symptoms usually disappear in 1 to 2 weeks in cases of mild exposure and up to 3 weeks when exposure is severe.

2.7.4.0.6. Reaction to poisonous plants can be prevented if the exposed skin is washed with mild soap and water within 10 minutes of contact. Contact can be prevented by site workers wearing appropriate clothing. Preventive measures which can prove effective for most site personnel are:

a. Avoid contact with any poisonous plants and keep a steady watch to identify, report, and mark poisonous plants found outside;

b. Clean tools suspected of being in contact with poisonous plants;

c. Wash hands, face, or other exposed areas at the beginning of each break period and at the end of each workday;

d. Avoid contact with, and wash on a daily basis, contaminated tools, equipment, and clothing;

e. Barrier creams, detoxification and wash solutions, may prove effective and should be tried to find the best preventive solution; and,

f. Avoid spreading oils from these plants to hands, other parts of the body, and onto surfaces where other personnel without proper PPE may become affected.

Figure D5-2-2
Poisonous Plants

COMMON POISON IVY
(RHUS RADICANS)

Spring

Summer

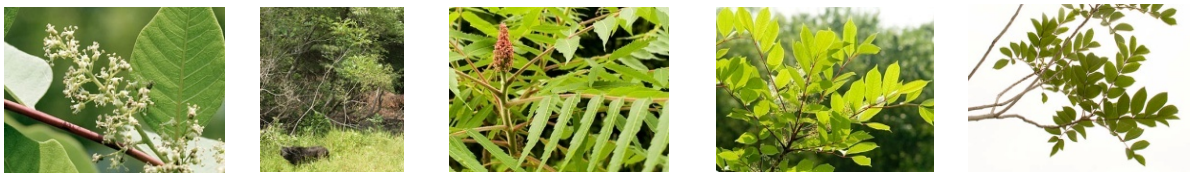
Fall

Winter

POISON OAK (RHUS DIVERSILOBA)

Figure D5-2.2 (*continued*)
Poisonous Plants

POISON SUMAC
(RHUS VERNIX)



2.7.5 Bloodborne Pathogens

2.7.5.0.0. In July of 1992, the Occupational Safety and Health Administration (OSHA) issued a final Standard for Protection of Workers Potentially Exposed to Bloodborne Pathogens (29 CFR 1910.1030). This primarily involves medical and research personnel. Bloodborne pathogens are pathogenic microorganisms that may be present in human blood and can cause disease in humans. These pathogens include, but are not limited to hepatitis B virus and human immunodeficiency virus.

2.7.5.0.1. Potential exposure during site activities results from workers who are infected. The OSHA Standard specifically includes first aid providers and is enforceable on site subject to the Hazardous Waste Site Work and Emergency Response Standard (29 CFR 1910.120). The basic concept of this standard is that medical care workers and first aiders must take the "Universal Precaution" of assuming that any blood containing fluid or person bleeding or contaminated with blood containing fluid is positive (infected) with both viruses.

2.7.5.0.2. Protection involves the use of personal protection such as gloves, eye shields, one-way valve rescue breather devices, and training. In order to effectively protect against any hazards, workers must have a basic understanding of the hazard. This is particularly true for personnel expected to administer first aid if necessary. First aid responders shall follow the guidelines contained in Shaw H&S procedure EIG-HS-512, Handling of Blood or Other Potentially Infectious Material.

2.8 Action Levels and Mitigation Methods

2.8.1 Implementation of Engineering Controls and Work Practices

Engineering controls and work practices will be implemented as necessary based on the criteria discussed in previous sections of this SSHP. Shaw will develop and implement applicable and feasible engineering and work practice controls to reduce safety and health hazards.

2.8.2 Upgrades/Downgrades in Levels of PPE

Should an unexpected event occur (e.g., soil with abnormal consistency and discoloration, buried waste, or unknown and unidentified materials), fieldwork at that location will be stopped and the SM, SUXOS, UXOSO and HSM will be notified. The UXOSO will identify potential concerns and implement appropriate requirements before field activities continue. This may require and upgrade in PPE or real-time air monitoring to evaluate potential worker exposure. The HSM will be consulted to determine proper handling and employee protection procedures. The level of PPE needed to protect employees from site hazards and the situations that would dictate an upgrade or downgrade in PPE is discussed in **Section 5** of this SSHP.

2.8.3 Work Stoppage and/or Emergency Evacuation of On-Site Personnel

All personnel have the right and obligation to request a work stoppage if they observe an unsafe condition or behavior. The SM, SUXOS and UXOSO will determine if an emergency evacuation is necessary in addition to a work stoppage.

2.8.4 Prevention and/or Minimization of Public Exposure

Site personnel will maintain the EZs. Any roadways in the MSD areas during MEC operations will be evacuated and/or roadways blocked to prevent non-essential personnel from entering during the conduct of MEC operations. Observers will be posted as necessary to ensure work is halted if non-essential personnel enter the MSD.

3.0 STAFF ORGANIZATION, QUALIFICATIONS, AND RESPONSIBILITIES

Staff organization, qualifications, and responsibilities are discussed in Section 3 of the APP.

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4.0 TRAINING

Training requirements are discussed in Section 5 of the APP.

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5.0 PERSONAL PROTECTIVE EQUIPMENT

5.0.0.0. Employee hazard and risk assessment will be an ongoing process to be conducted throughout the duration of the project. Changes in specific PPE, levels of PPE, or respiratory protection may be made in accordance with information obtained from actual implementation of site activities and information obtained from monitoring activities. As a rule, levels of PPE and respiratory protection will need to be reassessed if any of the following occur:

a. Appearance of previously unidentified or anticipated chemicals, conditions, or activity hazards;

b. Airborne concentrations of particulate exceed the action levels specified in **Table D5-8.1**;

c. Weather conditions change that impact the use of assigned PPE; or,

d. A new activity is introduced or a previously assigned and evaluated activity is expanded in scope.

5.0.0.1. If activities are added to the current scope of work after approval of this APP, the SM, SUXOS, and UXOSO shall identify and assess the activity hazards and relay that information to the HSM and the PM. The HSM will prepare an amendment to the APP and submit the amendment for approval from USAESCH and SEDA. The amendment will be added to the APP upon USAESCH and SEDA approval.

5.0.0.2. The SUXOS and UXOSO shall ensure PPE is utilized as appropriate and complies with all applicable OSHA, USACE, and Shaw requirements. The Level D and Modified Level D PPE described in this SSHP for Shaw personnel are Shaw approved levels of protection. Shaw personnel are not anticipated to require PPE above Level C since any COC were evaluated and engineering controls should be effective to mitigate the exposure.

5.0.0.3. It is the responsibility of each employee to report to work wearing proper attire and to assemble and inspect the necessary PPE prior to initiating its' donning.

5.0.0.4. Personnel working at SEDA shall use the appropriate type of PPE specified in this plan for each individual task. This SSHP makes provisions for the use of the following levels of PPE, in accordance with the hazards and contamination level anticipated for each task or operation: Level D, Modified Level D, and possibly Level C. The following paragraphs describe the PPE requirements for activities on site.

5.1 Task-Specific Levels of PPE

5.1.1 Special PPE Considerations

The following special considerations shall be observed in the selection of PPE:

a. Hard hats will be required when working around heavy equipment or when an overhead hazard exists.

b. Steel toe and shank boots are not required during anomaly location and reacquisition unless a significant foot impact hazard exists, where upon a composite safety toe will be used.

c. Safety glasses shall be selected which provide site personnel with the best protection from not only physical hazards, such as flying objects, but that also provide adequate splash protection.

d. Site tasks should continually be evaluated to identify hazards and PPE shall be provided to ensure the safety and health of site personnel, regardless of the activity they perform.

5.1.2 Level D PPE

5.1.2.0.0. Level D PPE is the initial level of protection for all project areas included in this remedial action. Level D PPE is not allowed in areas of the site where airborne particulate hazards are determined to exist. Level D should also be worn only if the activity in which personnel are engaged does not have the potential for splash, immersion or any other contact with hazardous substances.

5.1.2.0.1. Level D includes the following:

a. Cotton coveralls or work clothing;

b. Sturdy work boots or shoes, with steel toe when working around heavy equipment. Geophysical survey and reacquisition personnel will not use boots containing steel;

c. Safety glasses with side shields when an eye hazard exists;

d. Hard hat when working around heavy equipment or when an overhead hazard exists;

e. Chaps, hearing protection, head protection and face shield for protection during brush clearing operations involving the use of hand held equipment (e.g., chain saw);

f. Leather or cut resistant gloves when a abrasion or cut hazard exists;

g. Hearing protection, when working around heavy equipment; and,

h. High visibility Class 3 American National Standards Institute/Industrial Safety Equipment Association (ANSI/ISEA) vests when working adjacent to moving equipment.

5.1.3 Modified Level D PPE

For activities where the potential to encounter poisonous plant species occur or engineering controls are no efficient to reduce dermal protection. Modified Level D will be worn during the site activities and includes the following:

a. Cotton coveralls or other work clothes;

b. Permeable Tyvek;

c. Safety boots with rubber boot covers or equivalent;

d. Safety glasses with side shields or goggles when an eye hazard exists;

e. Hard hat (as required when adjacent to heavy equipment or an overhead hazard exists); and,

f. Hearing protection (as required when near heavy equipment).

5.1.4 Level C PPE

Level C provides protection from casual contact with contaminated soil or ash and also protects against a potential for airborne exposure to hazardous substances. Level C will be worn during the site activities when engineering controls are ineffective or not feasible, and includes the following:

a. NIOSH approved respirator with P-100 cartridges;

b. Permeable Tyvek where dermal particulate protection is necessary;

c. Outer Nitrile gloves;

d. Hard hat (as required when adjacent to heavy equipment and an overhead hazard exists); and,

e. Hearing protection (as required when near heavy equipment).

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6.0 MEDICAL SURVEILLANCE

Shaw will utilize the services of a Board-Certified Occupational Medicine physician for the medical surveillance requirements of this project. Dr. William Nassetta (below) will review all medical examinations and will be available for medical consultation on an as-needed basis.

Dr. William Nassetta, MD, MPH
CORE Health Services
12091 Bricksome Avenue, Suite B
Baton Rouge, Louisiana 70816
(225) 756-2673 (office)
(225) 295-4846 (fax)

6.1 Medical Examination

As required by Shaw H&S procedure EIG-HS-100 (Attachment D-2 of the APP), all personnel working Hazardous, Toxic, and Radioactive Waste (HTRW) or Hazardous Waste Operations and Emergency Response (HAZWOPER) projects will have successfully completed a pre-placement or periodic/updated physical examination. Shaw H&S procedure EIG-HS-102, Management of Employee Exposure and Medical Records, will be followed. The contents of this examination were determined by the Occupational Medical Physician. The HSM may consult with the physician and recommend additional testing of employees or subcontractors.

6.2 Pre-placement Examination

6.2.0.0. This examination was designed to meet the requirements of 29 CFR 1926.65 and 29 CFR 1910.120. The Shaw medical surveillance program examination, at a minimum, consists of:

a. Medical and occupational history questionnaire that includes information on past gastrointestinal, hematologic, renal cardiovascular, reproductive, immunological, and neurologic problems;

b. Physical examination;

c. Blood pressure measurements;

d. Complete blood count and differential to include hemoglobin and hematocrit determinations, red cell indices, and smear of peripheral morphology;

e. Blood urea nitrogen and serum creatinine;

f. Pulmonary function test (spirometry);

g. Respiratory protection clearance;

h. EKG as recommended by the physician;

i. Audiogram;

j. Drug screening;

k. Visual acuity;

l. Such information is, or has been, provided to the examining physician:

- Copy of 29 CFR 1910.120 (g) (5), 1910.134, and 1910.132;
- Description of employee's duties;
- Contaminants of potential exposure;
- Description of the PPE to be used; and,
- Information from previous medical exams.

6.2.0.1. The employee and their immediate supervisor will be informed of any medical conditions that would result in work restriction or that would prevent them from working at hazardous waste sites.

6.3 Annual Examination

Shaw field employees receive an annual update examination meeting the requirements of 29 CFR 1926.65. The results of these exams are compared to previous results and the baseline physical to determine if any effects due to exposure have occurred. Appropriate actions are taken as recommended by the physician should the results indicate an exposure; otherwise, employees are cleared for continued work.

6.4 Exit Examination

Shaw offers exit physical examinations for all employees involved in the medical surveillance program who are leaving the company for any reason to ensure they are in good health.

7.0 MEDICAL SUPPORT

Medical Support is discussed in Section 8 of the APP.

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8.0 EXPOSURE AIR MONITORING AND AIR SAMPLING PROGRAM

8.1 Introduction

8.1.0.0. An air monitoring and employee exposure assessment plan has been developed to protect the workers and potential off-site receptors during clearance and remedial actions at SEDA. This plan is in accordance with DER-10 Technical Guidance for Site Investigation and Remediation. Worker and public health and safety are ensured by monitoring within the work zone and perimeter upwind and down areas. Work zone and perimeter air monitoring will be conducted in accordance with the NYSDOH Generic Community Air Monitoring Plan (CAMP) during all intrusive investigation. Based on requirements specified in Appendix 1A of DER-10, the perimeter air monitoring program will consist of real-time perimeter measurements for airborne dust particulates (particulate matter less than 10 microns – PM10). A Data RAM 2000 aerosol monitor or equivalent industry standard will be used for particulate monitoring. The temporary up and downwind stations will be established at the perimeter of the EZ. The instruments will be mounted on a post at an elevation between 5 to 6 ft, representative of breathing zone heights. The measurements will be saved in the data loggers, downloaded daily, and maintained in the project records. The data logger will be capable of 15-minute time weighted average calculations. Previous site investigations did not identify VOCs as a contaminant of concern therefore VOC monitoring will not be required as a component of the CAMP.

8.1.0.1. A real-time aerosol monitor will also be deployed in the immediate intrusive and soil operations handling areas to evaluate worst-case scenario for employee exposure to airborne particulate matter potentially containing metals that were identified as COC from previous investigations at the OD area. Additional monitoring stations shall be established at the upwind and downwind perimeter of the exclusion zone as previously described. A minimum of one upwind and two downwind area stations shall be maintained during intrusive activity. The DER-10 Appendix 1A established perimeter action levels of 100 $\mu g/m^3$. Based on the anticipated COC and levels identified from previous site investigations at the OD area, the airborne action level in the work area and downwind monitoring locations is provided below as well as actions to be taken if the action level is achieved or exceeded.

Table D5-8-1
Particulate Action Levels

Analyte	Action Level (AL)[a]	Required Action
Respirable dust in immediate work area	≥ 2,977 µg/m^3 or (2.977 mg/m^3) above background in breathing zone (BZ) (background compared to subtracting upwind monitor reading from work area monitor measurement)	Stop activities, initiate dust controls, if readings are sustained continue dust control. Upgrade to Level C PPE if dust suppression does not reduce levels below AL.[b]
Respirable dust at downwind stations	≥ 100 µg/m^3 or (.1 mg/m^3) above background in BZ (background compared to subtracting upwind monitor reading from downwind measurement)	Stop activities, initiate dust controls. If readings are ≥ 150 µg/m^3 continue dust control. If readings are < 150 µg/m^3 continue work. If readings do not fall below 150 µg/m^3 stop work.[b]

[a] Four instantaneous peaks in any 15-minute period or a sustained reading for 5 minutes in excess of the action level will trigger a response.
[b] Contact with the H&S manager must be made prior to continuance of work. The H&S manager may then initiate perimeter/integrated air sampling along with additional engineering controls.

EQUATIONS USED IN THIS CALCULATION

Dust action level = (1E+6) / (Safety Factor)
(For mixed dusts) ———————————————————
Sum of [(Concentration mg/kg) / (Exposure Limit)]

The worker protection action level was derived using the maximum contaminant concentration for COC detected from previous site investigation and applying a safety factor of 2. The COC and highest concentration detected is as follows:

Copper 7,310 mg/kg
Vanadium 41.9 mg/kg
Cadmium 1,100 mg/kg
Mercury 9.1 mg/kg
Silver 205 mg/kg

It should be noted that the downwind perimeter action level required by the Generic CAMP is approximately 58 times more protective than the calculated exposure limit for the sum of the COC and current occupational exposure guidelines.

9.0 HEAT AND COLD STRESS

Heat and cold stress is discussed in Section 10 of the APP.

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10.0 STANDARD OPERATING PROCEDURES, ENGINEERING CONTROLS, AND WORK PRACTICES

10.1 General Safety

10.1.0.0. Field personnel must be able to recognize and understand potential hazards associated with the activity they will be performing. Personnel active in site operations must be thoroughly familiar with the programs, practices, and procedures outlined in this SSHP. H&S procedures for specific activities are contained in Attachment D-2 of the APP.

10.1.0.1. The following are considered standard safe work practices for work on this project.

a. Eating, drinking, chewing tobacco, smoking, and carrying matches or lighters are prohibited in a contaminated or potentially contaminated areas or where the possibility for cross contamination exists.

b. Avoid contact with potentially contaminated media or materials. Avoid, whenever possible, kneeling or sitting on the ground. Do not place equipment on potentially contaminated material.

c. All field members should be alert to all potentially dangerous situations e.g., presence of strong, irritating, unusual, or nauseating odors.

d. For each site, field personnel shall be familiar with:

   – The potential harmful chemicals;

   – Terrain;

   – Location of work zones;

   – Location of emergency equipment; and,

   – Designated PPE and clothing for work assignment.

e. All workers will use protective equipment as specified in this SSHP.

f. Workers will stay clear of heavy equipment when in operation.

g. All field personnel should pay specific attention to decreased performance capabilities resulting from the use of PPE, such as poor tactile skills when wearing certain types of gloves. Prior knowledge of limitations imposed by the use of such equipment will allow the worker to assess the decrease in his or her capability to perform field operations in a safe manner.

h. Overhead power lines or buried cables pose a danger of shock or electrocution if workers contact or sever them during operations. The location of these potential hazards will be assessed before beginning site activities.

i. Buddy system procedures will be enforced during site operations.

j. Site personnel will perform only those tasks that they are qualified to perform.

k. Site visitors are to be escorted by qualified personnel at all times.

l. Running and horseplay are prohibited in all areas of the site.

m. The number of personnel in the EZ will be the minimum number necessary to perform the task in a safe and efficient manner.

10.2 Ordnance Safety

Maximum safety in any UXO operation can be achieved through adherence to applicable safety precautions. Only those personnel necessary to the operation shall be allowed in the EZ during UXO activities (DOD 6055.09-M). Only personnel who are qualified under Department of Defense Explosives Safety Board (DDESB) TP 18, *Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel* are authorized to handle UXO. Procedures for ordnance safety are contained in EM 385-1-97, Explosives – Safety and Health Requirements Manual. An electronic copy will be available on site.

10.3 General Sanitation

Section 2 of EM 385-1-1 describes minimum sanitation requirements that Shaw will provide drinking water, toilets, and hand washing facilities. The requirements for each are described in the following subsections.

10.3.1 Drinking Water

Cool potable drinking water will be provided in sanitary, portable containers.

10.3.2 Toilets

An adequate number of chemical toilets (EM 385-1-1, Section 2.E) will be provided and located near the support trailers in the SZ and near investigation sites when practical.

10.3.3 Hand-Washing Facilities

Hand-washing capabilities will be provided on site during all field activities. Personnel will ensure that hand washing is performed prior to eating or drinking.

10.4 Material Handling Procedures

Numerous items will require handling during execution of on-site activities. Precautions will be taken when lifting or handling heavy or bulky items. Back strain or injury may be prevented by using proper lifting techniques. The fundamentals of proper lifting include:

a. Consider the size, shape, and weight of the object to be lifted. Two persons must lift an object if it cannot be lifted safely alone (e.g., greater than 60 pounds).

b. The hands and the object should be free of dirt or grease that could prevent a firm grip.

c. Gloves must be used, and the object inspected for metal slivers, jagged edges, and burrs, rough or slippery surfaces.

d. Fingers must be kept away from points that could crush or pinch them, especially when putting an object down.

e. Feet must be placed far enough apart for balance. The footing should be solid and the intended pathway should be clear.

f. The load should be kept as low as possible, close to the body with the knees bent.

g. To lift the load, grip firmly and lift with the legs, keeping the back as straight as possible.

10.5 Drum/Container/Tank Handling

10.5.0.0. Improper handling of drums and containers can result in severe injuries. These include painful back sprains, smashed toes and fingers, or exposure to hazardous chemicals, if the contents are leaking. Proper work practices can minimize risk of injury, so personnel should use the following recommendations:

a. Prior to handling the drum, read the label on the drum and look for symbols, words or other marks which indicate if its contents are hazardous, corrosive, toxic or flammable. If the drum isn't labeled, consider the contents hazardous until they are positively identified.

b. Look around the drum to see if it is leaking. Before cleaning up any spill, make sure the substance has been identified. Make sure that you've been trained in the hazards of the chemical, and have the correct materials for cleaning it up. Find and review the appropriate MSDS.

c. Before moving the drum or barrel, replace missing bungs and/or lids and secure as necessary.

d. Depending upon the contents of the drum, estimate its weight. Determine whether you can move it yourself or if you need assistance. A 55-gallon drum can weigh 400-800 pounds.

e. Use a forklift or heavy equipment, a hand truck or a drum cart that is designed specifically for drum handling.

f. If the drum can be rolled, stand in front of it and place both hands on the far side of the chime. Pull the drum forward until it balances on the bottom chime. You can now roll the drum on its chime, being careful to keep your hands from crossing over one another. You can also lower the drum to the ground for rolling by shifting your hands to the bottom side of the chime (not where they will be crushed). Then slowly lower the drum to the floor. Keep your back straight and bend at your knees. Then roll the drum with both hands. Don't use your feet or grasp the ends.

g. To upend a barrel or drum, a drum lifter bar is preferable. If one is not available, crouch in front of the drum, knees apart and firmly grasp the chime on each side. Keep your back straight and use your leg muscles to lift. Balance the drum on the lower chime, shift your hands to the far edge, and ease the drum into the upended position.

10.5.0.1. Protect your hands, feet, back and face during this work. Safety boots are be required when moving heavy drums. Gloves, eye protection, aprons, and other PPE may be needed, depending upon the contents of the drum.

10.6 Public Safety

10.6.1 General

The public or other unessential personnel will be kept out of the immediate work area by evacuating them beyond the EZ. If unauthorized personnel inadvertently enter the EZ, work will be stopped immediately. Work will not begin again until the unauthorized person is outside the EZ.

10.6.2 Establishment of Exclusion Zones

10.6.2.0.0. The EZ is an area used to protect the public and non-essential personnel from inadvertent detonations or hazardous releases. The EZs used at the OD Area is based on the munition with the greatest fragmentation distance EZ which is based on the Maximum Credible Event as provided in the approved ESS.

10.6.2.0.1. If any non-essential personnel are located within the EZ and additional engineering controls will not be used for the reduction of the EZ (i.e., approved shielding or blast mitigation methods) evacuations will be conducted prior to continuation of site work.

11.0 SITE CONTROL MEASURES

11.0.0.0. The UXOSO will designate and coordinate access and security on site to prevent access to potentially hazardous conditions by unauthorized personnel. Due to the hazardous nature of MEC, only UXO personnel may handle or evaluate potential MEC as part of this clearance and remediation effort, and only as necessary. Non-UXO personnel will not handle or evaluate potential MEC. All non-UXO personnel will be fully trained and capable of recognizing the specific MEC hazards on site. When non-essential MEC personnel (i.e., visitors, those persons not approved to perform MEC procedures) enter the EZ, all MEC operations will cease.

11.0.0.1. An EZ will be established around a work site. The EZ will be large enough to prevent personal injuries from physical hazards (i.e., excavations, swing radius of earth moving equipment, hazardous fragment distance, minimum separation distance, etc.). The limits of the EZ will be marked with hazard tape or other suitable marking material or UXO personnel will establish perimeter surveillance.

11.0.0.2. In case of emergency, personnel will exit the site and move to the designated safe area as determined in advance for the specific site condition.

11.1 Perimeter Postings

11.1.0.0. Appropriate warning signs will be strategically placed where people enter the EZ. Signs should read or be similar to:

"DANGER – DO NOT ENTER. INTRUSIVE INVESTIGATION AREA. KEEP CLEAR."

11.1.0.1. Signs may be more hazard-specific as necessary. Additional signs may be posted at the perimeter of the site to alert passersby of potential dangers.

11.2 Communications

11.2.0.0. Two-way radios will be provided to on-site field personnel during this project. Cellular telephones will also be available.

11.2.0.1. If MEC or electroexplosive devices susceptible to EMR devices in the radio frequency range are present, the UXOSO will notify personnel so that preventive steps can be taken.

11.3 Security

This section describes the procedures for controlling access by personnel and vehicles into potentially dangerous or hazardous working areas within the site. Security and road

barricades and warning signs will control access to each area. Entrance to each area will be restricted to specific points that will be controlled and monitored by project personnel. Only project personnel, subcontractor personnel, and authorized visitors with proper identification will be allowed access to the site. Security measures described in the sections below include:

a. Security operations;

b. General security; and,

c. Site-specific areas.

11.4 Security Operations

The primary mission of security operations is the control of personnel and vehicles entering and leaving the sites. Control will be provided by installing barricades across roadways leading to the intrusive investigation areas, depending on site-specific conditions, with specific points established to gain access. As work progresses, the barriers will be relocated, as required. Barriers will only be required when intrusive activities or demolitions are occurring.

11.5 General Security

Security operations will include:

a. Maintaining a visitor log at the project reception desk and work sites.

b. Escorting visitors to the site(s) by project personnel. Visitors will receive an abbreviated site orientation briefing in accordance with this SSHP.

c. Notifying Security in the event of vandalism, trespassing, or breaking and entering.

d. Locking site facilities containing items of value, or which are subject to vandalism, when unoccupied.

11.6 Site-Specific Areas

Site security for the remediation activities will consist of one or all measures:

a. Materials and supplies will be placed in locked boxes.

b. Signs stating "Authorized Personnel Only" will be installed around areas of work activity.

c. Warning signs will be erected at specific areas to provide warning of hazardous conditions in accordance with the requirements of this SSHP.

12.0 PERSONAL HYGIENE AND DECONTAMINATION

12.1 Introduction

To prevent harmful materials from being transferred into clean areas or from exposing unprotected workers, all field personnel and equipment exiting an area of potential contamination when there are indications of COCs either through air monitoring or visual inspection will undergo decontamination. The extent of decontamination depends on a number of factors, the most important being the type and concentration of the contaminant involved. This chapter discusses decontamination of personnel.

12.2 Decontamination Procedures for Personnel

12.2.1 Personnel Decontamination:

12.2.1.0.0. The decontamination procedures associated with the intrusive tasks are summarized below:

a. Equipment drop;

b. Removal and disposal of non-reusable protective clothing/equipment (e.g., surgical gloves);

c. Removal of safety glasses and hardhat; and,

d. Washing hands and face.

12.2.1.0.1. No heavy contamination of clothing is expected and disposable protective clothing/equipment will be disposed of as non-hazardous waste. This material will be disposed of in a garbage bag for site trash pickup.

12.2.1.0.2. Any decontamination fluids (i.e., detergent and water solutions, and rinse water) will be captured, containerized and held on site. Spoils and metallic debris generated and recovered during the intrusive investigation of anomalies/targets under this task will be collected in roll-off containers for later disposal.

12.2.1.0.3. The sanitation provisions specified in Section 2 of EM 385-1-1 will be established and maintained on site as outlined in the following paragraphs. Eating, drinking, smoking, chewing, and application of cosmetics will be restricted to the SZ.

12.2.1.0.4. Cool, potable drinking water will be provided in sanitary, portable containers at all sites. Where necessary, disposable cups will also be provided and used to drink from the drinking water containers.

12.2.1.0.5. Toilet facilities will be provided in accordance with EM 385-1-1, par. 02.E. Hand-washing facilities or cleaning wipes will be provided in the portable toilet facilities and cleaning wipes will be provided in the crew break area. Field team personnel will wash their hands prior to eating or drinking and prior to leaving a site.

12.2.1.0.6. Smoking will only be permitted in specific areas designated by the SSHO.

12.3 Contamination Control

12.3.0.0. This Section outlines the measures that will be taken to control contamination and prevent it from leaving the EZ.

12.3.0.1. The decontamination procedures described in Subchapter 12.2 will be the primary sources of contaminant control. Also, as indicated previously, all wastewater generated from decontamination procedures will be collected on site, tested, if necessary, and disposed of in accordance with the Work Plan. In addition to these procedures, measures will be taken to limit the movement of vapors that may be generated within the EZ.

12.3.0.2. Eating, drinking, smoking, chewing, and application of cosmetics shall be restricted to the clean (support) zone, except drinking of replacement fluids, which shall be permitted in designated areas of the CRZ. Personnel who have been exposed to contaminated material (based on air monitoring data) will be processed through the decontamination line before they are allowed to drink or eat.

13.0 EQUIPMENT DECONTAMINATION

13.1 Procedures for Heavy Equipment and Vehicle Decontamination

13.1.0.0. To the extent possible, all heavy equipment will remain outside of the EZ. Heavy equipment that enters the EZ will be decontaminated. It is anticipated that physical decontamination of the heavy equipment will be conducted.

13.1.0.1. Proper decontamination of equipment is extremely important to ensure contamination is not spread to uncontaminated portions of the site or to site personnel. The layer of protection will be changed as needed to prevent the spread of contamination to surfaces inside the operator area.

13.1.0.2. All equipment requiring maintenance or repair will be staged in the CRZ prior to servicing. The UXOSO will properly inspect, and approve for general cleanliness, all heavy equipment prior to the equipment exiting the CRZ for the SZ. In order for a vehicle or piece of heavy equipment to pass inspection, it must be in a broom-clean condition, free of loose dirt or material on tailgates, axles, and wheels. Approval for heavy equipment removal from the CRZ will be based on visual inspection of all exposed surfaces, and if needed, the analysis of smear samples.

13.1.0.3. Personnel assigned to heavy equipment and vehicle decontamination shall wear the protective equipment, clothing, and protection consistent with the levels of PPE worn during the site activities during which the heavy equipment/vehicle became contaminated. The decontamination personnel will wear a splash shield during the decontamination of heavy equipment/vehicles when splash hazards exist.

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14.0 EMERGENCY EQUIPMENT AND FIRST AID

14.1 First Aid Equipment

First aid kits for the treatment of minor injuries and burns will be maintained on site by the UXOSO. The first aid kits will meet the requirements for Type II kits contained in Shaw H&S procedure EIG-HS-104, First Aid Kits. First aid kits will be kept at the following locations:

a. All Shaw work vehicles used on site; and,

b. Administrative office trailer.

14.2 Fire Fighting Equipment

Fire extinguishers will be maintained on site by the UXOSO in accordance with EM 385-1-1. Fire extinguishers will be placed in each work vehicle, in occupied trailers, and at all other locations where immediate fire suppression equipment is necessary.

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15.0 EMERGENCY RESPONSE PLAN

15.1 Introduction

Emergency response procedures are provided in Section 10 of the APP.

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16.0 EMERGENCY RESPONSE TEAM

In the event of an accident, Shaw will maintain at least two personnel on site at all times during site work with current first aid/CPR training.

16.1 Emergency Response Team

a. Locate all victims, assess their conditions, and make an on-scene determination of the resources needed to stabilize and transport.

b. Request emergency response by outside agencies, if required.

c. Assess the situation and determine the existing hazards, potential for additional hazards, and need for additional response. SUXOS and UXOSO must ensure the hazardous condition is stabilized, eliminated, or permanently fixed. If personnel or properties are jeopardized, a determination must be made to alert the local community.

d. Remove injured personnel from the area. Decontamination, if required, will be accomplished through the CRZ.

16.2 UXOSO

The overall responsibility during emergencies rests with the UXOSO. In case of emergency, the UXOSO will implement the site emergency procedures. The UXOSO is specifically responsible for the following:

a. Implementing the site Emergency Response Plan including ordering site evacuations, coordinating firefighting efforts, and directing spill control and cleanup;

b. Supervising site evacuation and decontamination procedures;

c. Contacting emergency services such as the fire department, ambulance and security services;

d. Assisting in providing first aid services and medical support or evacuation for injured or exposed personnel;

e. Determining the cause of the incident and ways to prevent future occurrences; and,

f. Assisting the SM and SUXOS in preparing a written incident report in accordance with Shaw H&S procedure EIG-HS-020 for submission to the HSM, and ENG 3394 for submission to USAESCH Project Manager (PM) as applicable.

16.3 All On-site Personnel

On-site personnel are responsible for reporting emergencies immediately to their supervisors, alerting other employees, helping injured personnel, and assisting as directed to mitigate the incident.

16.4 Emergency Training

Prior to initiating the intrusive operations, the following will occur under the direction of the UXOSO and HSM:

16.4.1 Team Training

This will include the following:

a. Hazard communication;

b. Emergency procedures; and,

c. MEC-specific health and safety.

17.0 CONFINED SPACE ENTRY

Confined space entry is not anticipated as part of the remedial action.

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18.0 LOGS, REPORTS, AND RECORDKEEPING

Proper recordkeeping and data management are essential in the implementation of this SSHP. The forms associated with the record keeping and data management requirements shall be completed in an accurate, timely fashion and appropriately filed. The proper completion of safety forms is primarily the responsibility of the UXOSO. Completed forms will be kept and maintained by Shaw for a five-year period.

18.1 Employee Training and Medical Certification Records

18.1.0.0. Before personnel are allowed to work in regulated areas on site, the UXOSO shall verify that the following training documentation is current and available in the project Health and Safety file:

a. OSHA 40- or 24-hour HAZWOPER training certificate (all personnel);

b. OSHA 8-hour HAZWOPER Refresher training certificate (all personnel who attended the OSHA 40- or 24-hour HAZWOPER training over 12 months in the past);

c. OSHA 8-hour HAZWOPER Supervisor training certificate (all supervisory personnel such as the Field Superintendent and Crew Leaders/Foremen);

d. Three days of HAZWOPER supervised field experience;

e. A completed Training Acknowledgement Form;

f. Portable fire extinguisher training (two workers per crew);

g. First aid/CPR training (at least two workers on site);

h. Site-safety orientation training documentation indicating that employees have received the following training:

   – Review of SSHP (SSHP Acknowledgment Form);

   – Site-specific Hazard Communication training (Hazard Communication and Right-To-Know Standards Employee Training Record);

   – MEC Awareness Training; and,

   – Other training as applicable.

18.1.0.1. The UXOSO shall also verify that the following medical surveillance documentation is current and available in the project Health and Safety file:

a. The OSHA HAZWOPER medical surveillance certification for personnel working with HTRW as required by 29 CFR 1910.120 (f);

b. Annual audiogram evidence for workers who may be exposed to noise greater than 85 decibels; and,

c. Positive physician's medical determination regarding the employee's ability to use respiratory protection for personnel required to wear respiratory protection.

18.1.0.2. All personnel (including visitors) using respiratory protection, shall have successfully passed a respirator fit test in accordance with Shaw H&S procedure EIG-HS-601 within the last 12 months. A document providing proof of a fit test for the specific respirator used shall be available in the project Health and Safety file.

18.2 Daily Safety Log

18.2.0.0. The UXOSO will maintain and complete a daily log for each day's work. The daily log will document each day's safety and health activities in sufficient detail for future reference as needed.

18.2.0.1. The following items will be developed as applicable and maintained on site by the UXOSO as part of the daily safety log:

a. Daily safety meeting logs;

b. EZ sign-in logs;

c. Personnel training and medical certificates;

d. Hot Work Permits;

e. Air monitoring/sampling data forms;

f. Project safety inspections (daily and monthly);

g. Contractor safety inspections;

h. Warnings given related to safety infractions;

i. AHAs;

j. JSAs;

k. Accident investigation reports; and,

l. First aid log.

18.2.0.2. All personnel will be required to log in and out of EZs. The EZ sign-in log, maintained as part of the daily safety log, provides a project record of the following information for each shift's activities:

a. Worker's name;

b. Work area;

c. Duties performed;

d. Level of protection; and,

e. Time in/time out.

18.3 Safety Inspections/Audits

18.3.0.0. Shaw Environmental & Infrastructure, Inc.'s accident prevention program is centered on the following key procedures:

a. Investigating, reporting, and reviewing of all near misses, incidents, and accidents;

b. Managing reviews of all incident/accident reports, corrective action, and project safety concerns; and,

c. Reviewing of project, operations, and construction activities by safety and health professionals and supervisory personnel.

18.3.0.1. Safety reviews and inspections are conducted by all tiers of the management structure and are documented. A list of all corrective action items shall be maintained showing the corrective action, responsible person, and the date the action is to be completed. Follow-up inspections are conducted by safety and health personnel to verify that corrective actions or measures have been implemented.

18.3.0.2. The UXOSO will inspect the site daily and identify areas of safety concerns or ideas for safety improvement. Crew leaders will also inspect site conditions and activities daily to identify changing conditions or potential hazards.

18.3.0.3. Safety and occupational health deficiencies shall be tracked on the Safety and Occupational Health Deficiency Tracking Log, which provides the following information:

a. Date deficiency identified;

b. Description of deficiency;

c. Name of person responsible for correcting deficiency;

d. Projected resolution date; and,

e. Date actually resolved.

18.3.0.4. The SM or UXOSO will immediately notify the HSM of any OSHA or other regulatory agency inspections. The UXOSO shall provide the HSM a copy of any citations or reports issued by the inspector and any corrective action responses to the citation(s) or report(s).

18.4 Accident Investigation and Reporting

18.4.0.0. Project personnel are required to report all near misses, injuries, illnesses, and accidents to their immediate supervisor. The UXOSO shall immediately arrange appropriate medical care as required. Once immediate medical care for the injured personnel or other critical emergency procedures has been accomplished, the SM shall follow the Incident Notification, Reporting, and Management Procedure. The appropriate form(s) to be completed are in Attachment 2 of the APP and include the following:

a. Supervisor's Employee Injury/Illness Report Form;

b. Vehicle Accident Report;

c. Equipment, Property Damage and General Liability Loss Report;

d. Incident Investigation Report;

e. Injured Employee Statement;

f. Employee Witness Statement; and,

g. Accident Review Board.

18.4.0.1. All incidents shall be immediately reported to the PM and HSM. Except for rescue and emergency measures, the accident scene shall not be disturbed until it has been released by the investigating official.

18.4.0.2. In the event that an accident results in an employee being sent to a doctor, the Return-to-Work Examination Form shall be completed by the attending physician, on the date of treatment stating that either:

a. Employee may return to full duty work;

b. Employee may return to limited duty (with type of limitations); and,

c. Employee is unable to return to work.

18.4.0.3. A copy of this release shall accompany the accident report. In addition to the requirement for maintaining a log of OSHA recordable injuries/illnesses, a separate log will be maintained for all first aid treatments not otherwise recordable/reportable.

19.0 REFERENCES

American Conference of Government Industrial Hygienists (ACGIH), 2011, *Threshold Limit Values for Chemical Substances, Physical Agents, and Biological Exposure Indices*.

Department of Defense (DoD), 2010, 6055.09-M, *DoD Ammunition and Explosives Safety Standards*, 29 Feb 2008, administratively reissued 4 August.

Engineer Manual (EM), 2008, 385-1-1, *Safety – Safety and Health Requirements Manual*, U.S. Army Corps of Engineers. 15 November.

EM, 2008, 385-1-97, *Explosives – Safety and Health Requirements Manual*, U.S. Army Corps of Engineers. 15 September.

National Institute of Occupational Safety and Health (NIOSH), 2010, *NIOSH Pocket Guide to Chemical Hazards*. November.

U.S. Department of Defense Explosives Safety Board (DDESB), 2004, *Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel*, DDESB Technical Pamphlet (TP) 18, Alexandria, Virginia. 20 December.

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Appendix 1

Activity Hazard Analysis

Activity Hazard Analysis (AHA)

Activity/Work Task: Vegetation Removal	Overall Risk Assessment Code (RAC) (Use highest code)	**M**
Project Location: Seneca Army Depot Activity, NY, MEC Clearance at OD Grounds	**Risk Assessment Code (RAC) Matrix**	
Contract Number: W912DY-10-D-0014 DO 005	**Severity** / **Probability**	
Date Prepared: 03-09-12		
Prepared by (Name/Title): Winston D Russell/H&S Manager		
Reviewed by (Name/Title): William Wren/UXOSO		
Notes: (Field Notes, Review Comments, etc.)		

Severity	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	**E**	**E**	**H**	**H**	**M**
Critical	**E**	**H**	**H**	**M**	**L**
Marginal	**H**	**M**	**M**	**L**	**L**
Negligible	**M**	**L**	**L**	**L**	**L**

Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom, or Unlikely.

"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible

Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.

RAC Chart

- **E = Extremely High Risk**
- **H = High Risk**
- **M = Moderate Risk**
- **L = Low Risk**

Job Steps	Hazards	Controls	EM 385-1-1	RAC
Arrival of new personnel at site.	Unfamiliarity with: site, general site hazards, project safety rules, chain of command, and emergency procedures.	All personnel shall attend the site orientation training.	01.B.03 01.E.01 28	**M**
Vegetation removal.	Poor planning.	Complete Job Safety Analysis for each task, as specified in Shaw Environmental & Infrastructure, Inc. Procedure No. HS045, "Job Safety Analysis (JSA)." Use Hazard Assessment Resolution Program frequently – for each task to be completed.		**M**
	Heavy lifting, strains, and sprains.	No individual employee is permitted to lift any object that weighs over 60 pounds. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 60-pound limit.	14.A.01	**M**
	Struck-by/Against.	Wear reflective warning vests when exposed to vehicular traffic. Personnel working on or near roads and only remain on road long enough to complete work. Personnel walking along roadway shall stay off roadway as far as possible and walk on the side facing traffic.	05.F	**M**

Job Steps	Hazards	Controls	EM 385-1-1	RAC
Vegetation removal (continued).	Munitions and Explosives of Concern (MEC) / Unexploded Ordnance (UXO), Chemical Agent (CA).	Non-UXO personnel shall attend site-specific MEC Awareness (and recognition) Training prior to the commencement of any site activities. Use only UXO personnel qualified in accordance with Department of Defense Explosives Safety Board Technical Paper 18, Minimum Qualifications for UXO Technicians and Personnel. UXO Technicians shall be present during any activity occurring in a Munitions Response Areas. Perform all work in accordance with approved Work Plan. Have material on hand for EPDS contingency..	01.B.01 33.A.01 33.A.02 33.A.03	**M**
	Blast overpressure fragmentation blast.	The UXO Safety Officer is responsible for the location of each UXO team. Minimum safe distance maintained between two teams will never be less than 200 feet or the K40 overpressure distance in the formula: Minimum safe distance = 40 times the cube root of the net explosive weight of the munition with the greatest fragmentation distance at the Munitions Response Site.	33.A.01 33.A.02 33.A.03	**M**
	Accidental detonation of MEC.	Observe the requirements of Explosives Safety and Health Manual EM 385-1-97. Be alert and mark all MEC located. UXO trained personnel will escort non-UXO personnel at all times. Surface sweeps will be conducted with magnetometers or other suitable geophysical instrumentation to identify potential MEC.	33.A.01 33.A.02 33.A.03	**M**
	Intrusive activities.	Follow procedure for Intrusive Activities Permit in Accident Prevention Plan (APP) prior to commencing clearing and grubbing activities. Follow MEC avoidance techniques in accordance with EP 75-1-2 during all vegetation removal.	25.A.01	**M**
	Slips, trips, and falls.	Keep work areas clear and maintain housekeeping. Personnel shall not jump from elevated surfaces. Personnel shall use caution when walking on rocky, slippery, or uneven terrain.	14.C.01-10	**M**
	Hand injuries.	Items to be handled shall be inspected for sharp edges prior to being handled. Personnel shall wear leather gloves when handling sharp materials. Personnel shall be aware of and avoid pinch point hazards.	05.A.08	**L**

Job Steps	Hazards	Controls	EM 385-1-1	RAC
Vegetation removal (continued).	Use of heavy equipment.	Only qualified personnel shall be permitted to operate equipment. Heavy equipment shall be inspected daily after the initial U.S. Army Corps of Engineers inspection (and documented.) Do not use unsafe equipment. All equipment shall have backing alarms. All equipment shall be operated at safe speeds and in a safe manner. Equipment operators shall wear safety belts. Personnel are only permitted to approach equipment after a signal from the operator. Ground personnel, working near heavy equipment, shall wear high visibility conspicuity vests. Ground personnel shall not enter the swing radius of equipment. Ground personnel shall not position themselves between equipment and stationary objects. Personnel shall verify all mechanical guards are in place and functioning properly. Moving equipment shall be equipped with a back-up alarm. All equipment shall be shut down with energies dissipated prior to performing maintenance activities - lock out/tag out procedures may apply. Only qualified mechanics shall work on or repair heavy equipment. Heavy equipment shall be equipped with Falling Object Protective Structure.	18.A 18.G 18.B 05.F 18.B.12	**M**
	Injury from chain saws, wood/falling trees, chips, cuts, and noise.	Chain saw operators shall wear a specially designed helmet system (consisting of head, face, and hearing protection). Use gloves and chaps at all times when using saw. Operators shall wear chain saw protective boots with steel toes. Secure loose fitting clothing with duct tape. Keep other personnel at least two tree lengths away from tree being felled. Operators shall have escape routes planned that are at 45 degrees from the projected direction of the falling tree. Keep escape routes clear of all tools, materials, and wood/brush. Always cut away from the body. Shut off chain saws when walking between work areas. Have spotter assist when falling large or tall trees. Only cut trees, logs, or branches from ground height. Shut off engines before freeing pinched chains. Chain saw operators shall always hold the saw with both hands during cutting operations. Inspect chain saw before each use. Do not use saws in which any safety feature is not functioning. Frequently check and adjust tension on chain. Do not use saws with or dull cutters. Do not increase force used as cutters become dull. The idle speed shall be properly adjusted to prevent the chain from moving when the engine is idling. Keep bar groove clean. Use only new chains or professionally sharpened chains. Replace sprockets, which show signs of wear. Remain alert to kickback hazards and keep a firm, proper grip on chain saw at all times. All chain saws shall be equipped with automatic chain brake and other anti-kickback devices. Use wedges to prevent binding of the chain. Do not cut with the tip (nose) of the bar. Do not use dull chains. Do not overreach with chain saw. Personnel shall not operate chain saws above shoulder height. Personnel shall be familiar with cutting techniques.	13.F 13.A 31.C	**M**

Job Steps	Hazards	Controls	EM 385-1-1	RAC
Vegetation removal (continued).	Tree pruning, falling, and brush removal/chipping.	Personnel operating weed whackers shall wear hearing protection and eye/face protection. Steel blade use on weed whackers is prohibited. The procedures outlined in *Safety and Health Requirements Manual*, Sections 31.C, 31.D and 31.E shall be conveyed to all personnel involved in the operations. Remain clear of feed and discharge chutes on chippers.	31.C 31.D 31.E	**M**
	Fatigue.	Chainsaw and equipment operators shall be given ample rest breaks.		**M**
	Insect bites/West Nile Virus.	Wear personal protective equipment (PPE) and tape joints to keep insects away from the skin. Use protective insect repellents containing N,N-Diethyl-m-toluamide, such as, 3M Ultrathon or equivalent and clothing insecticide preparations containing permethrins (Repel Permanone or equivalent) to prevent insect bites. Check limbs/body for insects/insect bites before showering. Notify Site Safety and Health Officer (SSHO) of flu-like symptoms.	06.D.01	**L**
	Contact dermatitis and poison ivy.	Check around work areas to identify if poison ivy is present. Wear long-sleeve shirts/trousers or Tyvek® coveralls to avoid skin contact with plants or other skin irritants. Learn to identify poisonous plants. Avoid unnecessary clearing of plant/vegetation areas. Cover vegetation with plastic (visqueen) where sampling position raises exposure potential. Apply protective cream/lotion to exposed skin to prevent poison ivy or similar reactions. Identify workers who are known to contract poison ivy.	06.D.03	**L**
	Severe weather.	The UXOSO will monitor weather conditions each day in order to plan and prepare for hazardous conditions. Work activities will be suspended prior to weather conditions becoming hazardous so that workers have ample time to seek shelter. Upon seeing lightning or hearing thunder, outdoor activities shall be suspended and personnel shall be evacuated to safe areas (inside vehicles, buildings, or shelters as appropriate). Follow procedures outlined in the APP.	06.I	**L**
	Hazardous atmospheres.	Personnel shall immediately notify the UXOSO if odors are detected.		**L**
	Heat stress and cold stress.	Follow procedures outlined in the Site Safety and Health Plan.	06.I	**M**
	Dust.	Dust shall be monitored and controlled. PPE use is required when working in contaminated areas and dust levels exceed action levels..	28	**L**
	Fire.	Smoking shall be permitted in designated areas. Vehicles shall not be parked in tall dry grass. Engines shall be shut off before refueling. A 10 pound A:B:C:fire extinguisher shall be available when refueling. Smoking shall not be permitted near fueling areas. Gasoline shall be stored in safety cans with flash arrestors and spring-loaded vents.	09.E.01 09.A.06 09.B.08	**L**

Equipment to be Used	Training Requirements/Competent or Qualified Personnel Name(s)	Inspection Requirements
Personal Protective Equipment - Level D - Modified: Hard Hat Safety Glasses Safety-Toed Boots Work Gloves ANSI Class 2 reflective warning vests Disposable coveralls and protective gloves (when contact with irritating plants possible) Helmet systems for chain saw use Protective chaps for chain saw use Hearing protection Equipment: Magnetometers Geophysics Instruments Excavator or Bush Hog Equipped Skid Steer Fire Extinguishers Emergency Eyewash First Aid Kit Deep-Woods Off or Ultrathon Repel Permanone Drinking water Weather radio or AM/FM radio Chain saws Extra chains 2-way radios	Training Requirements: Site safety orientation UXO Technicians must be qualified IAW DDESB TP 18 Applicable AHAs HAZWOPER 40-Hour MEC Awareness Qualified equipment operators Lifting/back safety Fire extinguisher use Biological hazard identification and control Emergency procedures National Lightning Safety Institute Lightning Safety Procedures Competent persons William Wren and David Coe	Daily site safety inspection by competent person (UXOSO) – William Wren Daily site safety inspection by competent person (SUXOS) – David Coe Check Known Allergies Questionnaire Housekeeping (daily) Fire extinguisher (weekly) Vehicle inspection daily Overhead and underground utilities Mechanized equipment (U.S. Army Corps of Engineers form prior to use) Mechanized equipment (daily) Equipment and tools inspection daily and before use Survey areas for poisonous plants, insects, and animals Check body for ticks Monitor approaching storms

Activity Hazard Analysis (AHA)

Activity/Work Task: Monitoring Well Installation	Overall Risk Assessment Code (RAC) (Use highest code)	**M**
Project Location: Seneca Army Depot Activity, NY, MEC Clearance at OD Grounds	**Risk Assessment Code (RAC) Matrix**	
Contract Number: W912DY-10-D-0014 DO 005	**Severity** / **Probability**	
Date Prepared: 03-09-12	Frequent / Likely / Occasional / Seldom / Unlikely	
Prepared by (Name/Title): Winston D Russell/H&S Manager	Catastrophic: **E** **E** **H** **H** **M**	
	Critical: **E** **H** **H** **M** **L**	
Reviewed by (Name/Title): William Wren/UXOSO	Marginal: **H** **M** **M** **L** **L**	
	Negligible: **M** **L** **L** **L** **L**	
Notes: (Field Notes, Review Comments, etc.) This AHA serves as certification of hazard assessment.	Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)	
	"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom, or Unlikely.	**RAC Chart**
	"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible	**E = Extremely High Risk** **H = High Risk**
	Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.	**M = Moderate Risk** **L = Low Risk**

Job Steps	Hazards	Controls	RAC
Travel on and off project site (vehicular).	Vehicle Operation.	See AHA "Vehicle Operations."	**M**
Arrival of new personnel at site. Identify overhead and underground utilities. Set up and inspect specialty equipment. Operate equipment. Drill/bore holes. Install well casings. Place filter pack, seals, and grout. Provide surface completion. Develop well.	Newly hired personnel and visitors. Unfamiliarity with: site, general (chemical, physical, environmental) site hazards, project safety rules and hazard control procedures, chain of command, and emergency procedures.	All personnel working in hazardous, toxic, and radioactive waste (HTRW) areas (well drilling into contaminated water) shall submit Hazardous Waste Operations and Emergency Response (HAZWOPER) training certificates (40-hour, 8-hour refresher [if applicable], 8-hour supervisor [if applicable]) to the UXOSO. All personnel shall attend a site safety orientation. After personnel are trained in the contents of the Accident Prevention Plan (APP) and the Site Safety and Health Plan (SSHP), they shall sign the APP Acknowledgment Form and the SSHP Acknowledgment Form. All training certifications held by personnel shall also be made available and kept in on-site personnel files. Review emergency procedures and evacuation plans. Personnel who may participate in intrusive activities shall attend Munitions and Explosives of Concern (MEC) Awareness training.	**M**

Job Steps	Hazards	Controls	RAC
See job steps above.	Medical qualifications and hearing conservation.	All personnel working in HAZWOPER-regulated areas shall submit current physician's certificate stating that employee is participating in an appropriate medical surveillance program meeting Title 29, Code of Federal Regulations (CFR), §1910.120. Documentation of an annual audiogram for each site employee whose noise exposures may equal or exceed an 8-hour time-weighted average sound level (TWA) of 85 decibels measured on the A scale is required to be submitted to the UXOSO prior to beginning work on site.	**L**
	Medical emergencies.	All personnel should complete the Voluntary Allergy/Sensitivity/Medical Questionnaire.	**L**
	Complacency.	All personnel shall attend the morning safety meetings to re-focus themselves to hazards, emergency procedures and equipment, operational aspects, and change(s) in site/work conditions. Recommended control measures for the hazards shall be part of the discussion.	**M**
	Failure to properly plan daily activities.	A Job Safety Analysis (JSA), as required by Shaw Environmental & Infrastructure Group (Shaw E&I) Procedure No. EIG-HS-045, "Job Safety Analysis," shall be prepared by the crew prior to commencing daily activities. The JSA shall be used as a component of the morning Tailgate Safety Meeting. The JSA shall be revised at any time throughout the workday when new tasks are initiated, unforeseen circumstances arise, or if working conditions change. Personnel shall implement Hazard Assessment Resolution Process.	**M**
	Heavy lifting, strains, and sprains.	Proper lifting techniques shall be used. No individual worker is permitted to lift any object that weighs over 60 pounds. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 60-pound limit.	**M**
	Fire.	Fire extinguishers shall be available in work areas. The UXOSO shall establish smoking areas. Smoke only in designated areas. Only discard cigarette butts in proper receptacles – never discard cigarette butts onto the ground. Smoking shall not be permitted within 50 feet of fueling operations. Use caution with vehicle exhaust systems in grassy areas. Do not run vehicles while parked in grassy areas. Engines shall be shut off before refueling. Follow AHA 13.0, "Fueling Operations."	**L**

Job Steps	Hazards	Controls	RAC
See job steps above.	Overhead utilities.	Before equipment is moved, the travel route shall be surveyed for overhead and terrain hazards. The minimum distances from electrical lines must be observed. Power lines shall be assumed to be energized unless verified to be de-energized and visibly grounded. Operation beneath a power line that has not been verified as de-energized and grounded must maintain clearance distances stated above. A high-visibility elevated warning line or barricade shall be erected at the minimum approach distance. Each work crew member shall be trained in the electrocution hazards and emergency procedures associated with energized power lines.	**M**
	Underground utilities.	Follow the procedure for intrusive activities in the SSHP. Follow Shaw E&I Procedure No. EIG-HS-308, "Underground/Overhead Utility Contact Prevention." The Pre-Boring/ Checklist (Form EIG-HS-308.02) must be completed for each boring. Utilities shall be located and marked prior to commencing intrusive activities. The New York One Call Law must be followed. Retain a copy of mark-out ticket for documentation purposes and QC purposes. Documentation of utility mark-out must be completed using the Utility Mark-out Documentation form (EIG-HS-308.03). No boring work is to be performed until all utility mark-outs are verified. Intrusive activities may not proceed until an Intrusive Activities Permit has been issued by the Site Manager and UXOSO. All borings must be hand dug to 5 feet.	**M**
	Slips, trips, and falls.	Understand the hazard of slips, trips, and falls – consider the consequences. Do not jump from equipment or elevated surfaces. Clean-up work areas throughout the day and at the end of each workday. Use three-point contact rule for entering/exiting vehicles, trucks, and equipment.	**M**

Job Steps	Hazards	Controls	RAC
		Use hand rails and other stationary objects (door frames, door knobs, steering wheels, walls, etc) to increase stability. Use extra caution when walking on wet, muddy, frosty, icy, or snow-covered surfaces. Increase your awareness, keep alert, stay focused, and know your environment. Provide warning signs or cordon off areas where necessary. Consider postponing work as necessary and feasible. Avoid slippery areas when possible. Stay away from slopes, hills, and grades. Be cautious when using stairs. Remove snow and ice when possible (shoveling, chipping, and salt application). Apply traction aids, such as sand, gravels, and straw. Choose footwear wisely. Slow down - take smaller steps. Lower your center of gravity when necessary. Maintain proper illumination in work areas. Fall protection must be provided and used when personnel are exposed to fall hazards greater than 6 feet.	
See job steps above.	Hand injuries.	Items to be handled shall be inspected for sharp edges, splinters, burrs, rough surfaces, etc. prior to being handled. Personnel shall wear leather gloves when handling materials with sharp edges, splinters, burrs, rough surfaces, etc. Personnel shall be aware of and avoid pinch point hazards.	**L**
	Contaminated water.	Avoid physical contact with contaminated water. Additional personal protective equipment use is required when contact with	**M**

Job Steps	Hazards	Controls	RAC
		contaminated water is possible/probable. Perform air monitoring when contaminated groundwater has been brought to the surface. Maintain personal hygiene and perform decontamination. Personnel who sustain skin contact shall immediately wash the affected area with soap and water (eyes should be irrigated for 15 minutes with potable water) and report the incident to the UXOSO. Decontaminate equipment in accordance with the Work Plan..	
See job steps above.	Use of mechanical equipment.	Only qualified personnel shall be permitted to operate equipment. Forklift operators must be licensed. Mechanical equipment shall be inspected daily. Deficiencies in equipment shall be noted on the inspection form. Equipment found to be unsafe shall be taken out of serviced. Equipment operators shall wear safety belts and hearing protection (as necessary). All equipment shall be operated at safe speeds and in a safe manner. Ground personnel shall not position themselves between equipment and stationary objects (stay out of swing radius). Personnel are only permitted to approach equipment after a signal from the operator.	**M**
See job steps above.	Injury from drill rig use.	A copy of the drill rig manual shall be available at the job site. All components of the rig that has a direct bearing on the safety of the operation shall be inspected at the beginning of each shift and when possible, observed during operation. Do not use rig if it is not in a safe operating condition. The rig shall be positioned in a level fashion with stands and outriggers set. All guards for moving machinery shall be in place. Be aware of pinch-point hazards and work in a manner to prevent injuries. Keep hands out of areas that may present a pinching hazard and personnel shall not position themselves between equipment.	**M**

Job Steps	Hazards	Controls	RAC
		Crewmembers shall not wear loose coveralls, clothing, or jewelry. The operator shall verbally alert employees and visually ensure employees are clear from dangerous parts of equipment prior to starting or engaging equipment.operator Be aware of and avoid hot surfaces from heat generated from engine and rope friction (such as cathead). Drilling equipment shall be equipped two easily accessible emergency shutdown devices, one for the operator and one for the helper. All crewmembers, including geologists, shall know the location and operation of the kill switches. Augers shall be equipped with an auger guard or position sensor brake. Drill rods shall be neither run nor rotated through rod slipping devices: no more than one foot of drill rod column shall be hoisted above the top of the drill mast. Drill rod tool joints shall not be made up, tightened, or loosened while the rod column is supported by a rod slipping device. Clean augers or other tools only when rotating/actuating mechanisms are in neutral and stopped. Use long handle shovels to remove cuttings from augers.	
	Struck by and against (vehicles and equipment)	Wear PPE with high visibility vests when walking or working near moving equipment or vehicles. Personnel shall not be permitted in the swing radius of the equipment. Personnel shall maintain a safe distance from operations. Do not assume equipment and vehicle operators have seen you unless operator have made eye contact with you and signaled to you.	**M**
	Electrical.	GFCIs shall be used on all power tools and extension cords. Extension cords, power tools, and lighting equipment shall be inspected before each use, protected from damage, and kept out of wet areas. The extension cords amp rating will exceed the sum of amp ratings of	**M**

Job Steps	Hazards	Controls	RAC
		equipment connected to them. Only qualified electricians are permitted to work on electrical circuits. Electricians must follow NFPA 70 E (2009) when working on electrical circuits.	
See job steps above.	Injury from use of tools.	Select the proper tool – do not improvise. Inspect all power and hand tools before each use (do not use damaged tools). Tools shall be appropriate for the task and maintained in good condition. Check your position, footing, and grip before tool use. Avoid distraction, keep your focus, and concentrate on the job. Personnel shall maintain a steady pace when using tools and take adequate rest periods. Keep electric cords untangled and out of the way of rotating tools. Use double-insulated power tools when possible. Protect electric tools with ground-fault circuit interrupters (GFCIs).	**M**
	Open borings.	The boring/well shall be covered, secured, and flagged when work is not in progress.	**L**
	Dust.	Control dust by maintaining equipment operation rates. Control dust by applying water. Personnel shall stay out of dust and work from upwind when possible. Perform dust monitoring to verify dust control is effective.	**L**
	Use of operational chemicals.	Read and follow MSDS for each chemical used. Do not use any chemical that you have not been trained to safely use. Provide ventilation as necessary. Properly label all containers.	**L**

Job Steps	Hazards	Controls	RAC
See job steps above.	Use of portable generators.	Review operator manual before use. Keep the generator dry and do not use in rain or wet conditions. Dry your hands (if wet) before touching the generator. Use a heavy duty, outdoor-rated extension cord that is rated (in watts or amps) at least equal to the sum of the connected appliance loads (S, ST, SO, STO, SJ, SJO, SJT, SJOT). Check that the entire cord is free of cuts or tears and that the plug has all three prongs, especially a grounding pin. Check operator's manual for generator grounding requirements, if any. Before refueling the generator, turn it off and let it cool down. Gasoline spilled on hot engine parts could ignite. Do not use portable generators in areas with dry grass unless area has been adequately cleared of the grass. A 4-A:80-B:C fire extinguisher shall be readily available in locations where a generator is being used. Use hearing protection when working near a generator. Use proper lifting procedures when moving portable generators. Do not use indoors or in areas with poor ventilation without performing air monitoring for carbon monoxide.	**M**
	Noise.	All personnel shall wear hearing protection when exposed to high noise levels. All personnel shall wear hearing protection when operating powered hand tools or noisy equipment. Personnel working in vicinity of noisy tools or equipment shall wear hearing protection. Noise dosimetry shall be performed to verify hearing protection is adequate.	**L**

Job Steps	Hazards	Controls	RAC
See job steps above.	Welding, cutting, and grinding or any other operation producing spark or ignition sources (hot work).	Only qualified personnel shall operate welding and cutting equipment. A Hot Work permit must be available and properly completed. Welder helmets, tinted cutting goggles, aprons, leathers, and gloves shall be available and utilized for welding and cutting operations. Faceshield must be worn for all grinding operations. Remove dry grasses from areas where hot work will be performed. Do not perform hot work when conditions are dry and windy. Combustible materials must be protected from slag, heat, and sparks. All torch valves and gas supplies must be shut off when work is suspended. Oxygen cylinders in storage and fuel gases shall be separated by a fire resistive wall or by a distance of 20 feet. All oxygen-fuel gas cutting or welding shall be equipped with reverse-flow check valves between torch & hoses. Inspect the hoses for defects before each use. All pressure gauges and regulators shall be in proper working order. Inspect welding equipment daily. The electric welding unit shall be shutdown when leads are unattended. Frames of electric powered welders shall be grounded. Workers and the public shall be shielded from rays, flashes, sparks, molten metal and slag. Identify all hot surfaces with signs or tags to protect workers from burns. Provide a fire watch equipped with a fire extinguisher for at least 1-hour after hot work has been completed.	**M**

Job Steps	Hazards	Controls	RAC
See job steps above.	Use of pumps and hoses.	Understand the injury potential when using pumps and associated equipment. Review operator's manual for recommended operating procedures. Utilize appropriate PPE and always wear safety glasses and face shield when disconnecting hoses. Monitor for carbon monoxide from exhaust in areas with limited ventilation. Keep away from hot exhaust and hot surfaces. Use proper lifting procedures for pumps and hoses. Get help as necessary. Maintain control of hose ends when moving hoses to prevent striking self or other workers. Secure hoses with lashing to prevent whipping - do not allow hoses to whip. Identify and avoid pinch points. Secure cam lock fittings with safety clips/ties.	**M**
	Insect bites and stings.	Review injury and illness potential with workers. Inspect work areas for bee nests and activity prior to commencing work in that area. Wear PPE, such as disposable coveralls, to keep insects away from the skin. Expect to encounter insects when working in warm weather – especially at locations with vegetation present. Use protective insect repellents containing DEET (Deep Woods Off) to prevent insect bites, unless individual allergies and sensitivities prevent its use. Consider applying Permethrin (Repel Permanone or equivalent) preparations to clothing to repel ticks, chiggers, mosquitoes, and/or spiders. Check limbs/body for insects/ insect bites upon removing PPE and again during showering. Immediately notify supervisor or UXOSO of insect bites, stings, irritations, rashes, or flu-like symptoms.	**L**

Job Steps	Hazards	Controls	RAC
See job steps above.	Contact dermatitis from poisonous and irritating plants (poison ivy, poison oak, and poison sumac).	Learn to identify poisonous and irritating plants. Check around work areas to identify if poisonous and irritating plants are present. Identify workers who are known especially sensitive to poisonous and irritating plants and plan work accordingly. Wear Tyvek® coveralls to avoid skin contact with irritating plants. Immediately notify the UXOSO if you suspect you contacted an irritating plant. Avoid unnecessary clearing of plant/vegetation areas. Follow additional procedures outlined in the SSHP.	**L**
	Severe weather.	Anchor trailers to prevent tip-over from wind. The UXOSO to monitor weather conditions each day in order to plan and prepare for hazardous conditions. The UXOSO and SSR to identify the nearest suitable storm shelter at each work location. Work activities will be suspended prior to weather conditions becoming hazardous so that workers have ample time to seek shelter. Upon seeing lightning or hearing thunder, outdoor activities shall be suspended and personnel shall be evacuated to safe areas (inside vehicles, buildings, or shelters as appropriate). Follow additional procedures outlined in the SSHP.	**M**
	Heat stress.	Allow several days for workers to acclimatize to elevated ambient temperatures. Monitor for heat stress and perform physiological monitoring in accordance with the requirements of the SSHP. Drink plenty of water when under heat stress conditions (~ 1 quart per hour). Provide for adequate electrolyte replacement. Personnel shall take required breaks to cool down as needed. Provide shade or shelter during rest periods.	**M**

Job Steps	Hazards	Controls	RAC
See job steps above.	Cold stress.	Workers should dress in layers in response to the conditions. Monitor for cold stress in accordance with the requirements of the SSHP. Drink warm beverages when under cold stress conditions , but avoid caffiene. Personnel shall take required breaks to warm up as needed. Provide heated areas for rest periods.	**L**

Equipment to be Used	Training Requirements/Competent or Qualified Personnel Name(s)	Inspection Requirements
<u>Personal Protective Equipment</u> Hard Hat Safety Glasses with side shields Safety-Toed Boots Work Gloves Class 2 high visibility vests Hearing protection, as necessary Welding and cutting hazards - refer to SSHP. Fall protection - working at heights > 6’ <u>Other Equipment</u>: Aerosol monitor Fire Extinguishers First Aid Kit GFCI Heavy duty extension cords Drinking water Weather radio Insect repellant	Training Requirements (as determined by the UXOSO): HAZWOPER 40-Hour Site safety orientation Emergency procedures Hazard communication Hearing conservation MEC awareness Applicable AHAs Qualified equipment operators Qualified forklift operator Lifting/back safety Ladder use Fall protection Fire extinguisher use Biological hazard identification and control Lightning safety procedures Heat stress prevention and heat stroke treatment Cold stress prevention Competent persons William Wren and David Coe	Daily site safety inspection by competent person (UXOSO) – William Wren Daily site safety inspection by competent person (SUXOS) – David Coe Mechanized equipment (U.S. Army Corps of Engineers form prior to use) Mechanized equipment (daily) Overhead utilities (prior to operating equipment in area) Locate underground utilities (prior to intrusive activities) Drilling Equipment Operations Inspection Checklist - Pre-Mobilization and Mobilization: to be completed by the drilling contractor prior to/upon mobilization to the project site. Drilling Equipment Operations Inspection Checklist - Weekly Drilling Equipment Operations Inspection Checklist – Daily: to be completed daily by the drilling contractor. Rigging (before each use) Housekeeping (daily) Vehicle inspection (daily) Equipment and tools inspection (daily and before use) Survey areas for poisonous plants, insects, and animals(each work area) Check body for ticks (each evening during tick season)

Activity Hazard Analysis (AHA)

Activity/Work Task: Ash Handling & Burning Operations	Overall Risk Assessment Code (RAC) (Use highest code)	**M**
Project Location: Seneca Army Depot Activity, NY, MEC Clearance at OD Grounds	**Risk Assessment Code (RAC) Matrix**	
Contract Number: W912DY-10-D-0014 DO 005	**Severity** / **Probability**	
Date Prepared: 03-09-12	Frequent / Likely / Occasional / Seldom / Unlikely	
Prepared by (Name/Title): Winston D Russell/H&S Manager	Catastrophic: **E** **E** **H** **H** **M**	
	Critical: **E** **H** **H** **M** **L**	
Reviewed by (Name/Title): William Wren/UXOSO	Marginal: **H** **M** **M** **L** **L**	
	Negligible: **M** **L** **L** **L** **L**	
Notes: (Field Notes, Review Comments, etc.) This AHA serves as certification of hazard assessment.	Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)	
	"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom, or Unlikely.	**RAC Chart**
	"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible	**E = Extremely High Risk** **H = High Risk**
	Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.	**M = Moderate Risk** **L = Low Risk**

Job Steps	Hazards	Controls	RAC
Travel on and off project site (vehicular).	Vehicle Operation.	See AHA for Vehicle Operations	**M**
Arrival of new personnel at site. Movement of personnel on-site. Prepare for daily operations. Set-up for daily operations. Perform daily operations. Perform inspections. Perform observations. Provide supervision. Handle equipment and materials.	Newly arriving personnel and visitors. Unfamiliarity with: site, general (chemical, physical, environmental) site hazards, project safety rules and hazard control procedures, chain of command, and emergency procedures.	All personnel working on hazardous, toxic, and radioactive waste (HTRW) shall submit HAZWOPER training certificates (40-hour, 8-hour [if applicable], supervisor [if applicable]) to the UXOSO. All personnel shall attend a site safety orientation. All training certifications held by personnel shall also be made available and kept in on-site personnel files. Review emergency procedures and evacuation plans. All site personnel will attend the safety orientation and be certified to be able to wear their assigned respirator.	**M**
Burning of Incendiary munitions, bulk HE or other non-fragmentation munitions.	Medical qualifications.	All personnel working onsite shall submit current physician's certificate stating that employee is participating in an appropriate medical surveillance program meeting 29 Code of Federal Regulations (CFR) §1910.120 and is qualified to wear respirators.	**L**

Job Steps	Hazards	Controls	RAC
See principle job steps above.	Complacency.	All personnel shall attend the daily Tailgate Safety meetings to re-focus themselves to hazards, emergency procedures and equipment, operational aspects, and change(s) in site/work conditions. Procedures shall be conveyed to control these hazards.	**M**
	Failure to properly plan daily activities.	A Job Safety Analysis (JSA), as required by Shaw Procedure HS045, "Job Safety Analysis (JSA)," shall be prepared by the crew prior to commencing daily activities. The JSA shall be used as a component of the morning Tailgate Safety Meeting. The JSA shall be revised at any time throughout the workday when new tasks are initiated, unforeseen circumstances arise, or if working conditions change. Personnel shall implement Hazard Assessment Resolution Program.	**M**
	Heavy lifting, strains, and sprains.	No individual employee is permitted to lift any object that weighs over 60 pounds. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 60-pound limit. Burn pans will only be moved utilizing mechanical lifting equipment.	**M**
	Slips, trips, and falls.	Keep work areas clear and maintain housekeeping. Do not jump from equipment or elevated surfaces. Daily housekeeping will be implemented at the end of each workday. Use three-point contact rule for entering/exiting trucks and equipment. Use extra caution when walking on wet, muddy, surfaces. Maintain proper illumination in work areas.	**M**
	Use of mechanical equipment.	Only qualified personnel shall be permitted to operate equipment. Mechanical equipment shall be inspected daily. Deficiencies in equipment shall be noted on the inspection form. Equipment found to be unsafe shall be taken out of serviced. All equipment shall be operated at safe speeds and in a safe manner. Equipment operators shall wear safety belts and hearing protection (as necessary). A qualified UXO Safety Observer will be utilized whenever moving munitions or munitions debris. Ground personnel shall not position themselves between equipment and stationary objects (stay out of swing radius). Personnel are only permitted to approach equipment after a signal from the operator.	**M**
	Hand injuries.	Items to be handled shall be inspected for sharp edges, splinters, burrs, rough surfaces, etc. prior to being handled. Personnel shall wear chemical resistant gloves with cut-resistant liners when handling munitions and materials with sharp edges, splinters, burrs, rough surfaces, etc. Personnel shall be aware of and avoid pinch point hazards.	**L**
.	Fire.	Fire extinguishers shall be available in work areas. The UXOSO shall establish smoking areas. Smoke only in designated areas. Only discard cigarette butts in proper receptacles – never discard cigarette butts onto the ground. Engines shall be shut off before refueling. A 20-A:B:C fire extinguisher shall be available when refueling at the project site.	**L**

Job Steps	Hazards	Controls	RAC
See principle job steps above	Insect bites and stings.	Review injury and illness potential with workers. Inspect work areas for bee nests and activity prior to commencing work in that area. Expect to encounter insects when working in warm weather – especially at locations with vegetation present. Use protective insect repellents containing DEET to prevent insect bites, unless individual allergies and sensitivities prevent its use. Check limbs/body for insects/ insect bites upon removing PPE and again during showering. Immediately notify supervisor or UXOSO of insect bites, stings, irritations, rashes, or flu-like symptoms.	**L**
	Severe weather, heat stress, or cold stress.	The UXOSO will monitor weather conditions each day in order to plan and prepare for hazardous conditions. The UXOSO will identify a suitable storm shelter at each work location. The UXOSO will verify that the storm shelter is accessible and available. Work activities will be suspended prior to weather conditions becoming hazardous so that workers have ample time to seek shelter. Upon seeing lightning or hearing thunder, outdoor activities shall be suspended and personnel shall be evacuated to safe areas (inside vehicles, buildings, or storm shelters as appropriate). Monitor for heat stress in accordance with Shaw Procedure HS400, “Heat Stress” and the requirements of the SSHP. Monitor for cold stress in accordance with Shaw Procedure HS401, “Cold Stress” and the requirements of the SSHP. Drink plenty of water and minimal carbonated or caffeine-containing beverages. Perform physiological monitoring as needed. Personnel shall take required breaks to cool down/warm-up as needed. Personnel shall wear insulated clothing based the ambient temperature and wind chill conditions. Burning Operations will be suspended if heavy rains are expected, winds exceed 15 mph, or the wind direction is blowing toward operations personnel.	**L**
	Struck by and against: • Vehicles • Equipment • Flying debris/projectiles • Splashes.	Wear PPE with high visibility vests when walking or working near moving equipment or vehicles. Stay off roads and streets unless necessary; walk on left side of roads facing on-coming traffic. Personnel shall not be permitted in the swing radius of the equipment. Personnel shall maintain a safe distance from operations. Do not assume equipment and vehicle operators have seen you unless operator has made eye contact with you and signaled to you. Warning signs and signalmen may be necessary.	**M**
	Use of operational chemicals.	Read and follow MSDS for each chemical used. Do not use any chemical that you have not been trained to safely use. Wear proper PPE. Properly label all containers.	**L**
	Noise.	All personnel shall wear hearing protection when exposed to high noise levels. All personnel shall wear hearing protection when operating powered hand tools or noisy equipment. Personnel working in vicinity of noisy tools or equipment shall wear hearing protection. Noise dosimetry shall be performed to verify hearing protection is adequate.	
	Electrical.	Ground-fault circuit interrupters shall be used on all power tools and extension cords. Extension cords, power tools, and equipment shall be inspected before each use, protected from damage, and kept out of wet areas. Only qualified electricians are permitted to work on electrical circuits.	**M**

Job Steps	Hazards	Controls	RAC
		Electricians must follow NFPA 70 E (2009) when working on electrical circuits.	
See principle job steps above.	Tools.	Select the proper tool – do not improvise. Inspect all power and hand tools before each use (do not use damaged tools). Tools shall be appropriate for the task and maintained in good condition. Only trained and authorized personnel will use hand and power tools. Check your position, footing, and grip before tool use. Avoid distraction, keep your focus, and concentrate on the job. Personnel shall maintain a steady pace when using tools and take adequate rest periods. Keep electric cords untangled and out of the way of rotating tools. Use double-insulated power tools when possible. Protect electric tools with ground fault circuit interrupters (GFCI). Minimum PPE will include safety glasses with side-shields, hard hat, safety-toed work boots, and cut-resistant gloves. Store tools carefully to prevent damage to them and to make the proper tool easier to locate.	**M**
Burning Operations	Accidental Fires	Burns will be observed until the burning diminishes, at which time the SUXOS will secure the area for the prescribed waiting period.	**M**
See principle job steps above.	Physical Burns	No less than the prescribed waiting periods will be observed to allow complete consumption of material has taken place. The following minimum waiting times are: • Incendiaries – 24 hours • Bulk HE – 4 hours Waiting times begins after all evidence of burning ceases. If, on approach to the burn pan the demolition team leader sees indications that the burn continues, such as smoke or flames, an additional 8-hr wait will be observed.	**M**
	Misfires	In the event the fuel and dunnage fails to ignite the burn pan, a 60-minute wait will be observed. At that time the following steps will take place: • A Misfire Checklist will be completed by the Demolition Team Leader. • Resume burning operations.	**M**
	Chemical Exposure to Post-burn Residue (metals i.e., cadmium)	Prior to clean out the burn pan, personnel involved in the cleanout operations will moisten the ash to reduce particulate emission. If dust reduction is not effective, personnel wear a minimum of Level C PPE for this operation. The following will be performed during the cleanout operations: • All ash will be vacuumed from the burn pan and drummed for later characterization. • All metal components and remainders of MPPEH will be inspected and placed in a locked container pending MDAS certification. • Any MEC which cannot be certified will be subjected to further burning. • The burn pan will be inspected by the demolition team leader, and if clean, placed back into service.	**M**

Equipment to be Used	Training Requirements/Competent or Qualified Personnel Name(s)	Inspection Requirements
Personal Protective Equipment Modified Level D: Refer to SSHP and APP. Equipment: Portable water sprayers Fire Extinguishers Emergency Eyewash First Aid Kit Drinking water Weather radio 2-way radios	Competent Person (CP) / Qualified Person (QP): Training Requirements (as determined by UXOSO): UXO personnel are EOD/UXO trained HAZWOPER 40-Hour Site safety orientation Emergency procedures Hazard communication Applicable AHAs Qualified equipment operators Lifting/back safety Fire extinguisher use Biological hazard identification and control Storm shelter location Lightning safety procedures All site personnel will attend safety orientation and be certified to be able to wear their assigned respirator. Competent persons William Wren and David Coe	Daily site safety inspection by competent person (UXOSO) – William Wren Daily site safety inspection by competent person (SUXOS) – David Coe Check Known Allergies Questionnaire, training, and medical certifications against personnel roster Mechanized equipment initial inspection Mechanized equipment (daily) Housekeeping (daily) Fire extinguisher (weekly) Vehicle inspection daily Equipment and tools inspection daily and before use Verify weather no less than twice a day and prior to commencing burn operations

Activity Hazard Analysis (AHA)

Activity/Work Task: MEC Demolition Operations	Overall Risk Assessment Code (RAC) (Use highest code)	**M**
Project Location: Seneca Army Depot Activity, NY, MEC Clearance at OD Grounds	**Risk Assessment Code (RAC) Matrix**	
Contract Number: W912DY-10-D-0014 DO 005	**Severity** / **Probability**	
Date Prepared: 03-09-12		
Prepared by (Name/Title): Winston D Russell/H&S Manager		
Reviewed by (Name/Title): William Wren/UXOSO		
Notes: (Field Notes, Review Comments, etc.)		

Severity	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom, or Unlikely.

"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible

Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.

RAC Chart

- **E = Extremely High Risk**
- **H = High Risk**
- **M = Moderate Risk**
- **L = Low Risk**

Job Steps	Hazards	Controls	EM 385-1-1	RAC
Arrival of new personnel at site.	Unfamiliarity with: site, general site hazards, project safety rules, chain of command, and emergency procedures.	All personnel shall attend the site orientation training.	01.B.03 01.E.01 28	**M**
Munitions and Explosives of Concern (MEC) demolition operations.	Poor planning.	Complete Job Safety Analysis for each task, as specified in Shaw Environmental & Infrastructure, Inc. Procedure No. HS045, "Job Safety Analysis (JSA)." Use Hazard Assessment Resolution Program frequently – for each task to be completed.		**M**
	Heavy lifting, strains, and sprains.	No individual employee is permitted to lift any object that weighs over 60 pounds. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 60-pound limit.	14.A.01	**M**
	MEC/Unexploded Ordnance (UXO).	Use only UXO personnel qualified in accordance with Department of Defense Explosives Safety Board Technical Paper 18, Minimum Qualifications for UXO Technicians and Personnel. UXO Technicians shall be present during demolition operations. Minimum separation distances will be established in accordance with approved ESS.	01.B.01 33.A.01 33.A.02 33.A.03	**M**
	Blast overpressure fragmentation blast.	Minimum separation distances will be established for demolition based on the maximum horizontal fragmentation distance of the munition with the greatest fragmentation distance as indicated in the approved Work Plan. Follow ESS.	33.A.01 33.A.02 33.A.03	**M**

Job Steps	Hazards	Controls	EM 385-1-1	RAC
MEC demolition operations (continued).	MEC disposal operations - accidental detonation of MEC.	Observe UXO safety precautions contained in U.S. Army Corps of Engineers, Huntsville Center (CEHNC) Safety Concepts and Basic Considerations for MEC Operations. Observe procedures outlined in EOD/TM/TO 60A-1-1-31.	33.A.01 33.A.02 33.A.03	**M**
	Transportation of explosive materials - accidents during transportation of explosive materials.	Drivers operating will be licensed in accordance with federal, state, and local regulations. Vehicles transporting explosives off-road will not exceed 25 miles per hour. Chock wheels when loading or unloading donor explosives. Drivers will observe all posted speed limits while operating a motor vehicle on a public roadway.	29.B	**M**
	Transportation of explosive materials -accidental detonation of explosives.	Explosives will be transported in accordance with 49 Code of Federal Regulations, Parts 100-199. Refer to Explosives Management Plan in Remedial Investigation Work Plan. Explosives will be transported in closed vehicles whenever possible. Observe the CEHNC, Safety Concepts and Basic Considerations for MEC Operations. When using an open vehicle, explosives will be covered with a flame resistant tarpaulin. Motor vehicles will be shut off when loading/unloading explosives. Beds of vehicles will have a nonconductive bed liner, dunnage, or sand bags to protect the explosives from contact with the metal bed and fittings. Initiating explosives, such as blasting caps, will remain separated at all times. Each vehicle used for the transport of donor explosives will be outfitted with a fire extinguisher and first aid kit. Do not fuel trucks when loaded with donor explosives. No donor explosives allowed in passenger compartment of vehicle. No smoking in or around a vehicle containing donor explosives.	29.B 33.A.01 33.A.02 33.A.03	**M**
	Storage of explosive materials - accidental detonation of explosives.	Materials will be stored in accordance with federal, state and local regulations. Refer to Explosives Management Plan, and Explosives Siting Plan in the Remedial Investigation Work Plan. Observe the CEHNC, Safety Concepts and Basic Considerations for MEC Operations.	29.A.22	**M**
	Access survey of ingress/egress route - accidental detonation of explosives.	Survey will be conducted by a UXO team and safe routes clearly marked and delineated. Observe the CEHNC Basic Safety Concepts and Considerations for Ordnance and Explosives Operations.	33.A.01 33.A.02 33.A.03	**M**
	Slips, trips, and falls.	Keep work areas clear and maintain housekeeping. Personnel shall not jump from elevated surfaces. Personnel shall use caution when walking on rocky, slippery, or uneven terrain.	14.C.01-10	**M**
	Hand injuries.	Items to be handled shall be inspected for sharp edges prior to being handled. Personnel shall wear leather gloves when handling sharp materials. Personnel shall be aware of and avoid pinch point hazards.	05.A.08	**L**
	Insect bites/West Nile Virus.	Wear personal protective equipment (PPE) and tape joints to keep insects away from the skin. Use protective insect repellents containing N,N-Diethyl-m-toluamide, such as, 3M Ultrathon or equivalent and clothing insecticide preparations containing permethrins (Repel Permanone or equivalent) to prevent insect	06.D.01	**L**

Job Steps	Hazards	Controls	EM 385-1-1	RAC
		bites. Check limbs/body for insects/insect bites before showering. Notify Site Safety and Health Officer (SSHO) of flu-like symptoms.		
MEC demolition operations (continued).	Contact dermatitis and poison ivy.	Check around work areas to identify if poison ivy is present. Wear long-sleeve shirts/trousers or Tyvek® coveralls to avoid skin contact with plants or other skin irritants. Learn to identify poisonous plants. Avoid unnecessary clearing of plant/vegetation areas. Cover vegetation with plastic (visqueen) where sampling position raises exposure potential. Apply protective cream/lotion to exposed skin to prevent poison ivy or similar reactions. Identify workers who are known to contract poison ivy.	06.D.03	**L**
	Severe weather.	The UXOSO will monitor weather conditions each day in order to plan and prepare for hazardous conditions. Work activities will be suspended prior to weather conditions becoming hazardous so that workers have ample time to seek shelter. Upon seeing lightning or hearing thunder, outdoor activities shall be suspended and personnel shall be evacuated to safe areas (inside vehicles, buildings, or shelters as appropriate). Follow procedures outlined in the APP.	06.I	**L**
	Hazardous atmospheres.	Personnel shall immediately notify the UXOSO if odors are detected.		**L**
	Heat stress and cold stress.	Follow procedures outlined in the Site Safety and Health Plan.	06.I	**M**
	Dust.	Dust shall be monitored and controlled. PPE use is required when working in contaminated areas.	28	**L**
	Fire.	Smoking shall be permitted in designated areas. Vehicles shall not be parked in tall dry grass. Engines shall be shut off before refueling. A 10 pound A:B:C fire extinguisher shall be available when refueling. Smoking shall not be permitted near fueling areas. Gasoline shall be stored in safety cans with flash arrestors and spring-loaded vents.	09.E.01 09.A.06 09.B.08	**L**
	Public protection	Shaw will position personnel strategically outside the MCE to maintain site EZ security. Personnel shall survey the Yellow Lake and Arkansas River when applicable to the EZ. A boat may be utilized to warn public of pending detonations.	385-1-97	**M**

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
Personal Protective Equipment - Level D: Hard Hat Safety Glasses Safety-Toed Boots Work Gloves ANSI Class 2 reflective warning vests Modified Level D PPE Respiratory protection Equipment: Magnetometers Geophysics Instruments Fire Extinguishers Emergency Eyewash First Aid Kit Deep-Woods Off or Ultrathon Repel Permanone Drinking water Weather radio or AM/FM radio Hand tools Heavy equipment Donor explosives Barricades Warning signs Communication devices	Training Requirements: Site safety orientation UXO Technicians must be qualified IAW DDESB TP 18 HAZWOPER 40-Hour MEC Awareness Qualified equipment operators Lifting/back safety Fire extinguisher use Emergency procedures Biological hazard identification and control National Lightning Safety Institute Lightning Safety Procedures Training Requirements: USCG boat operator safety training Competent persons William Wren and David Coe	Daily site safety inspection by competent person (UXOSO) – William Wren Daily site safety inspection by competent person (SUXOS) – David Coe Vehicle inspection daily Explosive transporting vehicle (prior to use) Check Known Allergies Questionnaire Housekeeping (daily) Fire extinguisher (weekly) Vehicle inspection daily Overhead and underground utilities Mechanized equipment (U.S. Army Corps of Engineers form prior to use) Mechanized equipment (daily) Equipment and tools inspection daily and before use Survey areas for poisonous plants, insects, and animals Check body for ticks Monitor approaching storms

Activity Hazard Analysis (AHA)

Activity/Work Task: Operation of Earth Moving Machinery and Material Handling Equipment	Overall Risk Assessment Code (RAC) (Use highest code)	**M**
Project Location: Seneca Army Depot Activity, NY, MEC Clearance at OD Grounds	**Risk Assessment Code (RAC) Matrix**	
Contract Number: W912DY-10-D-0014 DO 005	**Severity** / **Probability**	
Date Prepared: 03-09-12		
Prepared by (Name/Title): Winston D Russell/H&S Manager		
Reviewed by (Name/Title): William Wren/UXOSO		
Notes: (Field Notes, Review Comments, etc.)		

Severity	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	**E**	**E**	**H**	**H**	**M**
Critical	**E**	**H**	**H**	**M**	**L**
Marginal	**H**	**M**	**M**	**L**	**L**
Negligible	**M**	**L**	**L**	**L**	**L**

Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom, or Unlikely.

"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible

Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.

RAC Chart

- **E = Extremely High Risk**
- **H = High Risk**
- **M = Moderate Risk**
- **L = Low Risk**

Job Steps	Hazards	Controls	EM 385-1-1	RAC
Arrival of new personnel at site.	Unfamiliarity with: site, general site hazards, project safety rules, chain of command, and emergency procedures.	All personnel shall attend the site orientation training.	01.B.03 01.E.01 28	**M**
MD removal	Poor planning.	Complete Job Safety Analysis for each task, as specified in Shaw Environmental & Infrastructure, Inc. Procedure No. HS045, "Job Safety Analysis (JSA)." Use Hazard Assessment Resolution Program frequently – for each task to be completed.		**M**
	Heavy lifting, strains, and sprains.	No individual employee is permitted to lift any object that weighs over 60 pounds. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 60-pound limit.	14.A.01	**M**
	Intrusive activities and underground utilities.	Follow procedure for Intrusive Activities Permit in Accident Prevention Plan (APP) prior to commencing excavation activities. Shaw E & I Procedure No. HS308, "Underground/Overhead Utility Contact Prevention," shall be followed.	25.A.01	**M**

Job Steps	Hazards	Controls	EM 385-1-1	RAC
MD Removal (continued).	Overhead hazards/utilities.	Overhead hazards shall be evaluated prior to moving equipment on the project site. Overhead power lines shall be shut-off and locked-out. Areas with overhead hazards shall be barricaded with caution tape to prevent contact In areas where it is not feasible to use barricades, spotters shall be provided: however, the minimum distances from electrical lines must be observed.	11.F.04	**M**
	MEC/Unexploded Ordnance (UXO).	Non-UXO personnel shall attend site-specific MEC Awareness (and recognition) Training prior to the commencement of any site activities. Use only UXO personnel qualified in accordance with Department of Defense Explosives Safety Board Technical Paper 18, Minimum Qualifications for UXO Technicians and Personnel. UXO Technicians shall be present during any activity occurring in a Munitions Response Areas (MRA). Perform all work in accordance with approved Work Plan and Explosives Site Plan (ESP) (USACE, May 2009).	01.B.01 33.A.01 33.A.02 33.A.03	**M**
	Blast overpressure fragmentation blast.	The UXO Safety Officer (UXOSO) is responsible for maintaining the minimum safe distance arcs indicated in the Work Plan for the fragmentation data sheet of the Munition with the Greatest Fragmentation Distance (MGFD) for the Munitions Response Site. Follow ESP.	33.A.01 33.A.02 33.A.03	**M**
	Accidental detonation of MEC.	Observe the requirements of Explosives Safety and Health Manual EM 385-1-97. Only UXO technicians will excavate or handle MEC. Personnel in the immediate vicinity of MEC operations will be kept to the minimum necessary for safe operations but no less than two UXO technicians. Do not subject MEC to heat, shock, or friction. Only hand excavation permitted when within one feet of MEC. Use equipment shielding when excavating and processing MD with heavy equipment. .	33.A.01 33.A.02 33.A.03	**M**
	Non-UXO personnel.	Establish minimum separation distance (MSD) based on the Hazardous Fragmentation Distance of the MGFD and maintain site control. Stop all MEC operations when non-UXO trained personnel are within the MSD arc.	28 33.A.03	**M**
	Buried hazardous materials.	Notify UXOSO and Health and Safety Manager if buried hazardous materials are encountered during excavations.		**M**
	Slips, trips, and falls.	Keep work areas clear and maintain housekeeping. Personnel shall not jump from elevated surfaces. Personnel shall use caution when walking on rocky, slippery, or uneven terrain.	14.C.01-10	**M**
	Hand injuries.	Items to be handled shall be inspected for sharp edges prior to being handled. Personnel shall wear leather gloves when handling sharp materials. Personnel shall be aware of and avoid pinch point hazards.	05.A.08	**L**

Job Steps	Hazards	Controls	EM 385-1-1	RAC
MD Removal (continued).	Use of heavy equipment.	Only qualified personnel shall be permitted to operate equipment. Heavy equipment shall be inspected daily after the initial U.S. Army Corps of Engineers inspection (and documented.) Do not use unsafe equipment. All equipment shall have backing alarms. All equipment shall be operated at safe speeds and in a safe manner. Equipment operators shall wear safety belts. Personnel are only permitted to approach equipment after a signal from the operator. Ground personnel, working near heavy equipment, shall wear high visibility conspicuity vests. Ground personnel shall not enter the swing radius of equipment. Ground personnel shall not position themselves between equipment and stationary objects. Personnel shall verify all mechanical guards are in place and functioning properly. Moving equipment shall be equipped with a back-up alarm. Mechanical excavation equipment will only be used within one foot of suspected subsurface target anomalies. All equipment shall be shut down with energies dissipated prior to performing maintenance activities - lock out/tag out procedures may apply. Only qualified mechanics shall work on or repair heavy equipment.	18.A 18.G 18.B 05.F	**M**
	Insect bites/West Nile Virus.	Wear personal protective equipment (PPE) and tape joints to keep insects away from the skin. Use protective insect repellents containing N,N-Diethyl-m-toluamide, such as, 3M Ultrathon or equivalent and clothing insecticide preparations containing permethrins (Repel Permanone or equivalent) to prevent insect bites. Check limbs/body for insects/insect bites before showering. Notify UXOSO of flu-like symptoms.	06.D.01	**L**
	Contact dermatitis and poison ivy.	Check around work areas to identify if poison ivy is present. Wear long-sleeve shirts/trousers or Tyvek® coveralls to avoid skin contact with plants or other skin irritants. Learn to identify poisonous plants. Avoid unnecessary clearing of plant/vegetation areas. Cover vegetation with plastic (visqueen) where sampling position raises exposure potential. Apply protective cream/lotion to exposed skin to prevent poison ivy or similar reactions. Identify workers who are known to contract poison ivy.	06.D.03	**L**
	Severe weather.	The UXOSO will monitor weather conditions each day in order to plan and prepare for hazardous conditions. Work activities will be suspended prior to weather conditions becoming hazardous so that workers have ample time to seek shelter. Upon seeing lightning or hearing thunder, outdoor activities shall be suspended and personnel shall be evacuated to safe areas (inside vehicles, buildings, or tornado shelters as appropriate). Follow procedures outlined in the APP.	06.I	**L**
	Hazardous atmospheres.	Personnel shall immediately notify the UXOSO if odors are detected.		**L**
	Heat stress and cold stress.	Follow procedures outlined in the APP.	06.I	**M**
	Dust.	Dust shall be monitored and controlled. Initiate engineering controls if particylate level action levels are measured.	28	**L**

Job Steps	Hazards	Controls	EM 385-1-1	RAC
MD Removal (continued).	Fire.	Smoking shall be permitted in designated areas. Vehicles shall not be parked in tall dry grass. Engines shall be shut off before refueling. A 10 pound A:B:C fire extinguisher shall be available when refueling. Smoking shall not be permitted near fueling areas. Gasoline shall be stored in safety cans with flash arrestors and spring-loaded vents. Heavy equipment shall be equipped with fire extinguishers.	09.E.01 09.A.06 09.B.08	**L**
	Exposure to potential contaminants of concern.	Air monitoring shall be performed in accordance with the SSHP. Institute engineering controls is air monitoring action levels are measured.	5 6 28	**M**
	Pressurized hydraulic hoses	All hoses and connections shall be routinely inspected.	18 20	**L**
	Rotating shafts and moving parts	All guards required by the manufacturer shall be installed and operational.	18	**L**
	Faulty conveyor equipment	Inspection, maintenance, and repairs shall be performed in accordance with the manufacturer's recommendations by qualified personnel. The entire system shall be visually inspected daily before start up.	17	**L**
	Conveyor exposure to moving parts	Systems shall be equipped witha time-delay_audible_and visual warning signal to be sounded immediately before starting of the conveyor. All conveyors shall be equipped with emergency stopping devices along their full length. The safety devices shall be designed to prevent the conveyor from restarting until the safety device is manually reset. All exposed moving machinery parts that present a hazard shall be mechanically or electrically guarded or guarded by location.	17	**M**
	Conveyor operation	Conveyor equipment shall be used to convey only those materials for which it was designed and within the rated capacities and speeds. A conveyor that could cause injury when started shall not be started until all personnel in the area are alerted by a signal or by a designated person that the conveyor is about to start. Before restarting a conveyor that has been stopped because of an emergency, an inspection of the conveyor shall be conducted and the cause of the emergency stop determined.	17	**L**
	Hoppers and chutes	All openings to the hopper and chutes shall be guarded to prevent persons from accidentally stepping into them. If guards are not practical, warning signs shall be posted.	17	**L**
	MEC processed through converor/screen	UXO personnel shall monitor throughput of material processing in the screen and conveyor system from behind a blast proof observation point. Remote emergency stop device shall be provided.	17	**M**
	Noise or acoustic trauma	All personnel working in the vicinity of processing equipment shall wear hearing protection.	17	**L**
	Fueling	All equipment shall be deenergized prior to fueling.	16	**L**

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
Personal Protective Equipment - Level D: Hard Hat Safety Glasses Safety-Toed Boots Work Gloves Hearing protection ANSI Class 2 reflective warning vests Equipment: Magnetometers Fire Extinguishers Emergency Eyewash First Aid Kit Repel Permanone Drinking water Weather radio or AM/FM radio Hand tools 2-way radios Heavy equipment, loader, trackhoe. Blast shielding	Training Requirements: Site safety orientation UXO Technicians must be qualified IAW DDESB TP 18 HAZWOPER 40-Hour MEC Awareness Qualified equipment operators Lifting/back safety Fire extinguisher use Emergency procedures Biological hazard identification and control National Lightning Safety Institute Lightning Safety Procedures Competent persons William Wren and David Coe	Daily site safety inspection by competent person (UXOSO) – William Wren Daily site safety inspection by competent person (SUXOS) – David Coe Vehicle inspection daily Check Known Allergies Questionnaire Housekeeping (daily) Fire extinguisher (weekly) Vehicle inspection daily Mechanized equipment (U.S. Army Corps of Engineers form prior to use) Mechanized equipment (daily) Equipment and tools inspection daily and before use Survey areas for poisonous plants, insects, and animals Check body for ticks Monitor approaching storms

Activity Hazard Analysis (AHA)

Activity/Work Task: Excavation of MEC	Overall Risk Assessment Code (RAC) (Use highest code)	**M**
Project Location: Seneca Army Depot Activity, NY, MEC Clearance at OD Grounds	**Risk Assessment Code (RAC) Matrix**	
Contract Number: W912DY-10-D-0014 DO 005	**Severity** / **Probability**	
Date Prepared: 03-09-12		
Prepared by (Name/Title): Winston D Russell/H&S Manager		
Reviewed by (Name/Title): William Wren/UXOSO		
Notes: (Field Notes, Review Comments, etc.)		

Severity	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom, or Unlikely.

"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible

Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.

RAC Chart

- **E = Extremely High Risk**
- **H = High Risk**
- **M = Moderate Risk**
- **L = Low Risk**

Job Steps	Hazards	Controls	EM 385-1-1	RAC
Arrival of new personnel at site.	Unfamiliarity with: site, general site hazards, project safety rules, chain of command, and emergency procedures.	All personnel shall attend the site orientation training.	01.B.03 01.E.01 28	**M**
Excavation of Munitions and Explosives of Concern (MEC).	Poor planning.	Complete Job Safety Analysis for each task, as specified in Shaw Environmental & Infrastructure, Inc. Procedure No. HS045, "Job Safety Analysis (JSA)." Use Hazard Assessment Resolution Program frequently – for each task to be completed.		**M**
	Heavy lifting, strains, and sprains.	No individual employee is permitted to lift any object that weighs over 60 pounds. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 60-pound limit.	14.A.01	**M**
	Intrusive activities and underground utilities.	Follow procedure for Intrusive Activities Permit in Accident Prevention Plan (APP) prior to commencing excavation activities. Shaw E & I Procedure No. HS308, "Underground/Overhead Utility Contact Prevention," shall be followed.	25.A.01	**M**

Job Steps	Hazards	Controls	EM 385-1-1	RAC
Excavation of MEC (continued).	Overhead hazards/utilities.	Overhead hazards shall be evaluated prior to moving equipment on the project site. Overhead power lines shall be shut-off and locked-out. Areas with overhead hazards shall be barricaded with caution tape to prevent contact In areas where it is not feasible to use barricades, spotters shall be provided: however, the minimum distances from electrical lines must be observed.	11.F.04	**M**
	MEC/Unexploded Ordnance (UXO).	Non-UXO personnel shall attend site-specific MEC Awareness (and recognition) Training prior to the commencement of any site activities. Use only UXO personnel qualified in accordance with Department of Defense Explosives Safety Board Technical Paper 18, Minimum Qualifications for UXO Technicians and Personnel. UXO Technicians shall be present during any activity occurring in a Munitions Response Areas (MRA). Perform all work in accordance with approved Work Plan and Explosives Site Plan (ESP) (USACE, May 2009).	01.B.01 33.A.01 33.A.02 33.A.03	**M**
	Blast overpressure fragmentation blast.	The UXO Safety Officer (UXOSO) is responsible for maintaining the minimum safe distance arcs indicated in the Work Plan for the fragmentation data sheet of the Munition with the Greatest Fragmentation Distance (MGFD) for the Munitions Response Site. Follow ESP.	33.A.01 33.A.02 33.A.03	**M**
	Accidental detonation of MEC.	Observe the requirements of Explosives Safety and Health Manual EM 385-1-97. Only UXO technicians will excavate or handle MEC. Personnel in the immediate vicinity of MEC operations will be kept to the minimum necessary for safe operations but no less than two UXO technicians. Do not subject MEC to heat, shock, or friction. Only hand excavation permitted when within one feet of MEC. Use magnetometers frequently to pinpoint the location of MEC.	33.A.01 33.A.02 33.A.03	**M**
	Non-UXO personnel.	Establish minimum separation distance (MSD) based on the Hazardous Fragmentation Distance of the MGFD and maintain site control. Stop all MEC operations when non-UXO trained personnel are within the MSD arc.	28 33.A.03	**M**
	Buried hazardous materials.	Notify UXOSO and Health and Safety Manager if buried hazardous materials are encountered during excavations.		**M**
	Slips, trips, and falls.	Keep work areas clear and maintain housekeeping. Personnel shall not jump from elevated surfaces. Personnel shall use caution when walking on rocky, slippery, or uneven terrain.	14.C.01-10	**M**
	Hand injuries.	Items to be handled shall be inspected for sharp edges prior to being handled. Personnel shall wear leather gloves when handling sharp materials. Personnel shall be aware of and avoid pinch point hazards.	05.A.08	**L**

Job Steps	Hazards	Controls	EM 385-1-1	RAC
Excavation of MEC (continued).	Use of heavy equipment.	Only qualified personnel shall be permitted to operate equipment. Heavy equipment shall be inspected daily after the initial U.S. Army Corps of Engineers inspection (and documented.) Do not use unsafe equipment. All equipment shall have backing alarms. All equipment shall be operated at safe speeds and in a safe manner. Equipment operators shall wear safety belts. Personnel are only permitted to approach equipment after a signal from the operator. Ground personnel, working near heavy equipment, shall wear high visibility conspicuity vests. Ground personnel shall not enter the swing radius of equipment. Ground personnel shall not position themselves between equipment and stationary objects. Personnel shall verify all mechanical guards are in place and functioning properly. Moving equipment shall be equipped with a back-up alarm. Mechanical excavation equipment will only be used within one foot of suspected subsurface target anomalies. All equipment shall be shut down with energies dissipated prior to performing maintenance activities - lock out/tag out procedures may apply. Only qualified mechanics shall work on or repair heavy equipment.	18.A 18.G 18.B 05.F	**M**
	Insect bites/West Nile Virus.	Wear personal protective equipment (PPE) and tape joints to keep insects away from the skin. Use protective insect repellents containing N,N-Diethyl-m-toluamide, such as, 3M Ultrathon or equivalent and clothing insecticide preparations containing permethrins (Repel Permanone or equivalent) to prevent insect bites. Check limbs/body for insects/insect bites before showering. Notify UXOSO of flu-like symptoms.	06.D.01	**L**
	Contact dermatitis and poison ivy.	Check around work areas to identify if poison ivy is present. Wear long-sleeve shirts/trousers or Tyvek® coveralls to avoid skin contact with plants or other skin irritants. Learn to identify poisonous plants. Avoid unnecessary clearing of plant/vegetation areas. Cover vegetation with plastic (visqueen) where sampling position raises exposure potential. Apply protective cream/lotion to exposed skin to prevent poison ivy or similar reactions. Identify workers who are known to contract poison ivy.	06.D.03	**L**
	Severe weather.	The UXOSO will monitor weather conditions each day in order to plan and prepare for hazardous conditions. Work activities will be suspended prior to weather conditions becoming hazardous so that workers have ample time to seek shelter. Upon seeing lightning or hearing thunder, outdoor activities shall be suspended and personnel shall be evacuated to safe areas (inside vehicles, buildings, or tornado shelters as appropriate). Follow procedures outlined in the APP.	06.I	**L**
Excavation of MEC (continued).	Hazardous atmospheres.	Personnel shall immediately notify the UXOSO if odors are detected.		**L**
	Heat stress and cold stress.	Follow procedures outlined in the APP.	06.I	**M**
	Dust.	Dust shall be monitored and controlled. PPE use is required when working in contaminated areas.	28	**L**

Job Steps	Hazards	Controls	EM 385-1-1	RAC
	Fire.	Smoking shall be permitted in designated areas. Vehicles shall not be parked in tall dry grass. Engines shall be shut off before refueling. A 10 pound A:B:C fire extinguisher shall be available when refueling. Smoking shall not be permitted near fueling areas. Gasoline shall be stored in safety cans with flash arrestors and spring-loaded vents.	09.E.01 09.A.06 09.B.08	**L**
	Exposure to chemicals of potential concern	Air monitoring shall be performed in accordance with the SSHP. Institute engineering controls is air monitoring action levels are measured.	5 6 28	**M**

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
Personal Protective Equipment - Level D: Hard Hat Safety Glasses Safety-Toed Boots Work Gloves ANSI Class 2 reflective warning vests Equipment: Magnetometers Geophysics Instruments Fire Extinguishers Emergency Eyewash First Aid Kit Repel Permanone Drinking water Weather radio or AM/FM radio Hand tools 2-way radios Heavy equipment	Training Requirements: Site safety orientation UXO Technicians must be qualified IAW DDESB TP 18 HAZWOPER 40-Hour MEC Awareness Qualified equipment operators Lifting/back safety Fire extinguisher use Emergency procedures Biological hazard identification and control National Lightning Safety Institute Lightning Safety Procedures Competent persons William Wren and David Coe	Daily site safety inspection by competent person (UXOSO) – William Wren Daily site safety inspection by competent person (SUXOS) – David Coe Vehicle inspection daily Check Known Allergies Questionnaire Housekeeping (daily) Fire extinguisher (weekly) Vehicle inspection daily Overhead and underground utilities Mechanized equipment (U.S. Army Corps of Engineers form prior to use) Mechanized equipment (daily) Equipment and tools inspection daily and before use Survey areas for poisonous plants, insects, and animals Check body for ticks Monitor approaching storms

Activity Hazard Analysis (AHA)

Activity/Work Task: Fueling Operations	Overall Risk Assessment Code (RAC) (Use highest code)	**M**
Project Location: Seneca Army Depot Activity, NY, MEC Clearance at OD Grounds	**Risk Assessment Code (RAC) Matrix**	
Contract Number: W912DY-10-D-0014 DO 005	**Severity** / **Probability**	
Date Prepared: 03-09-12		
Prepared by (Name/Title): Winston D Russell/H&S Manager		
Reviewed by (Name/Title): William Wren/UXOSO		
Notes: (Field Notes, Review Comments, etc.)		

Severity	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom, or Unlikely.

"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible

Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.

RAC Chart

- **E = Extremely High Risk**
- **H = High Risk**
- **M = Moderate Risk**
- **L = Low Risk**

Job Steps	Hazards	Controls	EM 385-1-1	RAC
Fueling operations.	Exposures to fuels.	Personnel shall periodically review the Material Safety Data Sheets (MSDS) for the fuels that are being used at the project. The handling and use of fuels shall be performed in well-ventilated areas – preferably outside of buildings. Personnel shall avoid skin and eye contact with fuels. Safety glasses and disposable nitrile gloves shall be worn while handling fuels. If personnel sustain skin contact with fuels, then the affected area shall be immediately washed with soap and water. If fuel contact with clothing is made, then clothing shall be removed and changed immediately.	06.B.01 09.B.07 05.B.01 09.B.05	**L**
	Fire: extinguisher requirements.	20 pound A:B:C fire extinguisher shall be readily available when fueling equipment at any location on site. Trucks with flammable/combustible fuels must be equipped with 20 pound A:B:C fire extinguisher. Personnel who intend to extinguish small fires shall be trained in the use of fire extinguishers. Equipment and property are of secondary concern in a fire situation - personnel shall never try to extinguish a fire if there is any doubt that it can be extinguished safely.	09.E.03 09.B.03	**L**

Job Steps	Hazards	Controls	EM 385-1-1	RAC
Fueling operations (continued).	Fire: elimination of ignition sources – hot surfaces.	All vehicles and equipment shall be shut down prior to fueling. Small equipment, such as generators, mowers, pressure washers, etc. shall be allowed to cool prior to re-fueling. Heavy equipment with the fuel cap near the engine or near other hot surfaces shall also be allowed to cool prior to re-fueling.	09.B.21	**M**
	Fire: elimination of ignition sources – arcs/sparks/open flames.	Smoking shall not be allowed within 50 feet of fueling operations. Personnel shall visually survey the immediate area for open flames and other ignition sources prior to commencing fueling operations. Personnel are prohibited from using cell-phones or two-way radios during all fueling operations.	09.B.02	**L**
	Fire: elimination of ignition sources – static electricity.	Personnel shall never fill portable fuel cans that are in the bed of a pickup truck or in the trunk of an automobile. Filling fuel containers on plastic pickup truck bed-liners can cause static electric discharges, which may ignite the fuel. The fuel can(s) shall be removed from the truck bed or automobile trunk and placed on the ground before adding fuel. Electrical continuity shall be maintained between the portable fuel can and the tank being filled. A bonding cable shall be used to maintain continuity between the metal fuel container and the equipment fuel tank. Allowing free-fall of fuel into the tank is prohibited. Personnel shall not re-enter vehicles while fueling is underway due to the static electric charge generated between clothing and vehicle seats. If you absolutely have to get in your vehicle while the gas is pumping, make sure you get out, close the door touching the metal, before you pull the nozzle out. This way the static from your body will be discharged before you remove the nozzle.	09.B.21	**L**
	Storage and transportation: five-gallon cans in pick-up trucks.	Gasoline shall be stored and transported in properly marked/labeled five-gallon safety cans (equipped with self-venting cap and flash arrestor). Gasoline cans shall be secured to prevent movement during transportation. No more than six - five gallon containers of gasoline may be transported in vehicles (back of pick-up trucks or trailers) at the same time unless all the Department of Transportation (DOT) Hazardous Material Regulations are complied with, such as proper packaging, completing shipping papers, placarding (as required), and the appropriate HM 126 Training (as well as having been provided emergency response information and training.) The total quantity of hazardous materials may never exceed 440 pounds total. Hazardous materials must be secured prior to transporting.	09.B.08 09.B.11	**L**
	Communication of hazards.	Drivers must be notified that they are transporting hazardous materials. Drivers shall review MSDS for the fuels transported in their vehicle.	01.B.01	**L**

Job Steps	Hazards	Controls	EM 385-1-1	RAC
Fueling operations (continued).	Storage of fuels on-site.	Portable safety gasoline cans must be stored within a flammable materials storage area, have appropriate warning signs, be posted as “No Smoking’, and have a fire extinguisher available in the area.	09.B.02 09.B.18	**M**
	Spills.	All spills shall be immediately cleaned-up. Spill control equipment shall be readily available. All spills shall be reported to the SUXOS and UXOSO.	09.B.19	**M**
	Storage and transportation: safety containers and saddle tanks in pick-up trucks.	Gasoline shall not be transported in portable saddle tanks – only diesel fuel shall be transported in saddle tanks. All portable saddle tanks mounted in pick-up trucks shall be manufactured to meet DOT specifications. Portable saddle tanks shall be securely mounted to the pick-up truck, as recommended by the manufacturer. Saddle tanks shall be properly marked (see 49 Code of Federal Regulation 172.101) with the proper shipping name and labeled for “No Smoking.” No more than 110 gallons of diesel fuel may be transported in a saddle tank unless all the DOT Hazardous Material Regulations are complied with, such as proper packaging, completing shipping papers, placarding, and the appropriate HM 126 Training (as well as having been provided emergency response information and training.)	09.B.08	**L**
	Bulk storage of diesel fuel on-site.	Caps on saddle tanks shall be securely closed. Saddle tanks shall be inspected weekly to check for leaks. Bulk storage tanks shall not be permitted on site without express permission from the Shaw Project Manager and Health and Safety Manager.		**M**

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
Personal Protective Equipment - Level D: Hard Hat Safety Glasses Safety-Toed Boots Disposable nitrile gloves ANSI Class 2 reflective warning vests Equipment: Fire Extinguishers Saddle tanks Bonding cable Eye wash station Five-gallon safety cans (equipped with self-venting cap and flash arrestor) Basic spill kit (55-gallon open top drum, shovels,	Training Requirements: Bonding techniques Materials of Trade Hazard communication - Review MSDS for fuels Portable fire extinguisher use Lifting/back safety Competent persons William Wren and David Coe	Daily site safety inspection by competent person (UXOSO) – William Wren Daily site safety inspection by competent person (SUXOS) – David Coe Survey area for ignition sources (prior to commencing fueling operations) Verify MSDSs for fuels are available in vehicles transporting fuels Saddle tanks (daily) Verify eye wash bottle is readily available Fire extinguisher (before fueling equipment)

plastic sheeting, sorbent pads and granular material)		

Activity Hazard Analysis (AHA)

Activity/Work Task: Geophysical Survey Operations	Overall Risk Assessment Code (RAC) (Use highest code)	**M**
Project Location: Seneca Army Depot Activity, NY, MEC Clearance at OD Grounds	**Risk Assessment Code (RAC) Matrix**	
Contract Number: W912DY-10-D-0014 DO 005		
Date Prepared: 03-09-12		
Prepared by (Name/Title): Winston D Russell/H&S Manager		
Reviewed by (Name/Title): William Wren/UXOSO		

Severity	**Probability**				
	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	**E**	**E**	**H**	**H**	**M**
Critical	**E**	**H**	**H**	**M**	**L**
Marginal	**H**	**M**	**M**	**L**	**L**
Negligible	**M**	**L**	**L**	**L**	**L**

Notes: (Field Notes, Review Comments, etc.)

Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom, or Unlikely.

"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible

Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.

RAC Chart

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

Job Steps	Hazards	Controls	EM 385-1-1	RAC
Arrival of new personnel at site.	Unfamiliarity with: site, general site hazards, project safety rules, chain of command, and emergency procedures.	All personnel shall attend the site orientation training.	01.B.03 01.E.01 28	**M**
Geophysical survey operations.	Poor planning.	Complete Job Safety Analysis for each task, as specified in Shaw Environmental & Infrastructure, Inc. Procedure No. HS045, "Job Safety Analysis (JSA)." Use Hazard Assessment Resolution Program frequently – for each task to be completed.		**M**
	Heavy lifting, strains, and sprains.	No individual employee is permitted to lift any object that weighs over 60 pounds. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 60-pound limit.	14.A.01	**M**
	Struck-by/Against.	Wear reflective warning vests when exposed to vehicular traffic. Personnel working on or near roads and only remain on road long enough to complete work. Personnel walking along roadway shall stay off roadway as far as possible and walk on the side facing traffic.	05.F	**M**

Job Steps	Hazards	Controls	EM 385-1-1	RAC
Geophysical survey operations (continued).	Munitions and Explosives of Concern (MEC) / Unexploded Ordnance (UXO).	Non-UXO personnel shall attend site-specific MEC Awareness (and recognition) Training prior to the commencement of any site activities. Use only UXO personnel qualified in accordance with Department of Defense Explosives Safety Board Technical Paper 18, Minimum Qualifications for UXO Technicians and Personnel. UXO Technicians shall be present during any activity occurring in a Munitions Response Areas. Perform all work in accordance with approved Work Plan.	01.B.01 33.A.01 33.A.02 33.A.03	**M**
	Blast overpressure fragmentation blast.	The UXO Safety Officer is responsible for the location of each UXO team. Minimum safe distance maintained between two teams will never be less than 200 feet or the K40 overpressure distance in the formula: Minimum safe distance = 40 times the cube root of the net explosive weight of the munition with the greatest fragmentation distance at the Munitions Response Site.	33.A.01 33.A.02 33.A.03	**M**
	Accidental detonation of MEC.	Observe the requirements of Explosives Safety and Health Manual EM 385-1-97. Be alert and mark all MEC located. UXO trained personnel will escort non-UXO personnel at all times. Surface sweeps will be conducted with magnetometers or other suitable geophysical instrumentation to identify potential MEC.	33.A.01 33.A.02 33.A.03	**M**
	Intrusive activities.	Follow procedure for Intrusive Activities Permit in Accident Prevention Plan (APP) prior to driving stakes. Check location with magnetometer prior to driving stakes.	25.A.01	**M**
	Slips, trips, and falls.	Keep work areas clear and maintain housekeeping. Personnel shall not jump from elevated surfaces. Personnel shall use caution when walking on rocky, slippery, or uneven terrain.	14.C.01-10	**M**
	Hand injuries.	Items to be handled shall be inspected for sharp edges prior to being handled. Personnel shall wear leather gloves when handling sharp materials. Personnel shall be aware of and avoid pinch point hazards.	05.A.08	**L**
	Insect bites/West Nile Virus.	Wear personal protective equipment and tape joints to keep insects away from the skin. Use protective insect repellents containing N,N-Diethyl-m-toluamide, such as, 3M Ultrathon or equivalent and clothing insecticide preparations containing permethrins (Repel Permanone or equivalent) to prevent insect bites. Check limbs/body for insects/insect bites before showering. Notify Site Safety and Health Officer (SSHO) of flu-like symptoms.	06.D.01	**L**
	Contact dermatitis and poison ivy.	Check around work areas to identify if poison ivy is present. Wear long-sleeve shirts/trousers or Tyvek® coveralls to avoid skin contact with plants or other skin irritants. Learn to identify poisonous plants. Avoid unnecessary clearing of plant/vegetation areas. Cover vegetation with plastic (visqueen) where sampling position raises exposure potential. Apply protective cream/lotion to exposed skin to prevent poison ivy or similar reactions. Identify	06.D.03	**L**

Job Steps	Hazards	Controls	EM 385-1-1	RAC
		workers who are known to contract poison ivy.		
Geophysical survey operations (continued).	Severe weather.	The UXOSO will monitor weather conditions each day in order to plan and prepare for hazardous conditions. Work activities will be suspended prior to weather conditions becoming hazardous so that workers have ample time to seek shelter. Upon seeing lightning or hearing thunder, outdoor activities shall be suspended and personnel shall be evacuated to safe areas (inside vehicles, buildings, or shelters as appropriate). Follow procedures outlined in the APP.	06.I	**L**
	Hazardous atmospheres.	Personnel shall immediately notify the UXOSO if odors are detected.		**L**
	Heat stress and cold stress.	Follow procedures outlined in the Site Safety and Health Plan.	06.I	**M**
	Fire.	Smoking shall be permitted in designated areas. Vehicles shall not be parked in tall dry grass. Engines shall be shut off before refueling. A 10 pound A:B:C fire extinguisher shall be available when refueling. Smoking shall not be permitted near fueling areas. Gasoline shall be stored in safety cans with flash arrestors and spring-loaded vents.	09.E.01 09.A.06 09.B.08	**L**
	Battery charging	Battery Charging operations will be conducted IAW EM 385-1-1. Appropriate PPE will be worn. Site vehicle battery will not be used as a back-up for this operation, because it may damage the system and strand field crew.	11.G 11.G.04	**M**

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
Personal Protective Equipment - Level D: Hard Hat Safety Glasses Safety-Toed Boots Work Gloves ANSI Class 2 reflective warning vests Equipment: Magnetometers Geophysics Instruments Fire Extinguishers Emergency Eyewash First Aid Kit Deep-Woods Off or Ultrathon Repel Permanone	Training Requirements: Site safety orientation UXO Technicians must be qualified IAW DDESB TP 18 HAZWOPER 40-Hour MEC Awareness Lifting/back safety Fire extinguisher use Emergency procedures Biological hazard identification and control National Lightning Safety Institute Lightning Safety Procedures Competent persons William Wren and David Coe	Daily site safety inspection by competent person (UXOSO) – William Wren Daily site safety inspection by competent person (SUXOS) – David Coe Check Known Allergies Questionnaire Housekeeping (daily) Fire extinguisher (weekly) Vehicle inspection daily Equipment and tools inspection daily and before use Survey areas for poisonous plants, insects, and animals Check body for ticks Monitor approaching storms

Drinking water Weather radio or AM/FM radio 2-way radios		

Activity Hazard Analysis (AHA)

Activity/Work Task: Analog Aided Geophysics Visual Site Inspection	Overall Risk Assessment Code (RAC) (Use highest code)	**M**
Project Location: Seneca Army Depot Activity, NY, MEC Clearance at OD Grounds	**Risk Assessment Code (RAC) Matrix**	
Contract Number: W912DY-10-D-0014 DO 005		
Date Prepared: 03-09-12		
Prepared by (Name/Title): Winston D Russell/H&S Manager		
Reviewed by (Name/Title): William Wren/UXOSO		
Notes: (Field Notes, Review Comments, etc.)		

Severity	**Probability**				
	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	**E**	**E**	**H**	**H**	**M**
Critical	**E**	**H**	**H**	**M**	**L**
Marginal	**H**	**M**	**M**	**L**	**L**
Negligible	**M**	**L**	**L**	**L**	**L**

Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom, or Unlikely.

"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible

Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.

RAC Chart

- **E = Extremely High Risk**
- **H = High Risk**
- **M = Moderate Risk**
- **L = Low Risk**

Job Steps	Hazards	Controls	EM 385-1-1	RAC
Arrival of new personnel at site.	Unfamiliarity with: site, general site hazards, project safety rules, chain of command, and emergency procedures.	All personnel shall attend the site orientation training.	01.B.03 01.E.01 28	**M**
Analog aided visual site inspections.	Poor planning.	Complete Job Safety Analysis for each task, as specified in Shaw Environmental & Infrastructure, Inc. Procedure No. HS045, "Job Safety Analysis (JSA)." Use Hazard Assessment Resolution Program frequently – for each task to be completed.		**M**
	Heavy lifting, strains, and sprains.	No individual employee is permitted to lift any object that weighs over 60 pounds. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 60-pound limit.	14.A.01	**M**
	Struck-by/Against.	Wear reflective warning vests when exposed to vehicular traffic. Personnel working on or near roads and only remain on road long enough to complete work. Personnel walking along roadway shall stay off roadway as far as possible and walk on the side facing traffic.	05.F	**M**
	Munitions and Explosives of Concern (MEC) / Unexploded Ordnance (UXO).	Non-UXO personnel shall attend site-specific MEC Awareness (and recognition) Training prior to the commencement of any site activities. Use only UXO personnel qualified in accordance with Department of Defense Explosives Safety Board Technical Paper 18, Minimum Qualifications for UXO Technicians and Personnel. UXO Technicians shall be present during any activity occurring in a Munitions Response Areas. Perform all work in accordance with approved Work Plan.	01.B.01 33.A.01 33.A.02 33.A.03	**M**

Job Steps	Hazards	Controls	EM 385-1-1	RAC
Analog aided visual site inspections (continued).	Blast overpressure fragmentation blast.	The UXO Safety Officer is responsible for the location of each UXO team. Minimum safe distance maintained between two teams will never be less than 200 feet or the K40 overpressure distance in the formula: Minimum safe distance = 40 times the cube root of the net explosive weight of the munition with the greatest fragmentation distance at the Munitions Response Site.	33.A.01 33.A.02 33.A.03	**M**
	Accidental detonation of MEC.	Observe the requirements of Explosives Safety and Health Manual EM 385-1-97. Be alert and mark all MEC located. Only clear and grub to within four inches of the ground surface. UXO trained personnel will escort non-UXO personnel at all times. Surface sweeps will be conducted with magnetometers or other suitable geophysical instrumentation to detect potential MEC.		**M**
	Intrusive activities.	Follow procedure for Intrusive Activities Permit in Accident Prevention Plan (APP) prior to driving stakes. Check location with magnetometer prior to driving stakes. MEC avoidance only during site inspection.	25.A.01	**M**
	Slips, trips, and falls.	Keep work areas clear and maintain housekeeping. Personnel shall not jump from elevated surfaces. Personnel shall use caution when walking on rocky, slippery, or uneven terrain.	14.C.01-10	**M**
	Hand injuries.	Items to be handled shall be inspected for sharp edges prior to being handled. Personnel shall wear leather or cut resistant gloves when handling sharp materials. Personnel shall be aware of and avoid pinch point hazards.	05.A.08	**L**
	Insect bites/West Nile Virus.	Wear PPE and tape joints to keep insects away from the skin. Use protective insect repellents containing N,N-Diethyl-m-toluamide, such as, Deep Woods OFF, 3M Ultrathon, or equivalent and clothing insecticide preparations containing permethrins (Repel Permanone or equivalent) to prevent insect bites. Check limbs/body for insects/insect bites before showering. Notify UXOSO of flu-like symptoms.	06.D.01	**L**
	Contact dermatitis and poison ivy.	Check around work areas to identify if poison ivy is present. Wear long-sleeve shirts/trousers or Tyvek® coveralls to avoid skin contact with plants or other skin irritants. Learn to identify poisonous plants. Avoid unnecessary clearing of plant/vegetation areas. Cover vegetation with plastic (visqueen) where sampling position raises exposure potential. Apply protective cream/lotion to exposed skin to prevent poison ivy or similar reactions. Identify workers who are known to contract poison ivy.	06.D.03	**L**

Job Steps	Hazards	Controls	EM 385-1-1	RAC
Analog aided visual site inspections (continued).	Severe weather.	The UXOSO will monitor weather conditions each day in order to plan and prepare for hazardous conditions. Work activities will be suspended prior to weather conditions becoming hazardous so that workers have ample time to seek shelter. Upon seeing lightning or hearing thunder, outdoor activities shall be suspended and personnel shall be evacuated to safe areas (inside vehicles, buildings, or shelters as appropriate). Follow procedures outlined in the APP/SSHP.	06.1	**L**
	Hazardous atmospheres.	Personnel shall immediately notify the UXOSO if odors are detected.		**L**
	Heat stress and cold stress.	Follow procedures outlined in the APP.	06.1	**M**
	Fire.	Smoking shall be permitted in designated areas. Vehicles shall not be parked in tall dry grass. Engines shall be shut off before refueling. A 10-A:B:C fire extinguisher shall be available when refueling. Smoking shall not be permitted near fueling areas. Gasoline shall be stored in safety cans with flash arrestors and spring-loaded vents.	09.E.01 09.A.06 09.B.08	**M**

Equipment to be Used	Training Requirements/Competent or Qualified Personnel Name(s)	Inspection Requirements
Personal Protective Equipment - Level D: Hard Hat Safety Glasses Safety-Toed Boots Work Gloves ANSI Class 2 reflective warning vests Equipment: Magnetometers Geophysics Instruments Fire Extinguishers Emergency Eyewash First Aid Kit Deep-Woods Off or Ultrathon Repel Permanone Drinking water Weather radio or AM/FM radio 2-way radios	Training Requirements: Site safety orientation UXO Technicians must be qualified IAW DDESB TP 18 HAZWOPER 40-Hour MEC Awareness Lifting/back safety Fire extinguisher use Emergency procedures Biological hazard identification and control National Lightning Safety Institute Lightning Safety Procedures Competent persons William Wren and David Coe	Daily site safety inspection by competent person (UXOSO) – William Wren Daily site safety inspection by competent person (SUXOS) – David Coe Check Known Allergies Questionnaire Housekeeping (daily) Fire extinguisher (weekly) Vehicle inspection daily Equipment and tools inspection daily and before use Survey areas for poisonous plants, insects, and animals Check body for ticks Monitor approaching storms

Activity Hazard Analysis (AHA)

Activity/Work Task: Vehicle Operations	Overall Risk Assessment Code (RAC) (Use highest code)	**M**
Project Location: Seneca Army Depot Activity, NY, MEC Clearance at OD Grounds	**Risk Assessment Code (RAC) Matrix**	
Contract Number: W912DY-10-D-0014 DO 005	**Severity** / **Probability**	
Date Prepared: 03-09-12		
Prepared by (Name/Title): Winston D Russell/H&S Manager		
Reviewed by (Name/Title): William Wren/UXOSO		
Notes: (Field Notes, Review Comments, etc.)		

Severity	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	**E**	**E**	**H**	**H**	**M**
Critical	**E**	**H**	**H**	**M**	**L**
Marginal	**H**	**M**	**M**	**L**	**L**
Negligible	**M**	**L**	**L**	**L**	**L**

Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom, or Unlikely.

"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible

Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.

RAC Chart

- **E = Extremely High Risk**
- **H = High Risk**
- **M = Moderate Risk**
- **L = Low Risk**

Job Steps	Hazards	Controls	EM 385-1-1	RAC
Project vehicle use.	Operation of motor vehicles and trucks-General.	All company owned, leased, or rented vehicle operations shall comply with the requirements of Shaw Environmental & Infrastructure, Inc. (Shaw E & I) Procedure No. HS800, "Motor Vehicle Operation: General Requirements." All company owned, leased, or rented commercial vehicle operations shall comply with the requirements of Shaw E & I Procedure No. HS810, "Commercial Motor Vehicle Operation and Maintenance." Subcontractors operating motor vehicles shall comply with all federal, state, and local traffic regulations. Subcontractors shall only use vehicles that are in good condition and safe to operate. All personnel shall drive defensively and wear seat belts while vehicles are in motion.	18.A.01 18.A.02 18.A.03 18.C.02 18.C.03	**M**
	Operation of motor vehicles and trucks-Accidents	In the event of an accident: Stop; call for medical assistance; notify police; complete Vehicle Accident Report and submit to your supervisor. If a Shaw employee is injured, the Health Resource forms, Return to Work, Medical Release, and Treatment of Injury/Illness must completed at the health clinic or Emergency Room.	01.D.01	**M**

Job Steps	Hazards	Controls	EM 385-1-1	RAC
Project vehicle use (continued).	Operation of motor vehicles and trucks-Backing	Back into parking spaces upon arrival, whenever possible. When preparing to move or back vehicles at the project site, walk around the vehicle before backing to identify any new conditions or obstructions. Use a spotter when backing whenever possible, and sound horn prior to backing. Determine and agree upon hand signals (between spotter and driver) before attempting to back vehicle. Check the rear-view and side mirrors prior to backing (Note: All vehicles, other than automobiles, must have small convex mirrors attached to the side mirrors.) Back slowly in areas of obstructed vision. Anticipate others who may be backing out into your pathway and adjust accordingly.	18.C.14 08.B.04 08.B.06	**L**
	Operation of motor vehicles and trucks - Unfamiliar with the vehicle	Familiarize yourself with the vehicle before moving. Review the dashboard controls, steering radius, overhead, and side clearances. Locate windshield wipers and lights. Properly adjust mirrors and seat.		**M**
	Operation of motor vehicles and trucks-Speed	Obey all posted speed limits. Radar detectors are prohibited in all company owned, leased, or rented vehicles. Reduce travel speed during hazardous conditions (i.e., rain, fog, snow).	08.B.06 18.C.04 18.C.05	**M**
	Operation of motor vehicles and trucks-Spacing/Distance	Identify if your vehicle has Anti-Lock Brakes. Follow the 3-second rule. Increase the 3-second rule as necessary during hazardous travel conditions. Always leave yourself an “out” during travel – this applies to stoplights as well. When stopping, make sure that you leave enough distance between you and the car in front of you (you should be able to see the rear tires of the vehicle in front, when stopped). When at a red light, and it turns green, use the “delayed start” technique, by counting to three before you take your foot off the brake. DO NOT TAILGATE! Allow extra spacing and braking time for trucks and vehicles towing trailers. Trailers shall be equipped with brakes		**M**
	Operation of motor vehicles and trucks-Skids	If the vehicle has begun to skid out of control, turn the steering wheel in the direction of the skid and re-adjust the wheel, as necessary. Slow travel speeds during hazardous travel conditions. Use 4-wheel drive, if available, when driving vehicles off road, on steep inclines, muddy conditions, etc. Do not take vehicles “off road” if they cannot be operated safely.	18.C.05	**M**

Job Steps	Hazards	Controls	EM 385-1-1	RAC
Project vehicle use (continued).	Operation of motor vehicles and trucks-Blind Spots	Become familiar with any blind spots associated with your vehicle. Adjust mirrors properly. Make sure you use your directional signals. Always look over your shoulder to assure the lane is clear when changing lanes.		**M**
	Operation of motor vehicles and trucks-Cellular phones	Exercise caution when approaching other driver's blind spots. Do not use handheld cellular phones while driving. Pull over to the side of the road when making a call.	18.C.01	**M**
	Operation of motor vehicles and trucks-Equipment Failure	Perform daily inspections of your vehicle. Any vehicle with mechanical problems that may endanger the safety of the driver, passengers, or the public shall not be used.	18.A.03 18.A.04	**M**
	Operation of motor vehicles and trucks-Spacing/Distance	Ensure safety equipment is in the vehicle. Safety equipment should include a spare tire, jack, first-aid kit, fire extinguisher, and flashlight. Flares and/or reflective triangles shall be available in larger trucks. Verify that the proper documentation is in the vehicle - documentation includes an operations manual for the vehicle, insurance card, vehicle registration, and Shaw Accident forms.	18.A.03	**M**
	Operation of motor vehicles and trucks- Influenced by drug and alcohol	Never drive under the influence of drugs or alcohol. Disciplinary action, including termination, will be taken against anyone who is convicted of or who pleads no-contest to the charges of driving under the influence in accordance with Shaw E & I Procedure No. HS800.	01.C.02	**M**
	Operation of motor vehicles and trucks-Driver Attitude/Fatigue	Do not operate any vehicle when abnormally tired, temporarily disabled, or under the influence of drugs or alcohol. Keep an even temper when driving. Do not let the actions of others affect your attitude. Avoid "highway-hypnosis" and "falling asleep at the wheel." Take plenty of breaks when driving long distances. Rotate driving responsibility with your partner. No employee is authorized to operate a company vehicle (including rentals) after having been on-duty for a period of 12-hours. No employee may drive for more than 10-hours in a single on-duty period.	01.C.04	**M**
	Operation of motor vehicles and trucks-Vehicle Loading	DO NOT OVERLOAD the vehicle. Secure all equipment within the body of the vehicle. Do not block side view mirrors with load. Do not transport Department of Transportation manifested hazardous materials without a commercial driver's license. Dispatch all equipment and personnel with proper forms and identification.	18.C.13 18.C.16	**M**

Equipment to be Used	Training Requirements/Competent or Qualified Personnel Name(s)	Inspection Requirements
Personal Protective Equipment – N/A: Equipment: Seatbelt Spare tire and jack First aid kit Fire extinguisher Flashlight Operations manual for the vehicle Insurance card Vehicle registration Accident report forms Hospital/Clinic maps	Training Requirements: Site safety orientation Licensed vehicle operators Defensive driving (all Shaw personnel) Competent persons William Wren and David Coe	Daily site safety inspection by competent person (UXOSO) – William Wren Daily site safety inspection by competent person (SUXOS) – David Coe Vehicle inspections (daily)

Activity Hazard Analysis (AHA)

Activity/Work Task: Mobilization/Preparation	Overall Risk Assessment Code (RAC) (Use highest code)	**M**
Project Location: Seneca Army Depot Activity, NY, MEC Clearance at OD Grounds	**Risk Assessment Code (RAC) Matrix**	
Contract Number: W912DY-10-D-0014 DO 005	**Severity** / **Probability**	
Date Prepared: 03-09-12		
Prepared by (Name/Title): Winston D Russell/H&S Manager		
Reviewed by (Name/Title): William Wren/UXOSO		
Notes: (Field Notes, Review Comments, etc.)		

Severity	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	**E**	**E**	**H**	**H**	**M**
Critical	**E**	**H**	**H**	**M**	**L**
Marginal	**H**	**M**	**M**	**L**	**L**
Negligible	**M**	**L**	**L**	**L**	**L**

Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom, or Unlikely.

"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible

Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.

RAC Chart

- **E = Extremely High Risk**
- **H = High Risk**
- **M = Moderate Risk**
- **L = Low Risk**

Job Steps	Hazards	Controls	EM 385-1-1	RAC
Travel at project site.	Vehicle Operation.	See AHA for vehicle operations.	18.A	**M**
Arrival of new personnel at site.	Untrained personnel.	All personnel working on hazardous, toxic, and radioactive waste (HTRW) shall submit HAZWOPER training certificates (40-hour, 8-hour (if applicable), and supervisor (if applicable) to the UXOSO. All personnel shall attend a site safety orientation. Other training certifications shall also be made available on site.	18.A	**M**
	Medical qualifications.	All personnel working on HTRW shall submit current physician's certificate stating that employee is participating in an appropriate medical surveillance program meeting 29 Code of Federal Regulation (CFR) 1910.120	01.B.03 01.E.01 28	**L**
	Allergies.	All personnel should complete the Known Allergies Questionnaire (voluntary only).	01.C.01	**L**

Job Steps	Hazards	Controls	EM 385-1-1	RAC
Arrival of new personnel at site (continued).	Unfamiliarity with: site, general (chemical, physical, environmental) site hazards, project safety rules and hazard control procedures, chain of command, and emergency procedures.	All personnel shall attend the site orientation training. After personnel are trained in the contents of the Accident Prevention Plan (APP), APP Addenda, and they shall sign the APP Acknowledgment Form. Personnel who may participate in intrusive activities shall attend Munitions and Explosives of Concern Awareness Training. All pertinent AHAs shall be reviewed with personnel (as applicable). Post all hazard warning signs, medical maps, and emergency phone numbers.	01.B.03 01.E.01 28 03.A.01.b	**M**
Unload equipment/prepare site.	Failure to properly plan daily activities.	A Job Safety Analysis (JSA), as required by Shaw Environmental & Infrastructure, Inc. Procedure No. HS045, "Job Safety Analysis (JSA)," shall be prepared by the crew prior to commencing daily activities. The JSA may be used as a component of the morning Tailgate Safety Meeting. The JSA shall be revised at any time throughout the workday when new tasks are initiated, unforeseen circumstances arise, or if working conditions change. Personnel shall implement Hazard Assessment Resolution Program.		**M**
	Heavy lifting, strains, and sprains.	No individual employee is permitted to lift any object that weighs over 60 pounds. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 60-pound limit.	14.A.01	**M**
	Use of mechanical equipment.	Only qualified personnel shall be permitted to operate equipment. Mechanical equipment shall be inspected daily. Deficiencies in equipment shall be noted on the inspection form. Equipment found to be unsafe shall not be used. All equipment shall be operated at safe speeds and in a safe manner. Equipment operators shall wear safety belts and hearing protection. Ground personnel shall not position themselves between equipment and stationary objects. Personnel are only permitted to approach equipment after a signal from the operator	18.G	**M**
Prepare site.	Hand injuries.	Items to be handled shall be inspected for sharp edges prior to being handled. Personnel shall wear leather gloves when handling sharp materials. Personnel shall be aware of and avoid pinch point hazards.	05.A.08	**L**
	Electrical.	Ground-fault circuit interrupters shall be used on all power tools and extension cords. Extension cords, power tools, and lighting equipment shall be inspected before each use, protected from damage, and kept out of wet areas. Keep extension cords off of roads.	11.A	**M**
	Fire.	Fire extinguishers shall be placed in work areas. The UXOSO shall establish smoking areas in compliance with the facility policy. Engines shall be shut off before refueling. A 20 pound A:B:Cfire extinguisher shall be available at refueling areas. Smoking shall not be permitted near fueling areas. Use caution with vehicle exhaust systems in grassy areas.	09.E.01 09.A.06	**L**

Job Steps	Hazards	Controls	EM 385-1-1	RAC
	Chemical hazards.	The Exclusion Zones and Contamination Reduction Zones shall be set-up and appropriately demarcated. The Emergency Eyewash station shall be inspected, cleaned, filled, and then placed in service. Notify all personnel of the emergency eyewash station location.	28 06.B.02.b 06.B.01.b	**L**

Equipment to be Used	Training Requirements/Competent or Qualified Personnel Name(s)	Inspection Requirements
Personal Protective Equipment - Level D: Hard Hat Safety Glasses Safety-Toed Boots Work Gloves ANSI Class 2 reflective warning vests Equipment: Fire Extinguishers Emergency Eyewash First Aid Kit Deep-Woods Off or Ultrathon Repel Permanone Drinking water Weather radio or AM/FM radio 2-way radios	Training Requirements: Site safety orientation Applicable AHAs HAZWOPER 40-Hour Qualified equipment operators Lifting/back safety Fire extinguisher use Emergency procedures Biological hazard identification and control National Lightning Safety Institute Lightning Safety Procedures Competent persons William Wren and David Coe	Daily site safety inspection by competent person (UXOSO) – William Wren Daily site safety inspection by competent person (SUXOS) – David Coe Check Known Allergies Questionnaire, training, and medical certifications against personnel roster Mechanized equipment (U.S. Army Corps of Engineers form prior to use) Mechanized equipment (daily) Overhead and underground utilities Housekeeping (daily) Fire extinguisher (weekly) Vehicle inspection daily Equipment and tools inspection daily and before use Survey areas for poisonous plants, insects, and animals Check body for ticks

Attachment D-6

Emergency and Occupational Clinic Route Maps, Directions, and Drive Times

mapquest

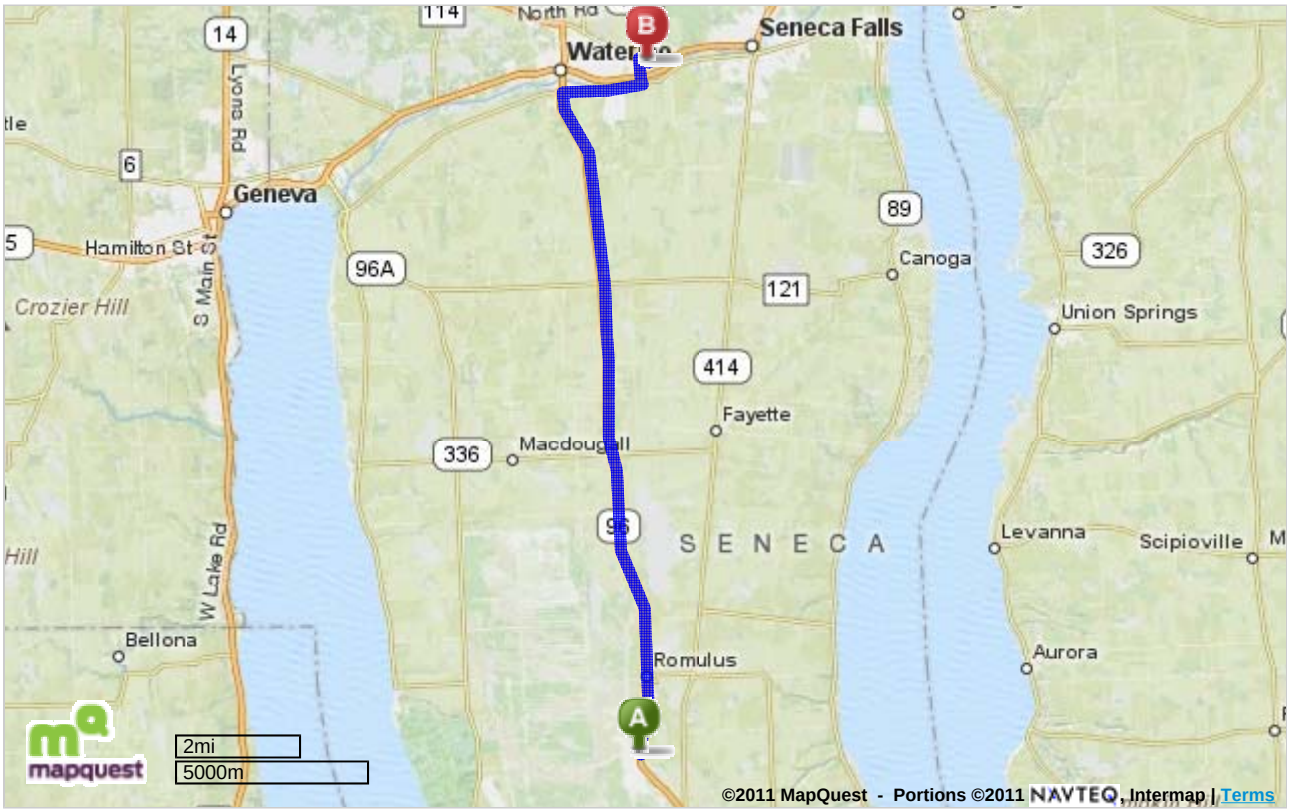
Trip to:
1991 Balsley Rd
Seneca Falls, NY 13148-6725
13.92 miles
20 minutes

Notes

Directions to Life Care Medical Associates (Occupational Health Clinic)

	5963 Rt-96 Romulus, NY 14541 42.732008401439195, -76.83634127466072 (Address is approximate)	**Miles Per Section**	**Miles Driven**
	1. Start out going **north** on **RT-96** toward **Yerkes Rd**.	**Go 11.8 Mi**	11.8 mi
	2. Turn **right** onto **W River St / RT-96**. Continue to follow **W River St**. *W River St is just past W Illick St* *If you reach W Kendig St you've gone a little too far*	**Go 0.8 Mi**	12.7 mi
	3. **W River St** becomes **E River Rd / CR-117**.	**Go 0.6 Mi**	13.3 mi
	4. Turn **left** onto **Mound Rd**. *Mound Rd is 0.3 miles past Bauer Rd* *If you are on River Rd and reach Kingdom Rd you've gone about 0.5 miles too far*	**Go 0.1 Mi**	13.4 mi
414	5. **Mound Rd** becomes **RT-414**.	**Go 0.3 Mi**	13.7 mi
	6. Turn **right** onto **Balsley Rd**. *Taco Bell is on the left* *If you reach Salcman Rd you've gone about 0.5 miles too far*	**Go 0.2 Mi**	13.9 mi
	7. **1991 BALSLEY RD** is on the **left**. *If you reach US-20 you've gone about 0.3 miles too far*		13.9 mi
	1991 Balsley Rd Seneca Falls, NY 13148-6725	**13.9 mi**	**13.9 mi**

Total Travel Estimate: **13.92 miles - about 20 minutes**



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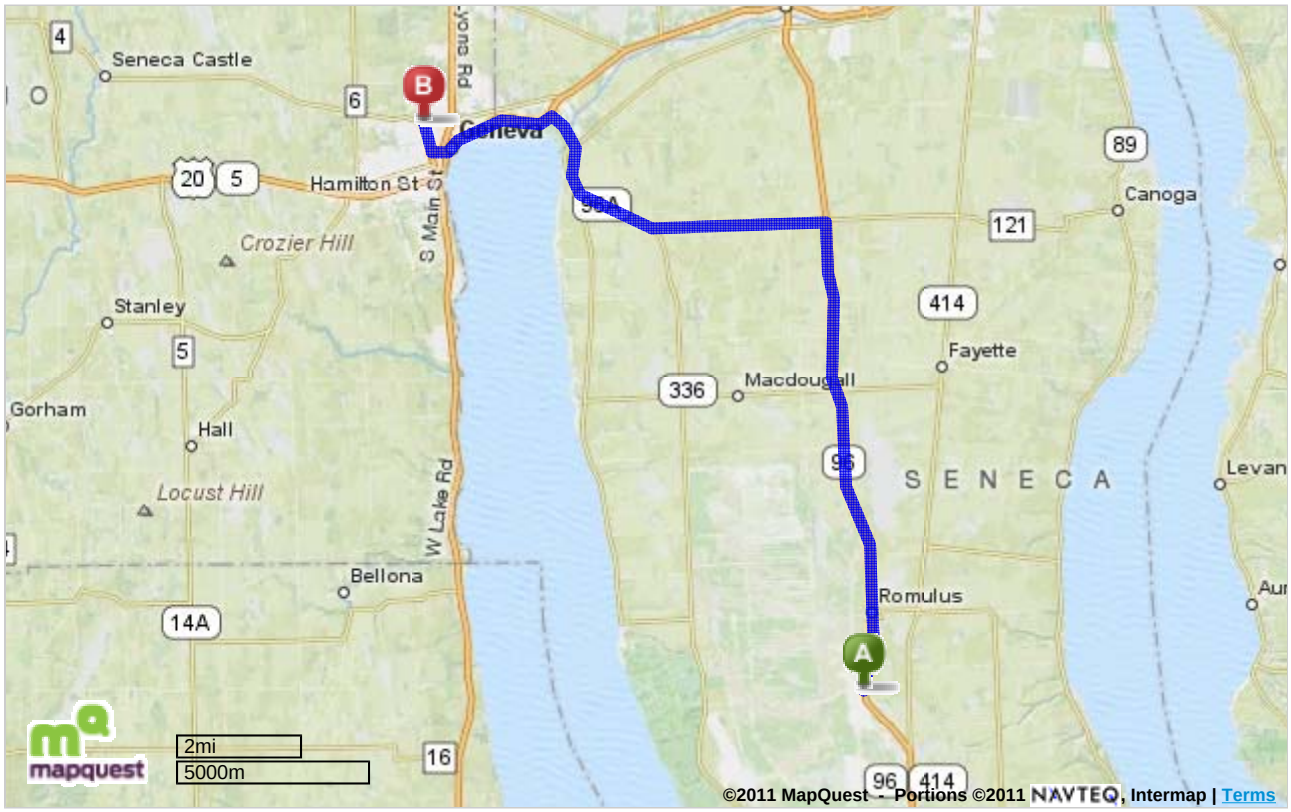
mapquest

Notes

Trip to:
Geneva General Hospital
196 North St
Geneva, NY 14456
(315) 787-4000
17.32 miles
25 minutes

A		**5963 Rt-96** Romulus, NY 14541 42.732008401439195, -76.83634127466072 (Address is approximate)	**Miles Per Section**	**Miles Driven**
		1. Start out going **north** on **RT-96** toward **Yerkes Rd**.	**Go 8.4 Mi**	8.4 mi
		2. Turn **left** onto **Yellow Tavern Rd**. *Dutchmen Family Restaurant is on the corner* *If you reach Christler Rd you've gone about 0.9 miles too far*	**Go 3.1 Mi**	11.4 mi
	NORTH 96A	3. Turn **right** onto **RT-96A N**. *RT-96A N is 0.8 miles past Post Rd*	**Go 3.0 Mi**	14.4 mi
	WEST 20	4. Turn **left** onto **US-20 W / RT-5 W**. *US-20 W is 0.7 miles past CR-119* *If you reach Border City Rd you've gone about 0.3 miles too far*	**Go 2.1 Mi**	16.4 mi
		5. Turn **right** onto **E Castle St**. *E Castle St is 0.1 miles past Lake St* *If you are on Lakefront Dr and reach Elizabeth Blackwell St you've gone about 0.1 miles too far*	**Go 0.3 Mi**	16.7 mi
		6. Turn **right** onto **N Main St**. *N Main St is just past Elm St* *Wing Tai Oriental Restaurant is on the right* *If you are on Milton St and reach Union St you've gone a little too far*	**Go 0.6 Mi**	17.3 mi
		7. Turn **right** onto **North St**. *North St is 0.1 miles past John St* *If you reach Bell Ave you've gone a little too far*	**Go 0.04 Mi**	17.3 mi
		8. **196 NORTH ST** is on the **left**. *If you reach Mason St you've gone a little too far*		17.3 mi
B		**Geneva General Hospital** 196 North St, Geneva, NY 14456 (315) 787-4000	**17.3 mi**	**17.3 mi**

Total Travel Estimate: **17.32 miles - about 25 minutes**



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Appendix E

Munitions Constituents Quality Assurance Project Plan

Draft Final
Quality Assurance Project Plan for MEC Clearance at Open Detonation (OD) Grounds

Prepared for U.S. Army Engineering and Support Center
4820 University Square
Huntsville, Alabama 35816-1822

Prepared by Shaw Environmental & Infrastructure, Inc.
111 Howard Boulevard, Suite 110
Mt. Arlington, NJ 07856

Contract No. W912DY-10-D-0014, Task Order No. 0005
Shaw Project Nos. 144717
Rev 0
May 2013

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Attachment B Subcontractor Laboratory Quality System Manuals
Attachment C Subcontractor Laboratory Standard Operating Procedures
Attachment D Subcontractor Laboratory ELAP Accreditations

AOC	area of concern
BRAC	Base Realignment and Closure
CA	corrective action
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLP	contract laboratory program
COC	chain of custody
COD	co-efficient of determination
CCV	continuing calibration verification
CQM	certified quality manager
DDESB	DOD Explosives Safety Board
DoD	Department of Defense
DoD QSM	*Department of Defense Quality Systems Manual for Environmental Laboratories*
EDD	electronic data deliverable
EE/CA	Engineering Evaluation / Cost Analysis
ELAP	DoD Environmental Laboratory Accreditation
EOD	explosive ordnance disposal
EQUIS	Environmental Quality Information System
ESV	Ecological Screening Values
FS	feasibility study
ft	foot
GCAL	Gulf Coast Analytical Laboratories, Inc.
HHRA	human health risk assessment
H&S	health and safety
HTW	hazardous and toxic waste
ICAL	initial calibration
ICPMS	inductively coupled plasma mass spectroscopy
ICS	interference check sample
ICV	initial calibration verification
IDW	investigative derived waste
IRP	Installation Restoration Program
IS	internal standard
lb/day	pound per day
LCS	laboratory control sample
LOD	level of detection
LOQ	limit of quantitation
LORAN	Long Range Navigation
LIMS	Laboratory Information Management System
LRA	Local Redevelopment Authority
LTM	long term monitoring
MB	method blank
MC	munitions constituent
MD	munitions debris

MDL	method detection limit
MEC	munitions and explosives of concern
mg/kg	milligram per kilogram
mg/L	milligram per liter
MMRP	Military Munitions Response Program
MPPEH	Materiel Potentially Presenting an Explosive Hazard
MS	matrix spike
MSD	matrix spike duplicate
NA	not applicable or not available
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NELAC	National Environmental Laboratory Accreditation Conference
NELAP	National Environmental Laboratory Accreditation Program
NFA	no further action
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OB	open burning
OD	open detonation
ORP	oxidation reduction potential
PARCC	precision, accuracy, representativeness, comparability, completeness
PCBs	polychlorinated biphenyls
PDF	portable document format
PDS	post digestion spike
PID	photoionization detector
PM	Project Manager
QA	quality assurance
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
RA	remedial action
RAR	remedial action report
RCRA	Resource Conservation and Recovery Act
RF	response factor
RI/FS	Remedial Investigation/Feasibility Study
RL	reporting limit
ROD	Record of Decision
RPD	relative percent difference
RRT	relative retention time
RSD	relative standard deviation
RSL	USEPA Regional Screening Level
SAP	Sampling and Analysis Plan
Shaw	Shaw Environmental & Infrastructure, Inc.

SEDA	Seneca Army Depot Activity
SI	Site Inspection
SIM	selective ion monitoring
SLERA	screening level ecological risk assessment
SOP	Standard Operating Procedure
SPLP	synthetic precipitation leaching procedure
SSHP	Site Safety and Health Plan
SUXOS	Senior Unexploded Ordnance Supervisor
SVOC	semi-volatile organic compound
TAL	target analyte list
TBD	to be determined
TCLP	toxicity characteristic leaching procedure
TP	Technical Paper
ug/L	microgram per liter
UFP-QAPP	Uniform Federal Policy for Quality Assurance Project Plan
USACE	United States Army Corps of Engineers
USAESCH	United States Army Engineering and Support Center
USEPA	United States Environmental Protection Agency
UXO	unexploded ordnance
UXOQCS	Unexploded Ordnance Quality Control Specialist
UXOSO	Unexploded Ordnance Safety Officer
VOC	volatile organic compound

QAPP Worksheet 1- Title and Approval Page

DRAFT
QUALITY ASSURANCE PROJECT PLAN (QAPP) FOR MUNITIONS AND EXPLOSIVES OF CONCERN (MEC) CLEARANCE AT OPEN DETONATION (OD) GROUNDS

MILITARY MUNITIONS RESPONSE ACTIONS
SENECA ARMY DEPOT ACTIVITY
ROMULUS, NEW YORK

CONTRACT NO. W912DY-10-D-0014
TASK ORDER 0005
PROJECT NUMBER 144717

Prepared for:
U.S. ARMY
SENECA ARMY DEPOT ACTIVITY

Prepared by:
U.S. ARMY ENGINEERING SUPPORT CENTER - HUNTSVILLE

and

SHAW ENVIRONMENTALAND INFRASTRUCTURE, INC.
111 Howard Boulevard, Suite 110
Mt. Arlington, NJ 07856
May 2013

Review Signature/Date: March 20, 2012

Eric Malarek, Shaw Environmental Project Chemist

Other Review Signature/Date: March 20, 2012

Doug Schicho, PE, PMP, Shaw Environmental Project Manager

QAPP Worksheet 2 - QAPP Identifying Information
Page 1 of 6

Site Number/Code: Seneca Army Depot Activity, Facility ID NY0213820830, Romulus, NY
Operable Unit: Open Detonation (OD) Grounds and Open Burning Tray in Open Burning (OB) Grounds
Contractor Name: Shaw Environmental and Infrastructure, Inc. (Shaw)
Contract Number: W912DY-10-D-0014
Contract Title: Seneca Army Depot Activity OB/OD Grounds Remedial Action
Work Assignment Number: Task Order 0005

1. This QAPP was prepared in accordance with the requirements of the *Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP)* (USEPA, 2005b), Chapter 25 of OPNAVINST 5090.1B, IR-CDQM, the *Department of Defense Quality Systems Manual for Environmental Laboratories* (DoD QSM), Version 4.2, October 25, 2010, and the DID MMRP-09-009, *Munitions Constituents Chemical Data Quality Deliverables*, August 19, 2009 (USACE, 2009).

2. Identify regulatory program: The Seneca Army Depot Activity (SEDA) Remedial Action is being performed under the Military Munitions Response Program (MMRP) and, per Department of Defense (DoD) policy, is being conducted in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). Regulatory oversight is provided by United States Environmental Protection Agency (USEPA) and New York State Department of Environmental Conservation (NYSDEC).

3. This QAPP is a *project-specific* QAPP.

4. List dates of scoping sessions that were held:

Scoping Session Date	**Reference Document**
15 December 2011 Kick Off Teleconference	Final meeting minutes
22 December 2011 Site Visit	Final meeting minutes

5. List dates and titles of QAPP documents written for previous site work, that are relevant to current investigation:

Title	**Received Date**
SEDA Generic Site-Wide Sampling and Analysis Plan (Parsons)	Revised Final, July 2006

6. List organizational partners (stakeholders) and connection with lead organization:
Project Management: U.S. Army Engineering and Support Center (USAESCH), SEDA, U.S. Army Corps of Engineers (USACE), New York District, U.S. Army Public Health Command; Regulators: USEPA Region 2, NYSDEC, and New York State Department of Health (NYSDOH)

7. Lead organization:
U.S. Army

8. If any required QAPP elements and required information are not applicable to the project or are provided elsewhere, then note the omitted QAPP elements and provide an explanation for their exclusion below:
None

QAPP Worksheet #2 - QAPP Identifying Information
Page 2 of 6

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to Related Worksheet / Documents
Project Management and Objectives		
2.1 Title and Approval Page	Title and Approval Page	Worksheet #1 − Title and Approval Page
2.2 Document Format and Table of Contents 2.2.1 Document Control Format 2.2.2 Document Control Numbering System 2.2.3 Table of Contents 2.2.4 QAPP Identifying Information	Table of Contents QAPP Identifying Information	The Table of Contents is provided following the Title and Approval page. Worksheet #2 − Identifying Information
2.3 Distribution List and Project Personnel Sign-Off Sheet 2.3.1 Distribution List 2.3.2 Project Personnel Sign-Off Sheet	Distribution List Project Personnel Sign-Off Sheet	Worksheet #3 − Distribution List Worksheet #4 – Project Personnel Sign-Off Sheet
2.4 Project Organization 2.4.1 Project Organization Chart 2.4.2 Communication Pathways 2.4.3 Personnel Responsibilities and Qualifications 2.4.4 Special Training Requirements and Certification	Project Organization Chart Communication Pathways Personnel Responsibilities and Qualifications Table Special Personnel Training Requirements Table	Worksheet #5 − Project Organization Chart Worksheet #6 − Communication Pathways Worksheet #7 − Personnel Responsibilities and Qualifications Table Worksheet #8 − Special Personnel Training Requirements Table.

QAPP Worksheet #2 - QAPP Identifying Information
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Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to Related Worksheet / Documents
2.5 Project Planning/Problem Definition 2.5.1 Project Planning (Scoping) 2.5.2 Problem Definition, Site History, and Background	Project Planning Session Documentation (including "Data Needs" tables) Project Scoping Session Participants Sheet Problem Definition, Site History, and Background Site Maps (historical and present)	Worksheet #9 – Project Scoping Sessions Participants Sheet Worksheet #10 − Problem Definition
2.6 Project Quality Objectives and Measurement Performance Criteria 2.6.1 Development of Project Quality Objectives Using the Systematic Planning Process 2.6.2 Measurement Performance Criteria	Site-Specific Project Quality Objectives Measurement Performance Criteria Table	Worksheet #11 − Project Quality Objectives/Systematic Planning Process Statements Worksheet #12 − Measurement Performance Criteria Tables
2.7 Secondary Data Evaluation	Sources of Secondary Data and Information Secondary Data Criteria and Limitations Table	Worksheet #13 − Secondary Data Criteria and Limitations Table
2.8 Project Overview and Schedule 2.8.1 Project Overview 2.8.2 Project Schedule	Summary of Project Tasks Reference Limits and Evaluation Table Project Schedule/Timeline Table	Worksheet #14 − Summary of Project Tasks Worksheet #15 − Reference Limits and Evaluation Table Worksheet #16 − Project Schedule/Timeline Table

QAPP Worksheet #2 - QAPP Identifying Information
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Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to Related Worksheet / Documents
Measurement/Data Acquisition		
3.1 Sampling Tasks 3.1.1 Sampling Process Design and Rationale 3.1.2 Sampling Procedures and Requirements 3.1.2.1 Sampling Collection Procedures 3.1.2.2 Sample Containers, Volume, and Preservation 3.1.2.3 Equipment/Sample Containers Cleaning and Decontamination Procedures 3.1.2.4 Field Equipment Calibration, Maintenance, Testing, and Inspection Procedures 3.1.2.5 Supply Inspection and Acceptance Procedures 3.1.2.6 Field Documentation Procedures	Sampling Design and Rationale Sample Location Map Sampling Locations and Methods / Standard Operating Procedures (SOP) Requirements Table Analytical Methods/SOP Requirements Table Field QC Sample Summary Table Sampling SOPs Project Sampling SOP References Table Field Equipment Calibration, Maintenance, Testing, and Inspection Table	Worksheet #17 − Sampling Design and Rationale Worksheet #18 − Sampling Locations and Methods / SOP Requirements Worksheet #19 − Analytical SOP Requirements (Sample Containers Preservation and Holding Times) Worksheet #20 – Field Quality Control Summary Worksheet #21 − Project Sampling SOP References (Copies of the field sampling SOPs are provided in the *SEDA Generic Site-Wide SAP* (Parsons, July 2006).) Worksheet #22 − Field Equipment Calibration, Maintenance, Testing, and Inspection Table

3.2 Analytical Tasks 3.2.1 Analytical SOPs 3.2.2 Analytical Instrument Calibration Procedures 3.2.3 Analytical Instrument and Equipment Maintenance, Testing, and Inspection Procedures 3.2.4 Analytical Supply Inspection and Acceptance Procedures	Analytical SOPs Analytical SOP References Table Analytical Instrument Calibration Table Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table	Worksheet #23 − Analytical SOP References – (Copies of the analytical SOPs are provided in the Attachment C.) Worksheet #24 − Analytical Instrument Calibration Table – Laboratory Worksheet #25 − Analytical Instrument and Equipment Maintenance, Testing, and Inspection

QAPP Worksheet #2 - QAPP Identifying Information
Page 5 of 6

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to Related Worksheet / Documents
3.3 Sample Collection Documentation, Handling, Tracking, and Custody Procedures 3.3.1 Sample Collection Documentation 3.3.2 Sample Handling and Tracking System 3.3.3 Sample Custody	Sample Collection Documentation Handling, Tracking, and Custody SOPs Sample Container Identification Example Chain-of-Custody (COC) Form and Seal	Worksheet #26 − Sample Handling System Worksheet #27 − Sample Custody Requirements
3.4 Quality Control (QC) Samples 3.4.1 Sampling Quality Control Samples 3.4.2 Analytical Quality Control Samples	QC Samples Table Screening/Confirmatory Analysis Decision Tree	Worksheet #28 – Laboratory QC Samples Tables
3.5 Data Management Tasks 3.5.1 Project Documentation and Records 3.5.2 Data Package Deliverables 3.5.3 Data Reporting Formats 3.5.4 Data Handling and Management 3.5.5 Data Tracking and Control	Project Documents and Records Table Analytical Services Table Data Management SOPs	Worksheet #29 − Project Documents and Records Table Worksheet #30 − Analytical Services Table

Assessment/Oversight		
4.1 Assessments and Response Actions 4.1.1 Planned Assessments 4.1.2 Assessment Findings and Corrective Action Responses	Assessments and Response Actions Planned Project Assessments Table Audit Checklists Assessment Findings and Corrective Action Responses Table	Worksheet #31 − Planned Project Assessments Table Worksheet #32 − Assessment Findings and Corrective Action Responses
4.2 QA Management Reports	QA Management Reports Table	Worksheet #33 − QA Management Reports Table

QAPP Worksheet #2 - QAPP Identifying Information
Page 6 of 6

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to Related Worksheet / Documents
4.3 Final Project Report	All QA Management Reports attached Additional data quality concerns and resolution documentation	Worksheet #33 − QA Management Reports Table
Data Review		
5.1 Overview		
5.2 Data Review Steps 5.2.1 Step I: Verification 5.2.2 Step II: Validation 5.2.2.1 Step IIa Validation Activities 5.2.2.2 Step IIb Validation Activities 5.2.3 Step III: Usability Assessment 5.2.3.1 Data Limitations and Actions from Usability Assessment 5.2.3.2 Activities	Verification (Step I) Process Table Validation (Steps IIa and IIb) Process Table Validation (Steps IIa and IIb) Summary Table Usability Assessment	Worksheet #34 − Verification (Step I) Process Table Worksheet #35 − Validation (Steps IIa and IIb) Process Table Worksheet #36 − Validation (Steps IIa and IIb) Summary Table Worksheet #37 − Usability Assessment

QAPP Worksheet 3- Distribution List

Name of QAPP Recipients	Title / Role	Organization	Telephone Number	Fax Number	E-mail Address
John Nohrstedt	Project Manager	USAESCH	(256) 895-1639	(256) 895-1602	John.Nohrstedt@usace.army.mil
Kevin Healy	Technical Lead	USAESCH	(256) 895-1627	(256) 895-1602	Kevin.W.Healy@usace.army.mil
Michael J. D'Auben	Project Chemist	USAESCH			
Randy Battaglia	Project Manager	USACE, New York District	(607) 869-1523	(607) 869-1251	Randy.W.Battaglia@usace.army.mil
Thomas Battaglia	Site Lead	USACE, New York District	(607) 869-1353	(607) 869-1251	Thomas.C.Battaglia@usace.army.mil
Steve Absolom	Base Realignment and Closure (BRAC) Coordinator	SEDA	(607) 869-1309	(607) 869-1309	Stephen.M.Absolom@us.army.mil
Doug Schicho	Project Manager (PM)	Shaw	(973) 773-5306	(973) 770-5315	Douglas.Schicho@shawgrp.com
Ken Martinez	Contractor Quality Control Manager	Shaw	(865) 670-2656	(865) 690-3626	KennethL.Martinez@shawgrp.com
Jeff Tarr	Site Manager	Shaw	(865) 690-3211	(865) 690-3626	Jeffrey.Tarr@shawgrp.com
Braden Livingstone	Unexploded Ordnance QC Specialist (UXOQCS)	Shaw	(303) 888-5017	NA	Braden.Livingstone@shawgrp.com
Eric Malarek	Project Chemist	Shaw	(410) 273-7233	(410) 273-7103	Eric.Malarek@shawgrp.com
Julio Vazquez	Federal Regulator	USEPA Region 2	(212) 637-4323	(212) 637-3256	Vazquez.Julio@epamail.epa.gov
Kuldeep Gupta	State Regulator	NYSDEC	(518) 402-9620	(518) 402-9020	KxGupta@gw.dec.state.ny.us
Mark Sergott	State Regulator	NYSDOH	(518) 402-7860	NA	Mss04@health.state.ny.us
Scott Bailey	Laboratory Director	Gulf Coast Analytical Laboratories, Inc.	(225) 769-4900	(225) 767-5717	Scott.Bailey@gcal.com
Shelley Bourgeois	Laboratory QA Officer	Gulf Coast Analytical Laboratories, Inc.	(225) 769-4900	(225) 767-5717	Shelley.Bourgeois @gcal.com
David Vandenberg	Laboratory Director	Microbac Laboratories, Inc[1]	(740) 373-4071	(740) 373-4835	dvandenberg@microbac.com
David Bumgarner	Laboratory QA Officer	Microbac Laboratories, Inc[1]	(740) 373-4071	(740) 373-4835	dbumgarner@microbac.com

[1]Microbac is subcontract laboratory for Gulf Coast Analytical Laboratories, Inc (GCAL). GCAL is primary laboratory.

QAPP Worksheet 4 - Project Personnel Sign-Off Sheet
Page 1 of 2

Organization: Shaw

Project Personnel	Title / Role	Telephone Number	Signature / Email Receipt	QAPP Section(s) Reviewed	Date QAPP Read
Douglas Schicho	PM	(973) 773-5306	Douglas.Schicho@shawgrp.com	Worksheets 1-37 Appendices	3/10/2012
Ken Martinez	Contractor QC System Manager	(865) 670-2656	KennethL.Martinez@shawgrp.com	Worksheets 1-37 Appendices	3/13/2012
Jeff Tarr	Site Manager	(865) 690-3211	Jeffrey.Tarr@shawgrp.com	Worksheets 1-37 Appendices	3/13/2012
Braden Livingstone	UXOQCS	(303) 888-5017	Braden.Livingstone@shawgrp.com	Worksheets 1-37 Appendices	3/13/2012
Eric Malarek	Project Chemist	(410) 273-7233	Eric.Malarek@shawgrp.com	Worksheets 1-37 Appendices	3/9/2012

QAPP Worksheet 4 - Project Personnel Sign-Off Sheet
Page 2 of 2

Organization: Gulf Coast Analytical Laboratories, Inc. (GCAL).

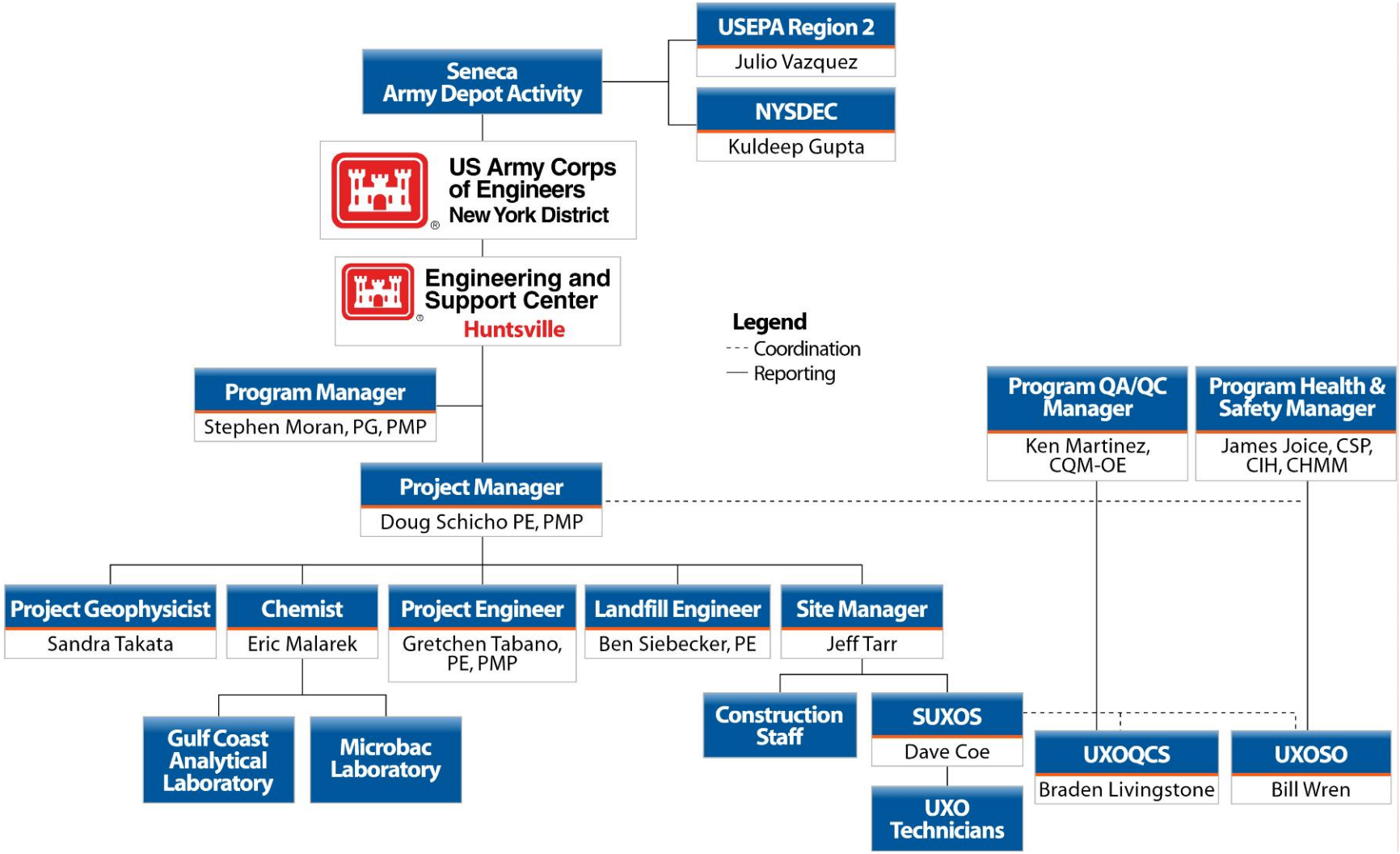
Project Personnel	Title / Role	Telephone Number	Signature / Email Receipt	QAPP Section(s) Reviewed	Date QAPP Read
Scott Bailey	Laboratory Director	(225) 769-4900	scott.bailey@gcal.com	Worksheets 1-37 Appendices	5/7/2013
Shelley Bourgeois	Laboratory QA Officer	(225) 769-4900	shelley.bourgeois@gcal.com	Worksheets 1-37 Appendices	5/7/2013
Brenda Martinez	Laboratory PM	(225) 769-4900	brenda.martinez@gcal.com	Worksheets 1-37 Appendices	5/7/2013

Organization: Microbac Laboratories, Inc (Subcontractor for GCAL)[1].

Project Personnel	Title / Role	Telephone Number	Signature / Email Receipt	QAPP Section(s) Reviewed	Date QAPP Read
David Vandenberg	Laboratory Director	740-373-4071	dvandenberg@microbac.com	Worksheets 1-37 Appendices	5/7/2013
David Bumgarner	Laboratory QA Officer	740-373-4071	dbumgarner@microbac.com	Worksheets 1-37 Appendices	5/7/2013
Stephanie Mossburg	Laboratory PM	740-373-4071	smossburg@microbac.com	Worksheets 1-37 Appendices	5/7/2013

[1] Microbac is a secondary subcontractor lab for GCAL. All correspondence must first through the primary laboratory GCAL.

QAPP Worksheet 5 - Project Organizational Chart



QAPP Worksheet 6 - Communication Pathways
Page 1 of 2

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or email	Procedure (timing, pathways, etc.)
Point of Contact with Regulators	SEDA BRAC Coordinator	Steve Absolom	(607) 869-1309 Stephen.M.Absolom@us.army.mil	All materials and information pertaining to the project will be forwarded to the regulators by the SEDA BRAC Coordinator or forwarded by Shaw on behalf of the BRAC Coordinator following review.
Manage All Project Phases	Shaw PM	Doug Schicho	(973) 770-5306 Douglas.Schicho@shawgrp.com	Issues are to be reported to the USAESCH PM immediately and followed up in writing within 2 business days.
QAPP Changes in the Field	Site Manager	Jeff Tarr	(865) 690-3211 Jeffrey.Tarr@shawgrp.com	Site Manager will notify the Shaw PM by phone and e-mail of changes to the QAPP made in the field and the reasons within 24 hours. Changes will be documented in a technical directive. Shaw PM will notify USAESCH and USEPA within one week.
Daily Field Progress Reports	Site Manager	Jeff Tarr	(865) 690-3211 Jeffrey.Tarr@shawgrp.com	Site Manager will provide daily reports to the Shaw PM via phone, fax, or e-mail. Further discussion may be found in Section 2 in the *SEDA Work Plan for MEC Clearance at the OD Grounds* (Shaw, 2012).
Reporting Laboratory Data Quality Issues	Laboratory QA Officer	Shelley Bourgeois	(225) 769-4900 Shelley.bourgeois@gcal.com	All QA/QC issues with laboratory analyses will be reported to the Shaw Project Chemist immediately and corrective actions implemented. The corrective actions follow-on report will be provided to the Shaw PM within 2 business days.

QAPP Worksheet 6 - Communication Pathways
Page 2 of 2

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or email	Procedure (timing, pathways, etc.)
Field Corrective Actions	Shaw UXOQCS	Braden Livingstone	(303) 888-5017 Braden.Livingstone@shawgrp.com	The need for corrective action for field issues will be reported by the UXOQCS and documented in a technical directive within 2 business days. Corrective actions will be reported to USAESCH, NY District Corps, SEDA, and USEPA within one week.
Lab Analytical Corrective Actions	Shaw Project Chemist	Eric Malarek	(410) 273-7233 Eric.Malarek@shawgrp.com	The Shaw Project Chemist will be notified immediately by the lab of the need for any item requiring immediate corrective actions for laboratory analytical issues. The corrective actions follow-on report will be provided to the Shaw PM within 2 business days. Corrective actions will be reported to USAESCH, NY District Corps, SEDA, and USEPA within one week.
Release of Analytical Data	Shaw Project Chemist	Eric Malarek	(410) 273-7233 Eric.Malarek@shawgrp.com	No analytical data will be released until verification is completed. Data will be verified by the Shaw Project Chemist within 1 business day of receipt from the laboratory.

QAPP Amendments	Shaw Project Chemist	Eric Malarek	(410) 273-7233 Eric.Malarek@shawgrp.com	Any major changes to the QAPP must be approved by the Shaw PM and the USAESCH PM before the changes can be forwarded to the SEDA Project Delivery Team (Worksheet 4) for approval. The proposed changes will be forwarded to the Project Delivery Team within 5 days of proposal. Changes to the QAPP will not be implemented unless approved by the Project Delivery Team.

QAPP Worksheet 7 - Personnel Responsibilities and Qualifications Table
Page 1 of 2

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Steve Absolom	SEDA BRAC Coordinator	US Army	Ultimate team leader for project decisions and actions.	TBD
John Nohrstedt	USAESCH PM	USAESCH	Oversees the project. Design Team Leader	TBD
Randy Battaglia	USACE NY District PM	USACE NY District	Oversees the project. Project Delivery Team Leader	TBD
Doug Schicho	Shaw PM	Shaw	Manages project and coordinates between USAESCH and other Project Delivery Team Members and Shaw.	B. S. Chemistry, M.S. Environmental Engineering, 19 years experience
Ken Martinez	Contractor QC System Manager	Shaw	Oversees the project Quality Systems.	A.S. Water Quality Management, B.S. Organizational Management, 23 years experience
Jeff Tarr	Site Manager	Shaw	Responsible for managing all field activities including evaluating sampling locations and parameters and ensuring requirements of QAPP are met.	A.S. Petroleum Engineering, B.S. Geology, 22 years experience
Braden Livingstone	UXOQCS	Shaw	Field QA oversight on the project.	11 years of Explosive Ordnance Disposal (EOD)/ Unexploded Ordnance (UXO) experience, Certified Quality Manager (CQM) Qualification 2009
Eric Malarek	Project Chemist	Shaw	Serves as liaison between Shaw and laboratory.	B.A. Chemistry, Master Business Administration, 25 years experience
Winston (Doug) Russell	Health & Safety (H&S) Manager	Shaw	Oversees the H&S for field activities.	Associate of Engineering. Electrical, 23 years experience

QAPP Worksheet 7 - Personnel Responsibilities and Qualifications Table
Page 2 of 2

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Scott Bailey	Laboratory Director	Gulf Coast Analytical Laboratories, Inc.	Manages the generation of analytical data.	B.S. Environmental Health, 28 years experience
Brenda Martinez	Laboratory PM	Gulf Coast Analytical Laboratories, Inc.	Serves as Laboratory PM and laboratory liaison with Shaw.	B.S. Bioenvironmental Science, M.S. Environmental Management 8 years experience
Shelley Bourgeois	Laboratory QA Officer	Gulf Coast Analytical Laboratories, Inc.	Performs laboratory QA oversight.	B.S. Microbiology, 15 years experience
David Vandenberg	Laboratory Director	Microbac Laboratories, Inc.	Manages the generation of analytical data (Secondary Lab).	B.S. Biochemistry, 18 years experience
Stephanie Mossburg	Laboratory PM	Microbac Laboratories, Inc.	Serves as Laboratory PM and laboratory liaison with GCAL.	M.S. Chemistry, 30 years experience
David Bumgarner	Laboratory QA Officer	Microbac Laboratories, Inc.	Performs laboratory QA oversight (Secondary Lab).	B.S. Biochemistry, 28 years experience

QAPP Worksheet 8- Special Personnel Training Requirements Table

Project Function	Specialized Training By Title or Description of Course	Training Provider	Training Date	Personnel / Groups Receiving Training	Personnel Titles / Organizational Affiliation	Location of Training Records / Certificates[1]
Environmental Sampling	• 40-Hour Hazardous Waste Site Worker • 8-Hour Hazardous Waste Site Worker Annual Refresher	Varies[2]	Varies[2]	All	Site Manager; Environmental Sampling Lead - Shaw	Certification files are maintained on-site during field activities.
UXO Team	• 40-Hour Hazardous Waste Site Worker • 8-Hour Hazardous Waste Site Worker Annual Refresher • Specialized training per the DoD Explosives Safety Board (DDESB) Technical Paper (TP) 18 (DDESB, 2004)	Varies[2]	Varies[2]	All	Senior UXO Supervisor; UXOQCS; UXO Safety Officer (UXOSO); UXO Technicians, all levels - Shaw	Certification files are maintained on-site during field activities.
Any personnel working in the exclusion zone or areas of contamination on the project site	• 40-Hour Hazardous Waste Site Worker • 8-Hour Hazardous Waste Site Worker Annual Refresher	Varies[2]	Varies[2]	All	Varies	Certification files are maintained on-site during field activities.

[1] Training records and/or certificates will be available on-site at SEDA.

[2] The training provider and date of the training may/will vary from person to person but is indicated on the individual's certificate.

QAPP Worksheet 9- Project Scoping Session Participants Sheet

Project Name: *SEDA OD Grounds MEC Clearance* ***Projected Date(s) of Sampling:*** *August 2012* ***Project Manager:*** *Doug Schicho*	***Site Name:*** *Seneca Army Depot Activity, OD Grounds and OB Tray at the OB Grounds* ***Site Location:*** *Romulus, New York*
Date of Session: December 15, 2012 **Scoping Session Purpose:** Kickoff Meeting	

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Stephen Absolom	BRAC Coordinator	SEDA	(607) 869-1309	Stephen.M.Absolom@us.army.mil	BRAC Environmental Coordinator
Randy Battaglia	Project Manager	USACE, NY District	(607) 869-1523	Randy.W.Battaglia@usace.army.mil	Project Manager
Tom Battaglia	Site Lead	USACE, NY District	(607) 869-1353	Thomas.C.Battaglia@usace.army.mil	Site Lead
Kevin Healy	Technical Lead	USAESCH	(256) 895-1627	Kevin.W.Healy@usace.army.mil	Technical Lead
John S. Nohrstedt	Project Manager	USAESCH	(256) 895-1639	John.Nohrstedt@usace.army.mil	Project Manager
Steve Moran	Program Manager	Shaw	(865) 694-7361	Steve.G.Moran@shawgrp.com	Program Manager
Doug Schicho	Project Manager	Shaw	(973) 773-5306	Douglas.Schicho@shawgrp.com	Project Manager
Gretchen Tabano	Project Engineer	Shaw	(410) 273-7321	Gretchen.Tabano@shawgrp.com	Project Engineer
Ben Siebecker	Landfill Engineer	Shaw	(617) 589-4041	Benjamin.Siebecker@shawgrp.com	Landfill Engineer
Mike Clemens	MEC Lead	Shaw	(509) 990-1149	Michael.Clemens@shawgrp.com	MEC Technical Lead
Tim Deignan	Project Geophysicist	Shaw	(720) 554-8273	Timothy.Deignan@shawgrp.com	Project Geophysicist

Decisions and Action Items Resulting from Meeting

1) TASKS AND APPPROACHES

Project Name: *SEDA OD Grounds MEC Clearance* ***Projected Date(s) of Sampling:*** *August 2012* ***Project Manager:*** *Doug Schicho*	***Site Name:*** *Seneca Army Depot Activity, OD Grounds and OB Tray at the OB Grounds* ***Site Location:*** *Romulus, New York*

Doug Schicho briefly discussed the tasks below with the purpose of asking preliminary questions and ensuring Shaw properly understood the objectives and methodologies involved in each task.

TASK 1 Preparation of Work Plans and Designs

- Work Plan in accordance with the WERS DIDs.
  - Preparation of the work plan is underway. The completion of the work plan is pending the receipt of the Parsons GIS and geophysical data. Kevin Healy has provided a copy of the Parsons Work Plan for the area outside the 1,000 foot radius.
- Accident Prevention Plan (APP).
  - The draft APP will be submitted with the draft work plan
- Uniform Federal Policy Quality Assurance Project Plan (UFP QAPP).
  - At the time of the conference call it was mistakenly assumed that the environmental sampling task was an unfunded option to the task order. Based on that assumption it was stated that the UFP QAPP would be completed after the award of the environmental sampling task. Subsequently it has been clarified by USACE that Task 3 was awarded as part of the base task. The UFP QAPP will be completed and submitted as part of the pre-Draft Work Plan.
- Quality Assurance Surveillance Plan (QASP)
  - The QASP will be produced after receipt of the example QASP from USAESCH.
- Landfill Design
  - Completion of the landfill cap design will lag the work plan completion. The contaminants of concern (COCs) and site cleanup levels (SCLs) to be established in the Feasibility Study will be required in order to design the cap to cover hazardous soils. The chemical analytical data collected by Parsons previously will be required for the cap design. Additionally, a topographic survey of the site will need to be performed in order to complete the design.

TASK 2a.1 Digital Geophysical Mapping of 58.4 Acres of 0-1000 foot Radius

- Doug Schicho summarized that his understanding of this task included geophysically mapping all areas of the 0-1000 radius excluding the area of the burning ground which has already been cleaned and the areas which are either too steep or heavily wooded to geophysically map.

TASK 2a.2 Excavation of Areas of Metallic Saturation

- Doug Schicho summarized that based on his understanding; this task included the excavation of areas exhibiting metallic saturation in the DGM survey. The amount of area requiring excavation is estimated at 20 acres. The excavated soil could then be screened and the screened soils placed beneath the landfill cap.

TASK 2a.3 Surface Sweep of Existing OD Hill for MPPEH

- Doug Schicho summarized that based on his understanding; the surface sweep would be carried out for areas with a high density of metal on the surface. The removal of the surface metal and MEC would be performed prior to the geophysical survey.

TASK 2a.4 Geophysical Re-Map of Excavated Areas

- Doug Schicho summarized that based on his understanding; this task included re-mapping all geophysical anomalies from within the areas to be excavated under Task 2a.2.

TASK 2a.5 Reacquire and Prosecute Mapped Targets in 500-1000 Foot Radius

- Doug Schicho summarized that based on his understanding; this task includes the reacquisition and prosecution of all mapped targets within the 0-1000 foot radius. The number of anomalies has been estimated at 15,240.

TASK 2c Mag and Dig 9,800 Anomalies

- Doug Schicho summarized that based on his understanding; this task includes mag and dig of anomalies in the areas of steep terrain and woods where DGM cannot be performed.

TASK 2g Open Burning Tray

- Doug Schicho summarized that based on his understanding; this task includes following the existing Work Plan for Burn Pan Closure.

Project Name: *SEDA OD Grounds MEC Clearance* ***Projected Date(s) of Sampling:*** *August 2012* ***Project Manager:*** *Doug Schicho*	***Site Name:*** *Seneca Army Depot Activity, OD Grounds and OB Tray at the OB Grounds* ***Site Location:*** *Romulus, New York*

TASK 3 Environmental Sampling and Analysis

- At the time of the kick off call it was mistakenly assumed that this optional task had not yet been awarded. Subsequently USACE has clarified that Task 3 was awarded as part of the original award. Shaw will work with the Army to formulate a sampling approach for incorporation into the pre-Draft Work Plan.

TASK 4 Remedial Action Report

- Completion of the Remedial Action Report after MEC removal and cap construction. Because capping cannot take place until after signature of the ROD, cap installation may not take place this year if a regulatory delay is experienced. This may necessitate the completion of a second Remedial Action Report (one for the munitions task and one for the Landfill Cap).

2) LINES OF COMMUNICATION

- Doug Schicho asked Steve Absolom to summarize how he would like to see regulatory communication take place on the project. He indicated that the Army stakeholders would do a pre-Draft review of all documents. After modification in light of the Army's comments the document would be submitted to the regulators as a draft under a cover letter from Shaw indicating the document is being submitted on behalf of the Army. The documents would be produced and sent out by Shaw. All regulatory interaction will be performed by Steve Absolom.

3) SITE VISIT

- Doug indicated that he understood that there would not be a site visit until after the draft work plan was submitted. Steve Absolom indicated that the meeting would be more productive at that time because there would be more to talk about but that if Shaw wanted to see the site sooner, he could accommodate a visit. Doug Schicho indicated he would talk to the Shaw team and get back to the Army about a site visit during the week of December 19th.

4) COMMENTS / QUESTIONS / CONCERNS

Project Name: *SEDA OD Grounds MEC Clearance* ***Projected Date(s) of Sampling:*** *August 2012* ***Project Manager:*** *Doug Schicho*	***Site Name:*** *Seneca Army Depot Activity, OD Grounds and OB Tray at the OB Grounds* ***Site Location:*** *Romulus, New York*

- Doug asked about Seneca's preference for update meetings, teleconferences, status reports, and face to face meetings. Steve Absolom indicated that once the project was in the field he would want to have weekly face to face meetings. He may not attend them all but the New York District representative would. When the project was not in the field weekly teleconferences would be fine. At other stages of the project, such as when the work plan is being drafted or during periods of regulatory review, less frequent update calls would be appropriate.

- Doug indicated that Kevin was working to get Shaw the administrative record documents they needed to complete the project work plan, but there were some documents Kevin did not have access to. Doug asked if it would be possible to get copies of the ROD and post-closure report for the Burning Ground. Steve Absolom indicated that the post closure report might be available and he would ship a copy to Doug so it could be reproduced. Due to the age of the document the ROD might not be available but he indicated he would check.

5) NEXT STEPS / ACTION ITEMS

- Kevin Healy to follow up with Parsons regarding the data that has been requested from them.
- Steve Absolom to determine if the ROD for the Burning Ground is available and send a copy of the closure report to Doug Schicho.
- Doug Schicho to get back to the Army regarding a site visit for the week of the 19th. (A site visit was conducted in December by Doug Schicho and Mike Clemens).

Date of Session: December 22, 2012
Scoping Session Purpose: Shaw Site Visit

Decisions and Action Items Resulting from Meeting

1- **Shaw's Field Team:** Steve Absolom asked what the organization will be for the Shaw field team. He indicated that his preference would be to have a site manager who has overall responsibility for coordinating and performing all field activities. In the past he has not seen good results on projects where the SUXOS has had to perform as both the SUXOS and Site Manager. The responsibilities and goals of the SUXOS and Site Manager are different and having a SUXOS perform the duties of the Site Manager in addition to his own can overload him. Doug Schicho agreed and had anticipated having these jobs performed by separate individuals. The SUXOS is anticipated to be David Coe. The Site Manager has not yet been selected.
2- **Location of the Screening Plant**: On the kick off call, Shaw suggested that a good location for the screening plant might be within the Open Burning (OB) Ground footprint which had already been remediated. After further consideration, Seneca does not want there to be any question that the area might have been re-contaminated by soils from the screening plant. The group discussed placing the screening

plant within the capping footprint. The area should have minimal targets to be excavated and would be remediated prior to the placement of the screening plant. As such, the screening plant will not be placed with the OB Grounds footprint.

3- **Establishing grids on a circular site**: The group discussed Shaw's plan to establish 200 by 200 foot grids across the site for DGM, surface sweep, mag and dig. This will mean part of the Shaw grids will fall outside the 1000 foot circular radius. The group discussed using the existing grid system of 100 by 100 foot grids used by Parsons in the 2004 EE/CA investigation. This will minimize the amount of area to be covered outside of the circular foot print and provide consistency between past investigations and the planned remedial action. The best approach will be to coordinate establishing the grids with Parsons so we are in the same system (assuming Parsons plans on establishing grids). Mike Clemens asked if any of the grid corner markers were still in place. Tom Battaglia said that they were not but that there were other benchmarks on SEDA (possibly on the OD) which could be used.

   - **Action Item:** Doug to request (through USACE) that Parsons provide the coordinate system for the grids used as part of earlier investigations along with the investigation results in GIS format. Doug to discuss the use of this existing grid system with Parsons to determine if using the same system is feasible.

4- **Burning Ground Reports**: On the kick off call, Shaw asked if the OB Ground Remedial Action Report and ROD was available. Steve Absolom had not yet had time to look for the documents. He indicated he would look and provide the documents if they are available.

   - **Action Item:** Steve Absolom to determine if the Burning Ground documents are available.

5- **Equipment Vendors**: The group discussed equipment vendors. Shaw will use a mixture of Shaw equipment and rental equipment which will be procured specifically for the project. Steve Absolom indicated that one of the original BRAC redevelopment goals was to utilize local vendors to the greatest extent possible. Shaw will make every effort to incorporate local vendors on bids and to the procurement process.

6- **Work Schedule:** Tom Battaglia proposed an idea to have each contractor work a 4 day – 10 hour/day work week. One contractor working Monday through Thursday and the other Tuesday through Friday. That way demo would be done on Mondays and Fridays by alternating contractors. Mike Clemens agreed that this is a workable solution and will factor it into the approach.

7- **Demolition Operations:** When demo is performed, Shaw will notify local authorities and the SEDA administrative assistant for situational awareness. Calls will be made prior to each shot. SEDA prefers the use of jet perforators for demolition.

8- **Shaw/Parsons Interaction:** The Army team expects Shaw and Parsons to work closely to minimize duplication of effort and extra strain on their resources. Shaw will make every effort to work efficiently side by side with Parsons and will seek out opportunities to streamline operations. An example of which (shared geophysical test plot) was proposed by Mike Clemens.

9- **Union vs. Non-Union:** Randy Battaglia asked if we intended on using equipment operators and laborers from local union shops. Doug Schicho said we intended on using Shaw Labor for the majority or all of the construction labor requirement. They were fine with that but indicated that when they get calls from the local shops they will refer them to Shaw. Steve Absolom indicated that the non-union contractors at SEDA have been asked to produce certified payroll in the past.

Project Name: *SEDA OD Grounds MEC Clearance* ***Projected Date(s) of Sampling:*** *August 2012* ***Project Manager:*** *Doug Schicho*	***Site Name:*** *Seneca Army Depot Activity, OD Grounds and OB Tray at the OB Grounds* ***Site Location:*** *Romulus, New York*

10- Blow in Place: The SEDA team could not recall the last time an item was found that was required to be blown in place. They don't anticipate having to do it on this project. The MEC that is found will be destroyed using consolidated shots. The shots will be performed on OD Hill. Each contractor will utilize a separate area of the hill.

11- Notification of Huntsville: If during the course of the project, a MEC item is found that necessitates that Huntsville be notified, Tom, Randy and Steve have to be involved on that call.

12- Shared Geophysics Test Plot: Mike Clemens asked if it would make sense for Shaw and Parsons to share a geophysical test plot. In that way the instrument verification would be standardized across the project. The group agreed that this approach makes sense.

- **Action Item:** Doug Schicho to open a dialog with Parsons, through the Army, about the logistics of sharing a geophysical test plot.

13- Use of the Burn Tray: The remaining burn tray can be used as needed during the project. SEDA has successfully used the tray to thermally validate small projectiles in the past.

14- OD Area Physical Characteristics: When it was an active OD ground, there were times when the 0-1000 foot radius was scraped to remove surface metal. So there will be areas where there is little metal at the surface. Additionally, the soil cover is thin in some areas. There are rock outcrops in some sections of the 0-1000 foot radius.

15- Geophysical Survey: The 50 mV threshold (combined on all 4 channels) is the established threshold for MEC investigations at SEDA. It has been demonstrated through site-specific experience to be the threshold that triggers intrusive investigation of the anomaly.

16- Data Quality Objectives of the MEC removal: Shaw should understand that the purpose of the MEC removal is to remove the explosive hazard, not to removal all metal from the site. It is not the goal (nor is it feasible) to removal all metal from the site.

17- Excavation and Screening: Excavation and screening is not the only method for MEC removal. There are several challenges that have previously arisen with screening soils on this site. Handling and dealing with the oversize fraction is a big challenge. Shaw's work plan must spell out how this will be handled. The work plan should clearly spell out how Shaw will perform the sifting operation and how Shaw will handle all three piles (sifted soil, metallic waste, and oversize). Clay soils and sod are another concern with the sifting operation. Shaw should clearly explain how the operators will run the screening plant. Any concerns about the operator's ability to view the plant due to barricades should be explained in the work plan. The work plan must explain who is behind the barricades and who is not.

18- Site Logistics: Both the Shaw and Parsons team will be given keys to open the site fences. It is more direct to enter the site from the western gate. Entering the site from the west only requires passing through (unlocking and relocking) one gate as opposed to three gates coming from the east. All explosive deliveries, equipment deliveries and trucks will enter and leave through the western gate. All gates must be relocked after passing through them. Gates contain multiple locks in series and must be relocked accordingly so all contractors and government personnel can get in and out.

19- Depth of MEC: Typically, MEC has not been found deeper than 1 foot in the area surrounding the OD Hill.

20- Site Tour: During the site tour, Tom Battaglia showed Mike Clemens and Doug Schicho the existing infrastructure available at the site. There is an office building which could be shared between Parsons and Shaw. Electric hookup will have to be re-established at the site.

Project Name: *SEDA OD Grounds MEC Clearance* ***Projected Date(s) of Sampling:*** *August 2012* ***Project Manager:*** *Doug Schicho*	***Site Name:*** *Seneca Army Depot Activity, OD Grounds and OB Tray at the OB Grounds* ***Site Location:*** *Romulus, New York*

There is a building that can be used for equipment storage. There are two storage magazines that can be used for storage of demolition explosives and MPPEH prior to demolition.

21- Communication: Randy Battaglia discussed project communication and stressed that the entire project team be kept in the loop. Randy Battaglia is the Project Manager for NY District. Steve Absolom is a very hands-on client and must be kept informed.

The problem to be addressed by the project:

Purpose and Scope

The purpose and scope of this Task Order is to design and complete the installation of an NYS Part 360 landfill cap to inter contaminated soils at the SEDA in Romulus, New York. Additionally, other activities will be performed in support of the landfill construction to include additional MEC remedial actions and long-term monitoring at the site. Specifically, this Task Order was established to conduct a remedial action within the 0-1000 foot radius area surrounding the former OD area to remove all Material Potentially Presenting an Explosive Hazard (MPPEH) as well as closing the Open Burning Tray. A landfill cap will also be placed at the site following the MEC remedial activities. This UFP QAPP addresses the sampling and analysis activities associated with this effort. The sampling includes the following:

- Soil sampling for Target Analyte List (TAL) metals, explosives, perchlorate (select samples) to delineate soil contamination and confirm that all contaminated soils are placed beneath the landfill cap;
- Soil sampling for Synthetic Precipitation Leaching Procedure (SPLP) TAL Metals in soils to evaluate potential leaching to groundwater and confirm that all contaminated soils are placed beneath the landfill cap;
- Surface water sampling downgradient of the landfill cap for TAL Metals to evaluate whether migration has occurred and impacted the stream;
- Sampling of the Open Burning Tray to support closure of this area to include concrete powder/dust chip characterization sampling for toxicity characteristic leaching procedure (TCLP) VOCs, TCLP SVOCs, TCLP Pesticides, TCLP Herbicides, and TCLP Metals;
- Long-term monitoring of groundwater. At the present time, this monitoring is assumed to be for TAL metals. Field photoionization detector (PID) (equipped with a 10.6 eV lamp) screening for VOCs will be performed at each groundwater well location during the first event, and if warranted, VOCs be added to the scope. In addition, the water quality parameters pH, conductivity, turbidity, temperature, dissolved oxygen, and oxidation/reduction potential will be performed for each well location.
- Sampling any generated investigative derived waste (IDW) (if warranted) for disposal characterization sampling for TCLP VOCs, TCLP SVOCs, TCLP Pesticides, TCLP Herbicides, TCLP Metals, Reactivity, Ignitability, and pH.

The environmental sampling efforts described in this QAPP cover all phases of the work to be performed at the OD Grounds. The MEC clearance efforts, landfill capping efforts, and long-term monitoring procedures are covered in separate work plans. The field methods to be utilized for completion of the environmental sampling are presented in the *Generic Site-Wide Sampling and Analysis Plan (SAP) for SEDA* (Parsons, July 2006).

The problem to be addressed by the project (continued):

Project Location and Description

The SEDA facility is located in Seneca County, Romulus, New York. It is a former United States Army site that occupies approximately 10,587 acres. It is bounded to the west by State Route 96A and to the east by State Route 96. Geneva and Rochester are located to the northwest (14 and 50 miles, respectively), Syracuse is 50 miles to the northeast, and Ithaca is 31 miles to the south. The surrounding area outside the SEDA property is used mainly for agriculture. The OD Grounds is located in the northwestern corner of SEDA in Seneca County, New York. The OD Grounds encompasses approximately 90 acres and, together with the OB Grounds, comprise the demolition area at SEDA. The OB Grounds was previously closed, so other than the Open Burning Tray, is not part of this scope of work. The Open Burning Tray is located within the OB Grounds (SEAD-23) in the northwestern portion of SEDA, approximately 3.5 miles northwest of SEDA's main entry gate off New York State Highway Route 96.

Site History

The SEDA facility was constructed in 1941, and was operated by the US Army until its closure in July 2000. From 1941 to 1995, the site was used for receipt, storage, maintenance, and supply of military items including munitions and equipment. In 1989, SEDA was included on the Federal Facilities NPL, which mandated that necessary remedial investigations and actions be completed for the site.

Following recommendation by DoD, approval by the Base Closure Commission, the President and Congress, SEDA was approved for the 1995 BRAC list in October 1995. The mission closure date was scheduled for September 30, 1999. Installation closure date was September 30, 2000, with 22 employees after that date. Current reuse plans project that most of the property will be transferred to the state for a wildlife refuge; some parts of the base will be transferred to various prison and correctional authorities.

The OD Grounds was formerly used for the disposal and detonation of military munitions, and consequently MEC and munitions debris are prevalent throughout this area. The OD Grounds consists of a large open area located in the northwest corner of the SEDA property. It is comprised of approximately 90 acres of wooded and non-wooded areas. Based on the findings from an Engineering Evaluation/Cost Analysis (EE/CA) performed by Parson (Parsons, 2001), the inner 1,000-foot (ft) radius is considered saturated with potential MEC and munitions debris.

The Open Burning Tray is located within the OB Grounds. The land at the OB Grounds was used for demilitarization of munitions for approximately fifty years. The original open burning procedure involved the preparation of combustible beds of pallets and wooden boxes on one of the nine designated burn pads followed by the placement of ammunition or the components to be demilitarized on the beds. A trail of propellant was placed on the ground leading to the combustible bed. Once ignited the energetic material was allowed to burn until only ash and empty casings remained. Items burned included various military munitions such as propellants and projectiles.

The problem to be addressed by the project (continued):
Designated munitions waste was open-burned on the nine separate burning pads comprising the OB grounds until 1987. After 1987, munitions were destroyed by burning them within an above ground steel tray mounted atop a concrete pad to minimize the impact of the burning on the environment. The Open Burning Tray measures 8 ft in width, 40 ft in length, and 2 ft in depth. The tray sat atop concrete blocks on top of a concrete pad measuring approximately 40 ft by 65 ft by approximately 1ft. thick. The maximum OB treatment capacity, proposed in SEDA's 1987 application for a Resource Conservation and Recovery Act (RCRA) Part A and Part B permit, was 5000 pound per day (lb/day) with a maximum of 80 burn days/year. The tray has not been used on a consistent basis since the closure of SEDA in 1995; however, it is still used sporadically to dispose of burnable items recovered during UXO clearance work performed at sites around SEDA.

The Army intends to close the Open Burning Tray and its underlying concrete pad upon completion of ongoing UXO clearance work at SEDA. Until that time, the tray will be maintained in its current state for use with any burnable waste generated during CERCLA cleanup actions. The 30-acre OB Grounds facility surrounding the tray has been remediated in accordance with a Record of Decision (ROD) under CERCLA, which was reviewed for adequacy under RCRA.

Current and Projected Land Use

In accordance with the requirements of the BRAC process, the Seneca County Board of Supervisors established the SEDA Local Redevelopment Authority (LRA) in October 1995. The primary responsibility assigned to the LRA was to plan and oversee the redevelopment of SEDA. The Reuse Plan and Implementation Strategy for SEDA was adopted by the LRA and approved by the Seneca County Board of Supervisors on October 22, 1996. Under this plan and subsequent amendment, areas within SEDA were classified as to their most likely future use. These areas included: housing, institutional, industrial, an area for the existing navigational Long Range Navigation (LORAN) transmitter, recreational/conservation and an area designated for a future prison. As of September 2000, the housing, institutional, and LORAN transmitter sites were already being used as anticipated. The prison had also begun operations and was utilizing the area expected exclusive of that covered by SEAD-44A, which still had not been cleared for MEC. Portions of the planned industrial area had also been leased. The OD Grounds has been designated for recreational/conservation uses.

Summary of Previous Site Investigation Findings

OD Grounds consists of a large open area approximately 90-acres in size. A variety of ordnance was destroyed by detonation at this area, including explosives, rockets, and heavy artillery. The blast radius shown on old drawings included in the Archive Search Report is 1800 feet from the center of the demolition berm. The 1000-1800 ft radius has been addressed previously, so this scope of work is for the 0-1000 ft radius, only. MEC and munitions debris (MD) are prevalent throughout this area. The density of MEC in the 0-1000 ft radius at OD Grounds is not known. The activities conducted at the OD Ground would indicate that the density of MEC could be high within relatively confined areas where MEC were detonated.

Hazards to human health and the environment as a result of an explosion are the primary risk factor involved with potential MEC at the OD Grounds. No installation workers are currently located at the OD Grounds and the area is enclosed with a perimeter fence. There is a potentially complete pathway for human exposure (authorized personnel, authorized visitors, and trespassers) to MEC. Further, if future land use plans are followed, the OD Grounds will be used for conservation and recreation and will become accessible to the public. This use is expected to attract a number of people to the property. This attraction will significantly increase the number of people visiting compared with current land use. This increase in people to the property will, in turn, intensify the probability of a person's exposure to MEC. While the fence encompassing the former depot restricts public access, the freedom of people to move about within the confines of the fenced site will be unrestricted unless Areas of Concern (AOCs) are controlled or restricted prior to public access.

The problem to be addressed by the project (continued):
Elevated metals were identified, primarily surrounding OD Hill, which is located at the center of the OD Grounds. These elevated metals are present within the 0-500 ft radius and were not observed outside this area. Risks to human health and the environment will be addressed by placing a landfill cap over the contaminated soils. The capping activities are being discussed in separate work planning documents, so the hazardous and toxic waste (HTW) contamination is not further discussed in this work plan.

The Open Burning Tray is empty of munitions so explosive hazards do not remain. The OB tray may be used for disposal of ordnance during the OD Grounds MEC clearance activities. Following completion of the MEC clearance activities, all left over materials will be removed from the tray. The maximum inventory of hazardous wastes ever present in the burn tray during its active life is estimated at approximately 5,000 lbs of propellant, which was the maximum weight requested in the RCRA Part A and Part B permit application. The propellant would have been present in many of the extremely varied types of munitions stored at SEDA. Residual hazardous wastes (i.e., munitions constituent [MC]) present in the Open Burning Tray could present an unacceptable risk to human health or the environment.

Areas of Concern and Investigation Strategy

The area where remedial actions will be performed as part of this contract include the 0-1000 ft radius of the OD Grounds (minus the OB portion of the site which has already been remediated) and the Open Burning Tray. The remedial actions will be performed in the following stages: 1) remove all MPPEH from the 0-1000 ft radius, 2) characterize residual environmental (soil and surface water) contamination as necessary, 3) construct landfill cap, and 4) long-term monitoring of groundwater.

Soil and Surface Water Sampling

Soil sampling for TAL Metals, explosives, perchlorate (select samples), and SPLP Metals will be performed to confirm that all contaminated soils are placed beneath the landfill cap. The SPLP data will be used to evaluate potential impact to groundwater from soils which are not capped. If SPLP leachate concentrations are greater than NYSDEC GA GW Effluent concentrations then the potential for metals leaching to groundwater will be factored into the cap design. The samples are being collected for worst case analysis from the immediate location of MEC items; therefore, discrete samples will be collected for all analysis. The location and number of samples to be collected and analyzed for perchlorate will be presented in the memorandum report. It is expected that the number of explosively filled items to be found to be very low. Based on previous studies, the majority of items are expected to be MD. Soil samples will be collected and analyzed for explosives in any areas where Blow in Place operations are conducted during this removal. No sampling for explosives or perchlorate is proposed for the OD Hill (will be capped), screened soil under the cap, or the concrete material. To allow for adequate flexibility to tailor the sampling approach in light of the results of the MEC removal, further details on the soil and surface water investigation field program to describe the activities to be employed and completed will be presented in a future memorandum report and Long Term Monitoring Plan. Samples will be biased to areas where MEC was found in greater density and removed. The sampling depths will be determined in light of the depth at which MEC items are located.

Surface water sampling will be performed for TAL Metals to evaluate whether migration has occurred and impacted the stream. Sample locations will be selected based on results from previous characterization efforts performed by Parsons and evaluated in the Feasibility Study (FS) for the OD Grounds as well as on the results from the MEC/MD clearance activities. The final sample locations will be proposed in a memo report following completion of the MEC clearance activities. Surface water samples will be collected in areas immediately up-gradient of, adjacent to and down gradient from area where MEC was removed. The memorandum report will describe the rationale for the locations, depths and number of the proposed soil and surface water samples. Additional surface water samples will be collected if the surface water is determined to be impacted. Additionally, the rationale for the locations, depths and number of groundwater samples to be collected in support of long-term groundwater monitoring will be discussed in the Long Term Monitoring Work Plan.

Concrete Powder/Dust or Chip Characterization Sampling

Samples will be collected pre-and post-removal of the Open Burning Tray to characterize and support closure of the Open Burning Tray materials for off-site disposal. Characterization samples for concrete/chip media will be analyzed for TCLP VOCs, TCLP SVOCs, TCLP Pesticides, TCLP Herbicides, and TCLP Metals. The closure of the burning tray will be performed in accordance with the *Closure Plan for the Open Burning Tray in Solid Waste Management Unit – SEAD-23* (Parsons, 2005).

Groundwater Sampling

Long-term monitoring of groundwater will be performed following completion of the MEC clearance and landfill capping tasks. The sampling locations will be developed and presented in a long-term monitoring plan. At present, it is assumed that the samples will be analyzed for TAL Metals. Field PID (equipped with an 10.6 eV lamp) screening for VOCs will be performed at each groundwater well location during the first time the newly installed wells are sampled as standard health and safety practice. After the wells are screened, if there is indication of contamination with VOCs, VOCs will be added to the analytical program. If additional parameters are required, an amendment to this QAPP will be prepared. If there is no indication of contamination with VOCs, the practice of screening the headspace will be discontinued. In addition, the water quality parameters pH, conductivity, turbidity, temperature, dissolved oxygen, and oxidation/reduction potential will be performed for each well location. The long-term monitoring requirements will be assessed in a Long-Term Monitoring Plan following completion of the MEC clearance activities.

IDW Sampling

If required, samples will be collected for any IDW generated from site sampling activities to characterize for off-site disposal. Waste disposal analysis is based upon the facility permit accepting the waste and the potential source contaminants of the waste, specifically the leaching capabilities. In this case, the projected waste disposal analysis may include up to TCLP VOCs, TCLP SVOCs, TCLP Pesticides, TCLP Herbicides, TCLP Metals, Reactivity, Ignitability, and pH.

The environmental questions being asked:

- Has the nature and extent of the contaminated soil to be placed beneath the landfill cap been determined?
- Have downgradient surface water impacts been determined and if present characterized?
- Has sufficient data to support the offsite disposal options and closure of the Open Burning Tray area been collected?
- Has the information required to support the long-term monitoring associated with the landfill cap been collected to evaluate the effectiveness of the remedy and support future remedial decision-making?

The possible classes of contaminants and the affected matrices:
Investigations performed to date have confirmed that metals are the contaminants of concern at the OD Grounds. No contaminants are anticipated to have been released to the environment through use of the Open Burning Tray. The analytical program includes the following scope.

Soil Analysis:

- TAL Metals (includes aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, zinc) by USEPA SW-846 6020A/7471B
- Explosives (includes HMX, RDX, 1,3,5-TNB, 1,3-DNB, Tetryl, NB, 2,4,6-TNT, 4-Am-DNT, 2-Am-DNT, 2,4-DNT, 2,6-DNT, 2-NT, 3-NT, 4-NT, NG, and PETN) by USEPA SW-846 8330B Modified
- Perchlorate by USEPA SW-846 6850
- SPLP TAL Metals by USEPA SW-846 1312/6020A/7470A

Surface Water Analysis:

- TAL Metals by USEPA SW-846 6020A/7470A

Concrete Powder/Dust/Chip TCLP Characterization Analysis:

- TCLP VOCs by USEPA SW-8461311/8260B
- TCLP SVOCs by USEPA SW-846 1311/8270C
- TCLP Pesticides by USEPA SW-846 1311/8081B
- TCLP Herbicides by USEPA SW-846 1311/8151A
- TCLP Metals by USEPA SW-846 1311/6010C/7470A

Groundwater Analysis:

- TAL Metals by USEPA SW-846 6020A/7470A
- Field Screening: PID equipped with a 10.6 eV lamp for VOCs (For first sampling event)
- Field Testing: pH (USEPA 150.1), conductivity (USEPA 120.1), turbidity (USEPA 180.1), temperature (USEPA 170.1), dissolved oxygen (USEPA 360.1), and oxidation/reduction potential (SM 2580B)

IDW Characterization Analysis:

- TCLP VOCs by USEPA SW-8461311/8260B
- TCLP SVOCs by USEPA SW-846 1311/8270C
- TCLP Pesticides by USEPA SW-846 1311/8081B
- TCLP Herbicides by USEPA SW-846 1311/8151A
- TCLP Metals by USEPA SW-846 1311/6010C/7470A Reactivity by USEPA SW-846 Ch7.3
- Ignitability by USEPA SW-846 1010A/1030
- pH by USEPA SW-846 9040C/9045D

The rationale for inclusion of chemical and nonchemical analyses:
Project decision conditions (If..., then...@ statements):
The Site Cleanup Levels (SCLs) for the soil and surface water samples are being established in the decision documents for the site. The Draft Feasibility Study for the site indicates that the NYS Commercial SCOs will be used as the basis for the SCLs. Both the existing chemical analytical data set and the additional soil samples will be compared to the SCLs as established in the FS, PP, and ROD for the site.

A Screening Level Ecological Risk assessment (SLERA), including an estimation of COPEC doses to wildlife and associated hazards, as well as a direct-contact hazard assessment for terrestrial plants, soil invertebrates, and aquatic biota will be performed using the chemical data. This type of detail is required because ecological screening levels should not be used as cleanup levels. A Screening Level Human Health Risk Assessment (SLHHRA), including simple comparisons of site data with SCLs and scaling to estimate risks and hazards, will be performed to assess potential human receptor impacts, This HHRA screening approach (compared with the more detailed SLERA approach) is appropriate given NY's position on HHRAs (i.e., NYSDEC does not typically accept detailed HHRAs).

The decision documents for the site indicate that New York State Commercial Cleanup Objectives will be used as the final action levels for determining which soils are placed under the cap. To determine soils required to be placed under the landfill cap, concentrations of detected compounds in soil will be screened against New York State Unrestricted Use Soil Cleanup Objectives (SCOs) and USEPA Regional Screening Levels [Priority for Selection of Soil Ecological Screening Values (ESVs): 1) EPA Eco-SSL; 2) EPA Region 4 ESVs for Soil] (shown in **Table 1**). The metals soil concentrations will be first compared to background concentrations, specifically; the 95% upper control limit (UCL) of the regional background levels for metals will be used for comparison purposes. If metals concentrations are greater than these levels, then further risk-based comparisons will be performed. The unrestricted SCOs and USEPA Regional Screening Levels are presented here-in for comparison purposes and to ensure the laboratory provides adequate detection limits. Concentration of contaminants detected in surface water will be screened against NYS Human Health Surface Water Screening Values (Fish Consumption) - Class C Waters [Ref.: *NYS DEC Section 703.5; Table 1 Water Quality Standards for Surface Water and Groundwater* (2008)] and Selected Surface Water ESV [Priority for Selection of Surface Water ESVs: 1) NYS WQS; 2) EPA Region 3 ESV; 3) EPA Region 4 ESV) (shown in **Table 1**). Concentration of contaminants detected in groundwater will be screened against NYS Human Health Groundwater Screening Values - Class GA [Ref.: *NYS DEC Section 703.5; Table 1 Water Quality Standards for Surface Water and Groundwater* (2008)]; Tap water Regional Screening Level (RSL) [Screening toxicity values are from the NYS SCOs (unrestricted, Table 375-6.8[a]) and USEPA RSL Table for November 2011. RSL value based on a cancer risk of 1.0E-06 and a hazard quotient of 0.1.]; and Drinking Water Maximum Contaminant Levels (MCLs) [Ref.: USEPA National Primary Drinking Water Standards (January 2011)] (shown in **Table 1**). The concentrations of analytes detected in the waste characterization samples collected from the Open Burning Tray materials will be compared to State and Federal Land Disposal Restrictions (LDRs) to determine the acceptable off-site disposal options for the materials.

To determine the potential for soils to impact groundwater, SPLP leachate data will be compared to NYS Human Health Groundwater Effluent Standards for GA waters [Ref.: NYS DEC Section 703.6; Table 3 Groundwater Effluent Limitations (2008)]. The SPLP data will be used to augment the totals data to determine the potential for impacts to groundwater from metals contamination in soil. The potential for groundwater impact (or lack thereof) will be factored into the design of the cap and the long term monitoring program. If SPLP leachate concentrations are greater than NYSDEC GA GW Effluent concentrations then the potential for metals leaching to groundwater will be factored into the cap design. The LTM plan will contain decision statements for groundwater monitoring. The final number of wells for the groundwater monitoring program will be presented in the LTM work plan.

IF the metals concentrations are determined to be above the 95% UCL of the regional background levels, **THEN** they will be compared to the action levels for soil or the risk-based human health and/or ecological screening values for surface water and/or groundwater. **IF** the values are below the risk based screening values, **THEN** no further evaluation for metals is required.

IF the metals concentrations exceed Site Cleanup Levels **THEN** this information will be factored into the remedial design of the landfill cap and additional surface water samples may be required if determined to be impacted. **IF** no unacceptable human health or ecological risks are determined for metals, **THEN**, this information will be factored into the design of the landfill cap and no additional surface water samples would be required.

IF the SPLP metals concentrations are greater than NYSDEC GA GW Effluent concentrations **THEN** the potential for metals leaching to groundwater will be factored into the cap design.

IF the concentrations of analytes detected in the waste characterization samples collected from the Open Burning Tray materials determine the materials are characteristic waste, **THEN** they will be disposed in a hazardous waste landfill.

IF the concentrations of analytes detected in the waste characterization samples collected from the Open Burning Tray materials determine the materials are not a characteristic waste, **THEN** they will be disposed in a non-hazardous waste landfill.

Who will use the data?
The data will be used by the SEDA Project Delivery Team to support remedial-decision making. The SEDA Project Delivery Team includes the Shaw project team members identified in Worksheet 4 including the Shaw PM, Shaw Contractor QC System Manager, Shaw Site Manager, Shaw UXOQCS, and the Shaw Project Chemist. Specifically, the final data will be used by the Shaw risk assessors to evaluate risk from exposure to MEC/MC.

What will the data be used for?
Shaw may perform a human health risk assessment (HHRA) and a screening level ecological risk assessment (SLERA) utilizing the sample results from soil, surface water, and possibly groundwater, to determine whether unacceptable risks are associated with the analytes detected at the site.

What types of data are needed (matrix, target analytes, analytical groups, field screening, on-site analytical or off-site laboratory techniques, sampling techniques)?
The purpose of the remedial effort sampling and analysis effort are: 1) to determine the nature and extent of environmental contamination (soil and surface water) associated with former military munitions activities at the OD Grounds; 2) to collect data to support off-site disposal requirements and closure of the Open Burning Tray; and 3) to complete long-term monitoring of groundwater as required to support the landfill cap. The number and location of soil, surface water, and groundwater samples will be presented in a memo report and/or long-term monitoring plan following completion of the MEC clearance and/or landfill cap as appropriate. The analytical sampling program (i.e. data) is provided to support the Task Order required to meet project objectives, specifically, the analytical sampling program includes the following:

General:

- The sampling effort for MEC clearance is detailed in the *Work Plan for MEC Clearance at Open Detonation (OD) Grounds Seneca Army Depot Activity, New York* (USACE, 2013). Specifically, the methods for performing MEC characterization are described in Section 3 of the *Work Plan for MEC Clearance at Open Detonation (OD) Grounds Seneca Army Depot Activity, New York* (USACE, 2013).
- Field sample collection and handling shall follow the SOPs found in the *SEDA Generic Site-Wide SAP* (Parsons, July 2006). The field SOPs for the sample collection and handling are listed in Worksheet 21.
- All analytical analysis shall meet the following requirements and guidelines. The laboratory preparatory and analytical SOPs are listed in Worksheet 23 and may be found in Attachment C.
    1. UFP-QAPP (Method Criteria specified in Worksheets 12, 15, and 28),
    2. *DOD Quality Systems Manual for Environmental Laboratories, Version 4.2* (USEPA, 2010), and
    3. USEPA *SW-846, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Analytical Protocols* (USEPA, 2007),
    4. USEPA *Methods for Chemical Analysis of Water and Wastes* (USEPA, 1983).

- All sample analysis will be performed by the off-site Environmental Laboratory Accreditation Program (ELAP) accredited laboratory Gulf Coast Laboratories, Inc. (GCAL) and Microbac Laboratories, Inc. for explosives and perchlorate analysis. Copies of the lab's accreditations may be found in Attachment D.
- The MC sampling program will be based on whether significant evidence of MEC is observed as well as taking into account previous investigation results and historic munitions activities. The actual number, type and location of samples cannot be determined at this time. This information will be communicated in a future LTM plan following completion of the MEC clearance activities. The number and location of the groundwater samples will be presented in a Long-Term Monitoring Plan following or during completion of the landfill capping activities. A total of 12 waste characterization samples are anticipated to be collected from the Open Burning Tray, in accordance with the approved Closure Plan for the Open Burning Tray in Solid Waste Management Unit – SEAD-23 (Parsons, 2005).
- Blind field duplicates pairs are to be collected at a frequency of 10 percent (1 per 10) and matrix spikes at 5 percent (1 per 20) of the total number of samples collected per matrix. Equipment (rinse) blanks are not required as disposable equipment will be used; if needed rinse blanks will be collected at 5 percent (1 per 20) of the field sample parameters per equipment type per matrix. Field duplicates, rinse blanks, and MS/MSD do not apply for disposal characterization samples for data end use is for proper disposition compliance of the disposal permit facility.

Soil Analysis (To confirm that all contaminated soils are placed beneath the landfill cap):

- TAL Metals (includes aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, zinc) by USEPA SW-846 6020A/7471B
- Explosives (includes HMX, RDX, 1,3,5-TNB, 1,3-DNB, Tetryl, NB, 2,4,6-TNT, 4-Am-DNT, 2-Am-DNT, 2,4-DNT, 2,6-DNT, 2-NT, 3-NT, 4-NT, NG, and PETN) by USEPA SW-846 8330B Modified
- Perchlorate by USEPA SW-846 6850
- SPLP TAL Metals by USEPA SW-846 1312/6020A/7470A (To evaluate potential impact to groundwater from soils which are not capped)

Surface Water Analysis (To evaluate whether migration has occurred and impacted the stream):

- TAL Metals by USEPA SW-846 6020A/7470A

Concrete Powder/Dust/Chip TCLP Characterization Analysis (To characterize and support closure of the Open Burning Tray materials for off-site disposal to meet disposal facility criteria):

- TCLP VOCs by USEPA SW-8461311/8260B
- TCLP SVOCs by USEPA SW-846 1311/8270C
- TCLP Pesticides by USEPA SW-846 1311/8081B

- TCLP Herbicides by USEPA SW-846 1311/8151A
- TCLP Metals by USEPA SW-846 1311/6010C/7470A

Groundwater Analysis (Long-term monitoring following completion of the MEC clearance and landfill capping tasks):

- TAL Metals by USEPA SW-846 6020A/7470A
- Field Screening: PID equipped with a 10.6 eV lamp for VOCs (For first sampling event. If there is no indication of contamination with VOCs the practice of screening the headspace will be discontinued)
- Field Testing: pH (USEPA 150.1), conductivity (USEPA 120.1), turbidity (USEPA 180.1), temperature (USEPA 170.1), dissolved oxygen (USEPA 360.1), and oxidation/reduction potential (SM 2580B)

IDW Characterization Analysis (To characterize and investigative derived waste for off-site disposal to meet disposal facility criteria):

- TCLP VOCs by USEPA SW-8461311/8260B
- TCLP SVOCs by USEPA SW-846 1311/8270C
- TCLP Pesticides by USEPA SW-846 1311/8081B
- TCLP Herbicides by USEPA SW-846 1311/8151A
- TCLP Metals by USEPA SW-846 1311/6010C/7470A
- Reactivity by USEPA SW-846 Ch7.3
- Ignitability by USEPA SW-846 1010A/1030
- pH by USEPA SW-846 9040C/9045D

How "good" does the data need to be in order to support the environmental decision?
For MEC, observations made by UXO-Qualified Personnel and geophysicists under the direction of the Project Geophysicist support decision making at the site. For MC, the method detection limits must be equal to or less than the screening levels (see worksheet 15), to the extent practicable using standard laboratory methods, to support the HHRA and SLERA. In general, the data will be of the quantity and quality necessary to provide technically sound and defensible assessments of potential risks to human health and ecological receptors posed by the contaminants identified. The laboratory methods will meet CERCLA, NYSDEC, USEPA, and USACE guidance. The data will be validated as described in Worksheet #35.

How much data are needed (number of samples for each analytical group, matrix, and concentration)?
The sampling effort is detailed in the *Work Plan for MEC Clearance at Open Detonation (OD) Grounds Seneca Army Depot Activity, New York* (USACE, 2013). The MC sampling program will be based on whether significant evidence of MEC is observed as well as taking into account previous investigation results and historic munitions activities. The number of samples required for soil and surface water for the OD Grounds will be evaluated and presented in a memo report following completion of the MEC clearance activities. The number and location of the groundwater samples will be presented in a Long-Term Monitoring Plan following or during completion of the landfill capping activities. A total of 12 waste characterization samples are anticipated to be collected from the Open Burning Tray, in accordance with the approved *Closure Plan for the Open Burning Tray in Solid Waste Management Unit – SEAD-23* (Parsons, 2005). Blind field duplicates pairs are to be collected at a frequency of 10 percent (1 per 10) and matrix spikes at 5 percent (1 per 20) of the total number of samples collected per matrix. Equipment (rinse) blanks are not required as disposable equipment will be used; if needed rinse blanks will be collected at 5 percent (1 per 20) of the field sample parameters per equipment type per matrix.

Where, when, and how should the data be collected/generated?
The MEC investigation will be detailed in Section 3 of the *Work Plan for MEC Clearance at Open Detonation (OD) Grounds Seneca Army Depot Activity, New York* (USACE, 2013). As part of the remedial activities (anticipated to be completed over the period of May 2012 – October 2013), discrete soil, surface water, and water characterization samples shall be collected. Long-term monitoring of groundwater will be performed for up to 5 years following completion of the landfill cap under this contract.

Who will collect and generate the data?
On-site Shaw personnel will collect the samples and ship them to the off-site laboratory. GCAL and its subcontractor Microbac will analyze the samples as per the methods contained in Worksheet 19.

How will the data be reported?
To ensure the integrity of sample analytical data from the time of collection in the field to the tabulation of results, data documentation protocols will be implemented as outlined in the *SEDA Generic Site-Wide SAP* (Parsons, July 2006) field collection SOPs and GCAL laboratory SOPs. This will include providing sample labels, chains-of-custody (COC) records, and field information forms to document field data; and for comparing laboratory analysis reports with tabular displays and graphic displays to evaluate the accuracy of the data transfer. A memo report for each sampling event will be prepared summarizing the data collection and the analytical results for each sample. The data will be distributed to the appropriate personnel. However, the waste characterization results will be included in the Remedial Action Report (RAR) that summarizes the results from the remedial action at the OD Grounds and the Open Burning Tray.

How will the data be reported? (Continued)

The laboratory will provide full contract laboratory program (CLP)-like hardcopy data packages to meet data validation requirements suitable for risk assessments as well as electronic data deliverables (EDDs) in Excel and Environmental Quality Information System (EQUIS) formats that have been generated by the laboratory's Laboratory Information Management System (LIMS). The data will be reported for each analyte using the method detection limit (MDL), limit of detection (LOD), and the reporting limit (RL). In addition, any positive value detected between the MDL and the RL must be reported as an estimated "J" concentration. Non-detections will be reported at the LOD level. The Excel EDDs will facilitate the data evaluation and validation process and the Shaw View and EQUIS EDD formats will be used to upload the data into the NYSDEC EQUIS database. A Long Term Monitoring (LTM) Report will be prepared summarizing the data collection and the analytical results for each sample. All of the data generated by the laboratory will be validated suitable for risk assessment for each parameter group as noted in Worksheets 34 and 35.

How will the data be archived?

Upon completion of all remedial activities, Shaw will prepare a RAR documenting results from the remedial action at the OD Grounds and the Open Burning Tray. The analytical reports completed through completion of the MEC clearance activities will be included in the RAR. Memo reports will be completed for data collected following completion of the RAR. The Army is responsible for the accuracy, maintenance and retention of the Administrative Record. Additionally, all analytical reports, electronic deliverables, and the RAR and memo reports will be stored on the Shaw server in portable document format (PDF). The server is backed up automatically and archived on tape daily in accordance with federal regulations. Hardcopy data will also be stored by Shaw through the final report deliverables. In accordance with Federal Acquisition Regulations, project files will be retained by the contractor for a period of three years after completion of the contract. The files will not be offered to the USEPA prior to destruction as all necessary and relevant information will have been provided to the USEPA with the project deliverables.

QAPP Worksheet 12 - Measurement Performance Criteria Table
Worksheet 12.1 Inductively Coupled Plasma Mass Spectroscopy (ICPMS) Metals
Page 1 of 2

Matrix	Soil, Surface Water, and Groundwater
Analytical Group	ICPMS Metals and ICPMS SPLP Metals
Concentration Level	Low

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
<u>Field SOPs</u> All field sampling SOPs may be found within: *SEDA Generic Site-Wide SAP* (Parsons, July 2006), Section 16. See Worksheet 21.	Solids: USEPA SW-846 3050B/6020A GCAL MET-004 & MET-021 Aqueous: USEPA SW-846 3010A/6020A GCAL MET-005 & MET-021 SPLP: SW-846 1312/3010A/6020C GCAL EXT-070, MET-005, & MET-021	Field Representativeness (Absence of interference / contamination)	The blank results are evaluated for the analytes of concern to ascertain the efficiency of decontamination and assess the potential for cross-contamination. All Target Compounds <1/2 RL. Project QLs for all target compounds are specified in: Worksheet 15.1 for ICPMS metals solids. Worksheet 15.2 for ICPMS metals aqueous Not applicable for SPLP metals.	Field Blank / Equipment Blank (See Worksheet 20 - Not needed if using disposable equipment)	S & A
		Field Precision	QC acceptance criteria for all target compounds as specified in: Worksheet 15.1 for ICPMS metals solids. Worksheet 15.2 for ICPMS metals aqueous Not applicable for SPLP metals.	Field Duplicate (See Worksheet 20)	S & A
		Laboratory Representativeness (Absence of interference / contamination)	The blank results are evaluated for the analytes of concern to ascertain the efficiency of decontamination and assess the potential for cross-contamination. All Target Compounds <1/2 RL. Blank result must not otherwise affect sample results. Project QLs for all target compounds are specified in: Worksheet 15.1 for ICPMS metals solids. Worksheet 15.2 for ICPMS metals aqueous and SPLP metals.	Method Blank (MB)	A
		Laboratory Accuracy	QC acceptance criteria for all target compounds as specified in: Worksheet 15.1 for ICPMS metals solids. Worksheet 15.2 for ICPMS metals aqueous and SPLP metals. Ref.: DoD QSM, if available, otherwise laboratory's own in-house criteria. %Recovery = (Calculated Value / True Value) *100%	Laboratory Control Sample (LCS)	A

QAPP Worksheet 12 - Measurement Performance Criteria Table
Worksheet 12.1 ICPMS Metals
Page 2 of 2

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Field SOPs All field sampling SOPs may be found within: SEDA Generic Site-Wide SAP (Parsons, July 2006), Section 16. See Worksheet 21.	Solids: USEPA SW-846 3050B/6020A GCAL MET-004 & MET-021 Aqueous: USEPA SW-846 3010A/6020A GCAL MET-005 & MET-021 SPLP: SW-846 1312/3010A/6020C GCAL EXT-070, MET-005, & MET-021	Accuracy (field samples)	QC acceptance criteria for all target compounds as specified in: Worksheet 15.1 for ICPMS metals solids. Worksheet 15.2 for ICPMS metals aqueous Not applicable for SPLP metals. Ref.: DoD QSM, if available, otherwise laboratory's own in-house criteria. DoD QSM uses LCS criteria. %Recovery = (Calculated Value - Sample Value / True Value) *100%	Matrix Spike (MS)	A
		Precision and Accuracy (field samples)	QC acceptance criteria for all target compounds as specified in: Worksheet 15.1 for ICPMS metals solids. Worksheet 15.2 for ICPMS metals aqueous Not applicable for SPLP metals. Ref.: DoD QSM, if available, otherwise laboratory's own in-house criteria. %Recovery = (Calculated Value – Sample Value / True Value) *100% Relative percent difference (RPD) (%) = [(XA-XB)/ XM] * 100 Where: XA and XB are the concentration in the MS and MSD, and XM is the average value of the concentrations in the MS and MSD, (XA + XB)/2	Matrix Spike Duplicate (MSD) or Sample Duplicate	A
		Accuracy	ICS-A: Absolute value of concentration for all non-spiked analytes < limit of detection (LOD) (unless they are a verified trace impurity from one of the spiked analytes); ICS-AB: Within ± 20% of true value.	Interference check solutions	A
		Precision (field samples)	Five-fold dilution must agree within ± 10% of the original measurement. Only applicable for samples with concentrations >100x MDL for ICPMS.	Serial Dilution Test	S& A
		Completeness	QC acceptance criteria: ≥95% for mercury aqueous, SPLP metals, and solids. % Analytical Completeness = 100 * (Number of Useable Data) / (Total Number of Requested Analyses)	Analytical Sample Completeness (Usability)	A

[1] Reference number from QAPP Worksheet #21. Field SOPs are subject to revision and updates during duration of the project, Shaw will use the most current revision of the SOP SEDA Generic Site-Wide SAP (Parsons, July 2006), Section 16 at the time of analysis.
[2] Reference number from QAPP Worksheet #23. Laboratory SOPs are subject to revision and updates during duration of the project, lab will use the most current revision of the SOP at the time of analysis.

QAPP Worksheet 12 - Measurement Performance Criteria Table
Worksheet 12.2 Mercury
Page 1 of 2

Matrix	Soil, Surface Water, and Groundwater
Analytical Group	Mercury
Concentration Level	Low

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Field SOPs All field sampling SOPs may be found within: *SEDA Generic Site-Wide SAP* (Parsons, July 2006), Section 16. See Worksheet 21.	Solids: USEPA SW-846 7471B GCAL EXT-070, MET-006, & MET-008 Aqueous: USEPA SW-846 7470A GCAL MET-008 SPLP: USEPA SW-846 1312/7470A GCAL EXT-070 & MET-008	Field Representativeness (Absence of interference / contamination)	The blank results are evaluated for the analytes of concern to ascertain the efficiency of decontamination and assess the potential for cross-contamination. All Target Compounds <1/2 RL. Project QLs for all target compounds are specified in: Worksheet 15.1 for mercury solids. Worksheet 15.2 for mercury aqueous. Not applicable for SPLP mercury.	Field Blank / Equipment Blank (See Worksheet 20 - Not needed if using disposable equipment)	S&A
		Field Precision	QC acceptance criteria for all target compounds as specified in: Worksheet 15.1 for mercury solids. Worksheet 15.2 for mercury aqueous. Not applicable for SPLP mercury.	Field Duplicate (See Worksheet 20)	S&A
		Laboratory Representativeness (Absence of interference / contamination)	The blank results are evaluated for the analytes of concern to ascertain the efficiency of decontamination and assess the potential for cross-contamination. All Target Compounds <1/2 RL. Project QLs for all target compounds are specified in: Worksheet 15.1 for mercury solids. Worksheet 15.2 for mercury aqueous and SPLP metals.	MB	A
		Laboratory Accuracy	QC acceptance criteria for all target compounds as specified in: Worksheet 15.1 for mercury solids. Worksheet 15.2 for mercury aqueous and SPLP metals. Ref.: DoD QSM, if available, otherwise laboratory's own in-house criteria. %Recovery = (Calculated Value / True Value) *100%	LCS	A

QAPP Worksheet 12 - Measurement Performance Criteria Table
Worksheet 12.2 Mercury
Page 2 of 2

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Field SOPs All field sampling SOPs may be found within: *SEDA Generic Site-Wide SAP* (Parsons, July 2006), Section 16. See Worksheet 21.	Solids: USEPA SW-846 7471B GCAL EXT-070, MET-006, & MET-008 Aqueous: USEPA SW-846 7470A GCAL MET-008 SPLP: USEPA SW-846 1312/7470A GCAL EXT-070 & MET-008	Accuracy (field samples)	QC acceptance criteria for all target compounds as specified in: Worksheet 15.1 for mercury solids. Worksheet 15.2 for mercury aqueous. Not applicable for SPLP mercury. Ref.: DoD QSM, if available, otherwise laboratory's own in-house criteria. DoD QSM uses LCS criteria. %Recovery = (Calculated Value - Sample Value / True Value) *100%	MS	A
		Precision and Accuracy (field samples)	QC acceptance criteria for all target compounds as specified in: Worksheet 15.1 for mercury solids. Worksheet 15.2 for mercury aqueous. Not applicable for SPLP mercury. Ref.: DoD QSM, if available, otherwise laboratory's own in-house criteria. %Recovery = (Calculated Value – Sample Value / True Value) *100% RPD (%) = [(XA-XB)/ XM] * 100 Where: XA and XB are the concentration in the MS and MSD, and XM is the average value of the concentrations in the MS and MSD, (XA + XB)/2	MSD or Sample Duplicate	A
		Completeness	QC acceptance criteria: ≥95% for mercury aqueous, SPLP metals, and solids. % Analytical Completeness = 100 * (Number of Useable Data) / (Total Number of Requested Analyses)	Analytical Sample Completeness (Usability)	A

[1] Reference number from QAPP Worksheet #21. Field SOPs are subject to revision and updates during duration of the project, Shaw will use the most current revision of the SOP SEDA Generic Site-Wide SAP (Parsons, July 2006), Section 16 at the time of analysis.
[2] Reference number from QAPP Worksheet #23. Laboratory SOPs are subject to revision and updates during duration of the project, lab will use the most current revision of the SOP at the time of analysis.

QAPP Worksheet 12 - Measurement Performance Criteria Table
Worksheet 12.3 Explosives
Page 1 of 2

Matrix	Soil
Analytical Group	Explosives (Nitroaromatics and Nitramines)
Concentration Level	Low

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
<u>Field SOPs</u> All field sampling SOPs may be found within: *SEDA Generic Site-Wide SAP* (Parsons, July 2006), Section 16. See Worksheet 21.	Solids: SW-846 8330B Mod; EXTNT02, HPLC02	Field Representativeness (Absence of interference / contamination)	The blank results are evaluated for the analytes of concern to ascertain the efficiency of decontamination and assess the potential for cross-contamination. All Target Compounds <1/2 RL. Project quantitation limits (QLs) for all target compounds are specified in: Worksheet 15.3 for explosives solids.	Field Blank / Equipment Blank (See Worksheet 20 - Not needed if using disposable equipment)	S&A
		Field Precision	QC acceptance criteria for all target compounds as specified in: Worksheet 15.3 for explosives solids.	Field Duplicate (See Worksheet 20 – No field triplicate required)	S&A
		Laboratory Representativeness (Absence of interference / contamination)	The blank results are evaluated for the analytes of concern to ascertain the efficiency of decontamination and assess the potential for cross-contamination. All Target Compounds <1/2 RL. Project QLs for all target compounds are specified in: Worksheet 15.3 for explosives solids.	Method Blank and Grinding Blank	A
		Laboratory Accuracy	QC acceptance criteria for all target compounds as specified in: Worksheet 15.3 for explosives solids. Ref.: DoD QSM, if available, otherwise laboratory's own in-house criteria for LCS. For LRM, per manufacturer criteria limit. %Recovery = (Calculated Value / True Value) *100%	Laboratory Control Sample (LCS) and Laboratory Reference Material (LRM)	A

QAPP Worksheet 12 - Measurement Performance Criteria Table
Worksheet 12.3 Explosives
Page 2 of 2

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Field SOPs All field sampling SOPs may be found within: *SEDA Generic Site-Wide SAP* (Parsons, July 2006), Section 16. See Worksheet 21.	Solids: SW-846 8330B Mod; EXTNT02, HPLC02	Accuracy (field samples)	QC acceptance criteria for all target compounds as specified in: Worksheet 15.3 for explosives solids. Ref.: DoD QSM, if available, otherwise laboratory's own in-house criteria. DoD QSM uses LCS criteria. %Recovery = (Calculated Value - Sample Value / True Value) *100%	Matrix Spike (MS)	A
		Precision and Accuracy (field samples)	QC acceptance criteria for all target compounds as specified in: Worksheet 15.3 for explosives solids. Ref.: DoD QSM, if available, otherwise laboratory's own in-house criteria. %Recovery = (Calculated Value – Sample Value / True Value) *100% RPD (%) = [(XA-XB)/ XM] * 100 RSD = [Std. Dev of data values)/ XM] * 100 Where: XA and XB are the concentration in the MS and MSD, and XM is the average value of the concentrations in the MS and MSD, (XA + XB)/2.	Matrix Spike Duplicate (MSD) or Sample Duplicate (No lab triplicate required)	A
		Accuracy	QC acceptance criteria: 1,2-Dinitrobenzene 50-150% for explosives solids. Ref.: DoD QSM, if available, otherwise laboratory's own in-house criteria. %Recovery = (Calculated Value / True Value) *100%	Surrogate Spike	A
		Confirmations	Confirmed on dissimilar columns with RPD≤40%.	Positive Confirmations	A
		Completeness	QC acceptance criteria: ≥95% for explosives solids. % Analytical Completeness = 100 * (Number of Useable Data) / (Total Number of Requested Analyses)	Analytical Sample Completeness (Usability)	A

[1] Reference number from QAPP Worksheet #21. Field SOPs are subject to revision and updates during duration of the project, Shaw will use the most current revision of the SOP SEDA Generic Site-Wide SAP (Parsons, July 2006), Section 16 at the time of analysis.
[2] Reference number from QAPP Worksheet #23. Laboratory SOPs are subject to revision and updates during duration of the project, lab will use the most current revision of the SOP at the time of analysis.

QAPP Worksheet 12 - Measurement Performance Criteria Table
Worksheet 12.3 Perchlorate
Page 1 of 2

Matrix	Soil
Analytical Group	Perchlorate
Concentration Level	Low

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Field SOPs All field sampling SOPs may be found within: *SEDA Generic Site-Wide SAP* (Parsons, July 2006), Section 16. See Worksheet 21.	Solids: SW-846 6850; SOP: HPLC06	Field Representativeness (Absence of interference / contamination)	The blank results are evaluated for the analytes of concern to ascertain the efficiency of decontamination and assess the potential for cross-contamination. All Target Compounds <1/2 RL. Project QLs for all target compounds are specified in: Worksheet 15.4 for perchlorate soils.	Equipment Blank	S&A
		Field Precision	QC acceptance criteria for all target compounds as specified in: Worksheet 15.4 for perchlorate soils.	Field Duplicate	S&A
		Laboratory Representativeness (Absence of interference / contamination)	The blank results are evaluated for the analytes of concern to ascertain the efficiency of decontamination and assess the potential for cross-contamination. All Target Compounds <1/2 RL. Project QLs for all target compounds are specified in: Worksheet 15.4 for perchlorate soils.	Method Blank	A
		Laboratory Accuracy	QC acceptance criteria for all target compounds as specified in: Worksheet 15.4 for perchlorate soils. %Recovery = (Calculated Value / True Value) *100%	LCS	A

QAPP Worksheet 12 - Measurement Performance Criteria Table
Worksheet 12.3 Perchlorate
Page 2 of 2

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Field SOPs All field sampling SOPs may be found within: *SEDA Generic Site-Wide SAP* (Parsons, July 2006), Section 16. See Worksheet 21.	Solids: SW-846 6850; SOP: HPLC06	Accuracy (field samples)	QC acceptance criteria for all target compounds as specified in: Worksheet 15.4 for perchlorate soils. Ref.: DoD QSM. QC MS acceptance criteria uses LCS criteria as specified by DoD QSM. %Recovery = (Calculated Value - Sample Value / True Value) *100%	MS	A
		Precision and Accuracy (field samples)	QC acceptance criteria for all target compounds as specified in: Worksheet 15.4 for perchlorate soils. Ref.: DoD QSM, if available, otherwise laboratory's own in-house criteria. %Recovery = (Calculated Value – Sample Value / True Value) *100% RPD (%) = [(XA-XB)/ XM] * 100 Where: XA and XB are the concentration in the MS and MSD, and XM is the average value of the concentrations in the MS and MSD, (XA + XB)/2	MSD or Sample Duplicate	A
		Completeness	QC acceptance criteria: ≥95% for perchlorate soils % Analytical Completeness = 100 * (Number of Useable Data) / (Total Number of Requested Analyses)	Analytical Sample Completeness (Usability)	A

[1] Reference number from QAPP Worksheet #21. Field SOPs are subject to revision and updates during duration of the project, Shaw will use the most current revision of the SOP SEDA Generic Site-Wide SAP (Parsons, July 2006), Section 16 at the time of analysis.
[2] Reference number from QAPP Worksheet #23. Laboratory SOPs are subject to revision and updates during duration of the project, lab will use the most current revision of the SOP at the time of analysis.

QAPP Worksheet 12 - Measurement Performance Criteria Table
Worksheet 12.3 GC/MS VOCs
Page 1 of 2

Matrix	Concrete and Dust and IDW
Analytical Group	Gas chromatography/ mass spectroscopy (GC/MS) TCLP Volatiles (VOCs)
Concentration Level	Low

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Field SOPs All field sampling SOPs may be found within: *SEDA Generic Site-Wide SAP* (Parsons, July 2006), Section 16. See Worksheet 21.	TCLP: USEPA SW-846 1311/5030B/8260B GCAL EXT-036 & GCMSV-003	Field Representativeness (Absence of interference / contamination)	The blank results are evaluated for the analytes of concern to ascertain the efficiency of decontamination and assess the potential for cross-contamination and sample transport. All Target Compounds <1/2 RL. Project quantitation limit (Qls) for all target compounds are specified in: Not applicable for TCLP VOCs aqueous	Field Blank / Equipment Blank (See Worksheet 20 - Not needed if using disposable equipment)	S&A
		Field Precision	QC acceptance criteria for all target compounds as specified in: Not applicable for TCLP VOCs	Field Duplicate	S&A
		Laboratory Representativeness (Absence of interference / contamination)	The blank results are evaluated for the analytes of concern to ascertain the efficiency of decontamination and assess the potential for cross-contamination. No analytes detected > ½ RL (>RL for common lab contaminants) and greater than 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. Project QLs for all target compounds are specified in: Worksheet 15.5 for TCLP VOCs	MB	A
		Laboratory Accuracy	QC acceptance criteria for all target compounds as specified in: Worksheet 15.5 for TCLP VOCs %Recovery = (Calculated Value / True Value) *100%	LCS	A
		Accuracy (field samples)	QC acceptance criteria for all target compounds as specified in: Not applicable for TCLP VOCs Ref.: DoD QSM, if available, otherwise laboratory's own in-house criteria. DoD QSM uses LCS criteria. %Recovery = (Calculated Value - Sample Value / True Value) *100%	MS	A

QAPP Worksheet 12 - Measurement Performance Criteria Table
Worksheet 12.3 GC/MS VOCs
Page 2 of 2

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Field SOPs All field sampling SOPs may be found within: *SEDA Generic Site-Wide SAP* (Parsons, July 2006), Section 16. See Worksheet 21.	TCLP: USEPA SW-846 1311/5030B/8260B GCAL EXT-036 & GCMSV-003	Precision and Accuracy (field samples)	QC acceptance criteria for all target compounds as specified in: Not applicable for TCLP VOCs Ref.: DoD QSM, if available, otherwise laboratory's own in-house criteria. %Recovery = (Calculated Value – Sample Value / True Value) *100% RPD (%) = [(XA-XB)/ XM] * 100 Where: XA and XB are the concentration in the MS and MSD, and XM is the average value of the concentrations in the MS and MSD, (XA + XB)/2	MSD or Sample Duplicate	A
		Accuracy	QC acceptance criteria for all target compounds as specified in: Worksheet 15.5 for TCLP VOCs Ref.: DoD QSM, if available, otherwise laboratory's own in-house criteria. %Recovery = (Calculated Value / True Value) *100%	Surrogate Spike	A
		Accuracy (Instrument sensitivity control)	Retention time ±30 seconds from retention time of the midpoint standard in the initial calibration (ICAL) extracted ion current profile (EICP) area within -50% to +100% of ICAL midpoint standard	Internal Standards	A
		Completeness	QC acceptance criteria: ≥95% for TCLP VOCs % Analytical Completeness = 100 * (Number of Useable Data) / (Total Number of Requested Analyses) % Sampling Completeness = 100 * (Number of Proposed Samples) / (Total Number of Samples Collected)	Analytical Sample Completeness (Usability)	S&A

[1] Reference number from QAPP Worksheet #21. Field SOPs are subject to revision and updates during duration of the project, Shaw will use the most current revision of the SOP SEDA Generic Site-Wide SAP (Parsons, July 2006), Section 16 at the time of analysis.
[2] Reference number from QAPP Worksheet #23. Laboratory SOPs are subject to revision and updates during duration of the project, lab will use the most current revision of the SOP at the time of analysis.

QAPP Worksheet 12 - Measurement Performance Criteria Table
Worksheet 12.4 GC/MS SVOCs
Page 1 of 2

Matrix	Concrete and Dust and IDW
Analytical Group	GC/MS TCLP Semivolatiles (SVOCs)
Concentration Level	Low

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Field SOPs All field sampling SOPs may be found within: *SEDA Generic Site-Wide SAP* (Parsons, July 2006), Section 16. See Worksheet 21.	TCLP: USEPA SW-846 1311/3510C/8270C GCAL EXT-026, EXT-003, & GCMSSV-001	Field Representativeness (Absence of interference / contamination)	The blank results are evaluated for the analytes of concern to ascertain the efficiency of decontamination and assess the potential for cross-contamination. All Target Compounds <1/2 RL. Project QLs for all target compounds are specified in: Not applicable for TCLP SVOCs	Field Blank / Equipment Blank (See Worksheet 20 - Not needed if using disposable equipment)	S&A
		Field Precision	QC acceptance criteria for all target compounds as specified in: Not applicable for TCLP SVOCs	Field Duplicate	S&A
		Laboratory Representativeness (Absence of interference / contamination)	The blank results are evaluated for the analytes of concern to ascertain the efficiency of decontamination and assess the potential for cross-contamination. No analytes detected > ½ RL (>RL for common lab contaminants) and greater than 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. Project QLs for all target compounds are specified in: Worksheet 15.6 for TCLP SVOCs	MB	A
		Laboratory Accuracy	QC acceptance criteria for all target compounds as specified in: Worksheet 15.6 for TCLP SVOCs %Recovery = (Calculated Value / True Value) *100%	LCS	A
		Accuracy (field samples)	QC acceptance criteria for all target compounds as specified in: Not applicable for TCLP SVOCs Ref.: DoD QSM, if available, otherwise laboratory's own in-house criteria. DoD QSM uses LCS criteria. %Recovery = (Calculated Value - Sample Value / True Value) *100%	MS	A

QAPP Worksheet 12 - Measurement Performance Criteria Table
Worksheet 12.4 GC/MS SVOCs
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Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Field SOPs All field sampling SOPs may be found within: *SEDA Generic Site-Wide SAP* (Parsons, July 2006), Section 16. See Worksheet 21.	TCLP: USEPA SW-846 1311/3510C/8270C GCAL EXT-026, EXT-003, & GCMSSV-001	Precision and Accuracy (field samples)	QC acceptance criteria for all target compounds as specified in: Not applicable for TCLP SVOCs Ref.: DoD QSM, if available, otherwise laboratory's own in-house criteria. %Recovery = (Calculated Value – Sample Value / True Value) *100% RPD (%) = [(XA-XB)/ XM] * 100 Where: XA and XB are the concentration in the MS and MSD, and XM is the average value of the concentrations in the MS and MSD, (XA + XB)/2	MSD or Sample Duplicate	A
		Accuracy	QC acceptance criteria for all target compounds as specified in: Worksheet 15.6 for TCLP SVOCs Ref.: DoD QSM, if available, otherwise laboratory's own in-house criteria. %Recovery = (Calculated Value / True Value) *100%	Surrogate Spike	A
		Accuracy (Instrument sensitivity control)	Retention time ±30 seconds from retention time of the midpoint standard in the ICAL EICP area within -50% to +100% of ICAL midpoint standard	Internal Standards	A
		Completeness	QC acceptance criteria: ≥95% for TCLP SVOCs % Analytical Completeness = 100 * (Number of Useable Data) / (Total Number of Requested Analyses) % Sampling Completeness = 100 * (Number of Proposed Samples) / (Total Number of Samples Collected)	Analytical Sample Completeness (Usability)	S&A

[1] Reference number from QAPP Worksheet #21. Field SOPs are subject to revision and updates during duration of the project, Shaw will use the most current revision of the SOP SEDA Generic Site-Wide SAP (Parsons, July 2006), Section 16 at the time of analysis.
[2] Reference number from QAPP Worksheet #23. Laboratory SOPs are subject to revision and updates during duration of the project, lab will use the most current revision of the SOP at the time of analysis.

QAPP Worksheet 12 - Measurement Performance Criteria Table
Worksheet 12.5 GC Pesticides
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Matrix	Concrete and Dust and IDW
Analytical Group	TCLP Pesticides
Concentration Level	Low

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
<u>Field SOPs</u> All field sampling SOPs may be found within: *SEDA Generic Site-Wide SAP* (Parsons, July 2006), Section 16. See Worksheet 21.	TCLP: USEPA SW-846 3510C/8081B GCAL EXT-026, EXT-010, & GC-013	Field Representativeness (Absence of interference / contamination)	The blank results are evaluated for the analytes of concern to ascertain the efficiency of decontamination and assess the potential for cross-contamination. All Target Compounds <1/2 RL. Project quantitation limits (QLs) for all target compounds are specified in: Not applicable for TCLP pesticides aqueous	Field Blank / Equipment Blank (See Worksheet 20 - Not needed if using disposable equipment)	S&A
		Field Precision	QC acceptance criteria for all target compounds as specified in: Not applicable for TCLP pesticides aqueous	Field Duplicate	S&A
		Laboratory Representativeness (Absence of interference / contamination)	The blank results are evaluated for the analytes of concern to ascertain the efficiency of decontamination and assess the potential for cross-contamination. No analytes detected > ½ RL and greater than 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. Project QLs for all target compounds are specified in: Worksheet 15.7 for TCLP pesticides aqueous	MB	A
		Laboratory Accuracy	QC acceptance criteria for all target compounds as specified in: Worksheet 15.7 for TCLP pesticides aqueous %Recovery = (Calculated Value / True Value) *100%	LCS	A
		Accuracy (field samples)	QC acceptance criteria for all target compounds as specified in: Not applicable for TCLP pesticides aqueous Ref.: DoD QSM, if available, otherwise laboratory's own in-house criteria. DoD QSM uses LCS criteria. %Recovery = (Calculated Value - Sample Value / True Value) *100%	MS	A

QAPP Worksheet 12 - Measurement Performance Criteria Table
Worksheet 12.5 GC Pesticides
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Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Field SOPs All field sampling SOPs may be found within: *SEDA Generic Site-Wide SAP* (Parsons, July 2006), Section 16. See Worksheet 21.	TCLP: USEPA SW-846 3510C/8081B GCAL EXT-026, EXT-010, & GC-013	Precision and Accuracy (field samples)	QC acceptance criteria for all target compounds as specified in: Not applicable for TCLP pesticides aqueous Ref.: DoD QSM, if available, otherwise laboratory's own in-house criteria. %Recovery = (Calculated Value – Sample Value / True Value) *100% RPD (%) = [(XA-XB)/ XM] * 100 Where: XA and XB are the concentration in the MS and MSD, and XM is the average value of the concentrations in the MS and MSD, (XA + XB)/2	MSD or Sample Duplicate	A
		Accuracy	QC acceptance criteria for all target compounds as specified in: Worksheet 15.7 for TCLP pesticides aqueous Ref.: DoD QSM, if available, otherwise laboratory's own in-house criteria. %Recovery = (Calculated Value / True Value) *100%	Surrogate Spike	A
		Laboratory Accuracy	Degradation ≤15%D for both DDT and endrin.	Breakdown check (Endrin / DDT)	A
		Completeness	QC acceptance criteria: ≥95% for TCLP pesticides aqueous % Analytical Completeness = 100 * (Number of Useable Data) / (Total Number of Requested Analyses) % Sampling Completeness = 100 * (Number of Proposed Samples) / (Total Number of Samples Collected)	Analytical Sample Completeness (Usability)	S&A

[1] Reference number from QAPP Worksheet #21. Field SOPs are subject to revision and updates during duration of the project, Shaw will use the most current revision of the SOP SEDA Generic Site-Wide SAP (Parsons, July 2006), Section 16 at the time of analysis.
[2] Reference number from QAPP Worksheet #23. Laboratory SOPs are subject to revision and updates during duration of the project, lab will use the most current revision of the SOP at the time of analysis.

QAPP Worksheet 12 - Measurement Performance Criteria Table
Worksheet 12.6 GC Herbicides
Page 1 of 2

Matrix	Concrete and Dust and IDW
Analytical Group	TCLP Herbicides
Concentration Level	Low

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Field SOPs All field sampling SOPs may be found within: *SEDA Generic Site-Wide SAP* (Parsons, July 2006), Section 16. See Worksheet 21.	TCLP: USEPA SW-846 3510C/8081B GCAL EXT-026, EXT-017, & GC-011	Field Representativeness (Absence of interference / contamination)	The blank results are evaluated for the analytes of concern to ascertain the efficiency of decontamination and assess the potential for cross-contamination. All Target Compounds <1/2 RL. Project quantitation limits (QLs) for all target compounds are specified in: Not applicable for TCLP herbicides aqueous	Field Blank / Equipment Blank (See Worksheet 20 - Not needed if using disposable equipment)	S&A
		Field Precision	QC acceptance criteria for all target compounds as specified in: Not applicable for TCLP herbicides aqueous	Field Duplicate	S&A
		Laboratory Representativeness (Absence of interference / contamination)	The blank results are evaluated for the analytes of concern to ascertain the efficiency of decontamination and assess the potential for cross-contamination. No analytes detected > ½ RL and greater than 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. Project QLs for all target compounds are specified in: Worksheet 15.8 for TCLP herbicides aqueous	MB	A
		Laboratory Accuracy	QC acceptance criteria for all target compounds as specified in: Worksheet 15.8 for TCLP herbicides aqueous %Recovery = (Calculated Value / True Value) *100%	LCS	A
		Accuracy (field samples)	QC acceptance criteria for all target compounds as specified in: Not applicable for TCLP herbicides aqueous Ref.: DoD QSM, if available, otherwise laboratory's own in-house criteria. DoD QSM uses LCS criteria. %Recovery = (Calculated Value - Sample Value / True Value) *100%	MS	A

QAPP Worksheet 12 - Measurement Performance Criteria Table
Worksheet 12.6 GC Herbicides
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Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Field SOPs All field sampling SOPs may be found within: *SEDA Generic Site-Wide SAP* (Parsons, July 2006), Section 16. See Worksheet 21.	TCLP: USEPA SW-846 3510C/8081B GCAL EXT-026, EXT-017, & GC-011	Precision and Accuracy (field samples)	QC acceptance criteria for all target compounds as specified in: Not applicable for TCLP herbicides aqueous Ref.: DoD QSM, if available, otherwise laboratory's own in-house criteria. %Recovery = (Calculated Value – Sample Value / True Value) *100% RPD (%) = [(XA-XB)/ XM] * 100 Where: XA and XB are the concentration in the MS and MSD, and XM is the average value of the concentrations in the MS and MSD, (XA + XB)/2	MSD or Sample Duplicate	A
		Accuracy	QC acceptance criteria for all target compounds as specified in: Worksheet 15.8 for TCLP herbicides aqueous Ref.: DoD QSM, if available, otherwise laboratory's own in-house criteria. %Recovery = (Calculated Value / True Value) *100%	Surrogate Spike	A
		Completeness	QC acceptance criteria: ≥95% for TCLP herbicides aqueous % Analytical Completeness = 100 * (Number of Useable Data) / (Total Number of Requested Analyses) % Sampling Completeness = 100 * (Number of Proposed Samples) / (Total Number of Samples Collected)	Analytical Sample Completeness (Usability)	S&A

[1] Reference number from QAPP Worksheet #21. Field SOPs are subject to revision and updates during duration of the project, Shaw will use the most current revision of the SOP SEDA Generic Site-Wide SAP (Parsons, July 2006), Section 16 at the time of analysis.
[2] Reference number from QAPP Worksheet #23. Laboratory SOPs are subject to revision and updates during duration of the project, lab will use the most current revision of the SOP at the time of analysis.

QAPP Worksheet 12 - Measurement Performance Criteria Table
Worksheet 12.7 ICP Metals
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Matrix	Concrete and Dust and IDW
Analytical Group	TCLP ICP Metals
Concentration Level	Low

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Field SOPs All field sampling SOPs may be found within: *SEDA Generic Site-Wide SAP* (Parsons, July 2006), Section 16. See Worksheet 21.	TCLP: USEPA SW-846 1311/3010A/6010C GCAL EXT-026, MET-005, & MET-010	Field Representativeness (Absence of interference / contamination)	The blank results are evaluated for the analytes of concern to ascertain the efficiency of decontamination and assess the potential for cross-contamination. All Target Compounds <1/2 RL. Project QLs for all target compounds are specified in: Not applicable for TCLP ICP metals.	Field Blank / Equipment Blank (See Worksheet 20 - Not needed if using disposable equipment)	S&A
		Field Precision	QC acceptance criteria for all target compounds as specified in: Not applicable for TCLP ICP metals.	Field Duplicate (See Worksheet 20)	S&A
		Laboratory Representativeness (Absence of interference / contamination)	The blank results are evaluated for the analytes of concern to ascertain the efficiency of decontamination and assess the potential for cross-contamination. All Target Compounds <1/2 RL. Blank result must not otherwise affect sample results. Project QLs for all target compounds are specified in: Worksheet 15.9 for TCLP ICP metals.	MB	A
		Laboratory Accuracy	QC acceptance criteria for all target compounds as specified in: Worksheet 15.9 for TCLP ICP metals. Ref.: DoD QSM, if available, otherwise laboratory's own in-house criteria. %Recovery = (Calculated Value / True Value) *100%	LCS	A

QAPP Worksheet 12 - Measurement Performance Criteria Table
Worksheet 12.7 ICP Metals
Page 2 of 2

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Field SOPs All field sampling SOPs may be found within: *SEDA Generic Site-Wide SAP* (Parsons, July 2006), Section 16. See Worksheet 21.	TCLP: USEPA SW-846 1311/3010A/6010C GCAL EXT-026, MET-005, & MET-010	Accuracy (field samples)	QC acceptance criteria for all target compounds as specified in: Not applicable for TCLP ICP metals. Ref.: DoD QSM, if available, otherwise laboratory's own in-house criteria. DoD QSM uses LCS criteria. %Recovery = (Calculated Value - Sample Value / True Value) *100%	MS	A
		Precision and Accuracy (field samples)	QC acceptance criteria for all target compounds as specified in: Not applicable for TCLP ICP metals. Ref.: DoD QSM, if available, otherwise laboratory's own in-house criteria. %Recovery = (Calculated Value – Sample Value / True Value) *100% RPD (%) = [(XA-XB)/ XM] * 100 Where: XA and XB are the concentration in the MS and MSD, and XM is the average value of the concentrations in the MS and MSD, (XA + XB)/2	MSD or Sample Duplicate	A
		Accuracy	ICS-A: Absolute value of concentration for all non-spiked analytes < LOD (unless they are a verified trace impurity from one of the spiked analytes); ICS-AB: Within ± 20% of true value.	Interference check solutions	A
		Precision (field samples)	Five-fold dilution must agree within ± 10% of the original measurement. Only applicable for samples with concentrations >100x MDL for ICPMS.	Serial Dilution Test	S&A
		Completeness	QC acceptance criteria: ≥95% for TCLP ICP metals. % Analytical Completeness = 100 * (Number of Useable Data) / (Total Number of Requested Analyses)	Analytical Sample Completeness (Usability)	A

[1] Reference number from QAPP Worksheet #21. Field SOPs are subject to revision and updates during duration of the project, Shaw will use the most current revision of the SOP SEDA Generic Site-Wide SAP (Parsons, July 2006), Section 16 at the time of analysis.
[2] Reference number from QAPP Worksheet #23. Laboratory SOPs are subject to revision and updates during duration of the project, lab will use the most current revision of the SOP at the time of analysis.

QAPP Worksheet 12 - Measurement Performance Criteria Table
Worksheet 12.8 Mercury
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Matrix	Concrete and Dust and IDW
Analytical Group	TCLP Mercury
Concentration Level	Low

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Field SOPs All field sampling SOPs may be found within: *SEDA Generic Site-Wide SAP* (Parsons, July 2006), Section 16. See Worksheet 21.	TCLP: USEPA SW-846 1311/7470A GCAL MET-008	Field Representativeness (Absence of interference / contamination)	The blank results are evaluated for the analytes of concern to ascertain the efficiency of decontamination and assess the potential for cross-contamination. All Target Compounds <1/2 RL. Project QLs for all target compounds are specified in: Worksheet 15.1 for mercury solids. Not applicable for TCLP and SPLP mercury aqueous.	Field Blank / Equipment Blank (See Worksheet 20 - Not needed if using disposable equipment)	S&A
		Field Precision	QC acceptance criteria for all target compounds as specified in: Worksheet 15.1 for mercury solids. Not applicable for TCLP and SPLP mercury aqueous.	Field Duplicate (See Worksheet 20)	S&A
		Laboratory Representativeness (Absence of interference / contamination)	The blank results are evaluated for the analytes of concern to ascertain the efficiency of decontamination and assess the potential for cross-contamination. All Target Compounds <1/2 RL. Project QLs for all target compounds are specified in: Worksheet 15.1 for ICPMS mercury solids. Worksheet 15.2 for SPLP ICPMS mercury. Worksheet 15.9 for TCLP ICPMS mercury.	MB	A
		Laboratory Accuracy	QC acceptance criteria for all target compounds as specified in: Worksheet 15.1 for ICPMS mercury solids. Worksheet 15.2 for SPLP ICPMS mercury. Worksheet 15.9 for TCLP ICPMS mercury. Ref.: DoD QSM, if available, otherwise laboratory's own in-house criteria. %Recovery = (Calculated Value / True Value) *100%	LCS	A

QAPP Worksheet 12 - Measurement Performance Criteria Table
Worksheet 12.8 Mercury
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Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Field SOPs All field sampling SOPs may be found within: *SEDA Generic Site-Wide SAP* (Parsons, July 2006), Section 16. See Worksheet 21.	TCLP: USEPA SW-846 1311/7470A GCAL MET-008	Accuracy (field samples)	QC acceptance criteria for all target compounds as specified in: Worksheet 15.1 for mercury solids. Not applicable for TCLP and SPLP mercury aqueous. Ref.: DoD QSM, if available, otherwise laboratory's own in-house criteria. DoD QSM uses LCS criteria. %Recovery = (Calculated Value - Sample Value / True Value) *100%	MS	A
		Precision and Accuracy (field samples)	QC acceptance criteria for all target compounds as specified in: Worksheet 15.1 for mercury solids. Not applicable for TCLP and SPLP mercury aqueous. Ref.: DoD QSM, if available, otherwise laboratory's own in-house criteria. %Recovery = (Calculated Value – Sample Value / True Value) *100% RPD (%) = [(XA-XB)/ XM] * 100 Where: XA and XB are the concentration in the MS and MSD, and XM is the average value of the concentrations in the MS and MSD, (XA + XB)/2	MSD or Sample Duplicate	A
		Completeness	QC acceptance criteria: ≥95% for mercury solids ≥95% for TCLP and SPLP mercury. % Analytical Completeness = 100 * (Number of Useable Data) / (Total Number of Requested Analyses)	Analytical Sample Completeness (Usability)	A

[1] Reference number from QAPP Worksheet #21. Field SOPs are subject to revision and updates during duration of the project, Shaw will use the most current revision of the SOP SEDA Generic Site-Wide SAP (Parsons, July 2006), Section 16 at the time of analysis.
[2] Reference number from QAPP Worksheet #23. Laboratory SOPs are subject to revision and updates during duration of the project, lab will use the most current revision of the SOP at the time of analysis.

QAPP Worksheet 12 - Measurement Performance Criteria Table
Worksheet 12.9 Reactivity, Ignitability, and pH
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Matrix	IDW
Analytical Group	Reactive Cyanide/Sulfide, Ignitability, and pH
Concentration Level	Low

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Field SOPs All field sampling SOPs may be found within: *SEDA Generic Site-Wide SAP* (Parsons, July 2006), Section 16. See Worksheet 21.	Aqueous: SW-846 Sec 7.3 GCAL WL-054, WL-051, & WL-015 SW-846 1010A GCAL WL-060 SW-846 9040C GCAL EXT-033 Solids: SW-846 Sec 7.3 GCAL WL-054, WL-051, & WL-015; SW-846 1030 GCAL WL-066; SW-846 9045D GCAL EXT-032	Laboratory Representativeness (Absence of interference / contamination)	The blank results are evaluated for the analytes of concern to ascertain the efficiency of decontamination and assess the potential for cross-contamination. No analytes detected > ½ RL and greater than 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. Project QLs for all target compounds are specified in: Worksheet 15.10 for Reactive Cyanide/Sulfide, Ignitability, and pH solids and aqueous.	Method Blank	A
		Laboratory Accuracy	QC acceptance criteria for all target compounds as specified in: Worksheet 15.10 for Reactive Cyanide/Sulfide, Ignitability, and pH solids and aqueous. %Recovery = (Calculated Value / True Value) *100%	Laboratory Control Sample	A
		Accuracy (field samples)	For cyanide and sulfide: QC acceptance criteria for all target compounds as specified in: Worksheet 15.10 for Reactive Cyanide/Sulfide, Ignitability, and pH solids and aqueous. For pH and ignitability: Not Applicable Ref.: DoD QSM, if available, otherwise laboratory's own in-house criteria. DoD QSM uses LCS criteria. %Recovery = (Calculated Value - Sample Value / True Value) *100%	Matrix Spike	A

QAPP Worksheet 12 - Measurement Performance Criteria Table
Worksheet 12.9 Reactivity, Ignitability, and pH
Page 2 of 2

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Field SOPs All field sampling SOPs may be found within: *SEDA Generic Site-Wide SAP* (Parsons, July 2006), Section 16. See Worksheet 21.	Aqueous: SW-846 Sec 7.3 GCAL WL-054, WL-051, & WL-015 SW-846 1010A GCAL WL-060 SW-846 9040C GCAL EXT-033 Solids: SW-846 Sec 7.3 GCAL WL-054, WL-051, & WL-015; SW-846 1030 GCAL WL-066; SW-846 9045D GCAL EXT-032	Precision and Accuracy (field samples)	For cyanide and sulfide: QC acceptance criteria for all target compounds as specified in: Worksheet 15.10 for Reactive Cyanide/Sulfide, Ignitability, and pH solids and aqueous. For pH: % QC acceptance criteria for sample duplicate for all target compounds as: %RPD≤10% For ignitability: Not Applicable Ref.: DoD QSM, if available, otherwise laboratory's own in-house criteria. %Recovery = (Calculated Value – Sample Value / True Value) *100% RPD (%) = [(XA-XB)/ XM] * 100 Where: XA and XB are the concentration in the MS and MSD, and XM is the average value of the concentrations in the MS and MSD, (XA + XB)/2	Matrix Spike Duplicate or Sample Duplicate	A
		Completeness	QC acceptance criteria: ≥95% for Total Cyanide, Total Sulfide, Ignitability, and Corrosivity as pH solids and aqueous % Analytical Completeness = 100 * (Number of Useable Data) / (Total Number of Requested Analyses) % Sampling Completeness = 100 * (Number of Proposed Samples) / (Total Number of Samples Collected)	Analytical Sample Completeness (Usability)	S + A

[1] Reference number from QAPP Worksheet #21. Field SOPs are subject to revision and updates during duration of the project, Shaw will use the most current revision of the SOP SEDA Generic Site-Wide SAP (Parsons, July 2006), Section 16 at the time of analysis.
[2] Reference number from QAPP Worksheet #23. Laboratory SOPs are subject to revision and updates during duration of the project, lab will use the most current revision of the SOP at the time of analysis.

QAPP Worksheet 13 - Secondary Data Criteria and Limitations Table

Secondary Data	Data Source (originating organization, report title and date)	Data Generator(s) (originating organization, data types, data generation / collection dates)	How Data Will Be Used	Limitations on Data Use
Existing MC Data	Engineering Science, Inc., Expanded Site Inspection Report Seven Areas of Concern, Seneca Army Depot, Romulus, New York, December 1995	Engineering Science, seismic refraction data, EM31 data, GPR data, surface and subsurface soil, surface water, sediment, and groundwater data, October 1993 – April 1994.	Data will be used to aid in the delineation of areas where potentially elevated levels of MC are located and capping is required or that require relocation under the landfill cap. Data will also be used to assist in placing groundwater monitoring wells for the LTM program.	Groundwater data was taken approximately 16 years ago. Conditions may have changed. During the MEC clearance, excavation and relocation of soils may occur. This will need to be evaluated to determine if contaminated soils have been moved. Additional samples will be collected to characterize the nature and extent of contamination as necessary
Existing MC Data	Parsons, Draft Completion Report Additional Munitions Response Site Investigations Seneca Army Depot Activity, April 2010	Parsons, surface and subsurface soil data, SPLP, March – April 2010.	Data will be used to aid in the delineation of areas where potentially elevated levels of MC are located and capping is required or that require relocation under the landfill cap.	During the MEC clearance, excavation and relocation of soils may occur. This will need to be evaluated to determine if contaminated soils have been moved. Additional samples will be collected to characterize the nature and extent of contamination as necessary.

Sampling Tasks:

1. Each sampling team will consist of two members. One team member will collect the samples and one will be a UXO Technician who will employ MEC avoidance procedures during the sampling activities. If MEC is identified, the item will be flagged and avoided. Work in the immediate area will stop until the UXO technician determines it is safe to resume work.
2. Soil sampling for TAL Metals, explosives (discrete), perchlorate (select samples), and SPLP TAL metals to confirm that all contaminated soils are placed beneath the landfill cap.
3. Surface water sampling downgradient of the landfill cap for TAL Metals to evaluate whether migration has occurred and impacted the stream. Additional surface water samples may be required if the surface water is determined to be impacted.
4. Sampling of the Open Burning Tray to support closure of this area to include concrete powder/Dust/Chip chip characterization sampling for TCLP VOCs, TCLP SVOCs, TCLP Pesticides, TCLP Herbicides, and TCLP Metals.
5. Long-term monitoring of groundwater will be performed. At the present time, this monitoring is assumed to be for TAL metals. Field PID (equipped with an 10.6 eV lamp) screening for VOCs will be performed at each groundwater well location the first time the newly installed wells are sampled as standard health and safety practice. After the wells are screened, if there is indication of contamination with VOCs, it will be added to the analytical program. If there is no indication of contamination with VOCs the practice of screening the headspace will be discontinued. In addition, the water quality parameters pH, conductivity, turbidity, temperature, dissolved oxygen, and oxidation/reduction potential will be performed for each well location. Water quality parameters are considered to be stable for sample collection for when there are three consecutive readings as defined as follows:

   - pH ± 0.1 units
   - Temperature ± 1.0 °C
   - Turbidity ± 10 percent for turbidity below 50NTUs (10 NTUs or below is preferred)
   - Specific conductivity ± 3 percent of reading
   - Dissolved oxygen ± 10 percent of reading
   - Redox Potential (ORP or Eh) ± 10 mV

   (Reference: Groundwater Sampling – Low Flow Purging and Sampling from Monitoring Well - SEDA Generic Site-Wide SAP (Parsons, July 2006), Section 16.4.1.)
6. If required, samples will be collected for any IDW generated from site sampling activities to characterize for off-site disposal. Characterization samples will be analyzed for TCLP VOCs, TCLP SVOCs, TCLP Pesticides, TCLP Herbicides, TCLP Metals, Reactivity, Ignitability, and pH.
7. All environmental sampling will be performed in accordance with the SOPs described in the *SEDA Generic Site-Wide SAP* (Parsons, July 2006)
8. All sample documentation and COC procedures outlined in Worksheet 27 should then be followed. After proper documentation has been performed, sample packaging and shipping as outlined in Worksheet 27 of this document should be completed.

Analysis Tasks:

1. GCAL and Microbac will process, prepare, and analyze MC samples for the parameters agreed to by the Project Delivery Team. Discrete sampling techniques will be performed for metals (6020A/7470A/7471B), explosives (8330B Mod), perchlorate (6850), SPLP metals (1312/6020A/7470A), and TCLP analysis (1311/6010C/7470A/8260B/8270C/8081A/8151A). Microbac will be performing the explosives and perchlorate analysis. The 8330B Modifications for SEDA soil samples include for explosive samples include the following. A 10-gram portion is taken for analysis and thoroughly mixed to allow for representative homogenizing. This is achieved by air-drying at room temperature for at least 24 hours, sieving through a 10-mesh sieve, grinding, and mixing the bulk sample. The modification includes discrete sampling (i.e., no field incremental sampling [IS]) with subjectively removing vegetation (organic debris) and pebbles with no puck mill grinding, no laboratory and no field triplicate samples; however, will include laboratory reference material (LRM) standard, mortar and pestle grinding, and batch specific composite grinding blank. This is based upon the project data quality objectives (DQOs). See Worksheet 19 for analytical method requirements.

Quality Control Tasks:

1. Implement SOPs as defined in Worksheet 18 for field sampling procedures, follow guidelines as described in Worksheet 26 and 27 for sample custody procedures, packaging and transporting of samples.
2. Laboratory to follow preparation and analysis methods as described in Worksheets 15 and 19. Laboratory to follow quality control samples and procedures as defined in Worksheet 28.
3. Blind field duplicate samples will be collected at 1 per 10 field samples per matrix. Rinse blanks are not required if disposable equipment will be used; else, if needed will be collected at 1 per 20 field samples per matrix.

Secondary Data:

1. See Worksheet 13.

Data Management Tasks:

1. Analytical data will be placed in an excel spreadsheet with risk-based screening values, analytical reports will be received in PDF format. The data will be reported for each analyte to include the method detection limit (MDL), limit of detection (LOD), and reporting limit (RL). In addition, any positive value detected between the MDL and the RL must be reported as an estimated "J" concentration. Non-detections are reported at the LOD level. The RL takes into account each samples characteristics for analysis such as sample dilutions, sample volumes and weights, and percent solids (soils) for dry weight.
2. The laboratory will include an Excel and EQUIS EDD for each analytical batch. The Excel EDDs will facilitate the data evaluation and validation process and the EQUIS format will be used to upload the data into the NYSDEC EQUIS database.
3. The laboratory will provide data results (emailed or faxed) within the specified turnaround time (TAT). The faxed data shall include batch QC results, including laboratory control sample / laboratory control sample duplicates (LCS/LCSD), MS/MSD, surrogate spikes, and method blanks unless otherwise stipulated by the Shaw Project Chemist. The completed, original COC, with records of sample transfers, acknowledgments, receipt conditions and any discrepancies, must be submitted with the electronic data package. Any out-of-control event or changes in the analytical program shall be clearly indicated on the COC and stated in the case narrative.
4. The laboratory will provide full contract laboratory program (CLP)-like hardcopy data packages to meet data validation requirements. All data packages shall be systematically organized. All pages within the data package shall be stamped legibly with consecutive page numbers.

5. The laboratory will include an Excel and EQUIS EDD for each analytical batch. The Excel EDDs will facilitate the data evaluation and validation process and the EQUIS format will be used to upload the data into the NYSDEC EQUIS database. The EDDs will facilitate the data evaluation and validation processes. The laboratory will address via a brief explanation in the Non-Conformance Log any non-conformance that is not within their control. The final laboratory non conformance report and results shall be provided to the project chemist and data validator to expedite the validation process and the validation qualifier fields populated.
6. Analytical data will be placed in an excel spreadsheet with risk-based screening values, analytical reports will be received in PDF format. The data will be reported for each analyte to include the MDL, LOD, and RL/LOQ. In addition, any positive value detected between the MDL and the RL must be reported as an estimated "J" concentration.

Documentation and Records:

1. All samples collected will have sample locations documented in field logbooks. COC records, air bills, and laboratory sample logs will be retained for each sample and will become a part of the analytical PDF data report.
2. Analytical laboratory reports and electronic deliverables will be stored on the Shaw server. Hardcopy data will be stored by Shaw through the RAR and memo reports as well.
3. Copy of the finalized QAPP will be retained in the Shaw and subcontract labs central file area and at the site (during site activity) for review.

Assessment / Audit Tasks:

1. Sampling SOPs and Safety will be reviewed prior to start up of sampling.
2. QC meetings will be conducted throughout the project at a minimum monthly and if necessary more frequently. QC meetings will be held more frequently at the beginning of the project.

Data Review Tasks:

1. The Shaw Project Chemist will verify that data has been received for all samples submitted to the laboratory. An evaluation of these data will be performed to determine whether the laboratory met the QC requirements for the analytical as stated in the analytical methods and laboratory SOPs.
2. Data verification (a.k.a limited validation) will be performed on all samples by qualified Shaw personnel. Data verification will include that sample analysis was performed as stated in the QAPP and per the laboratory SOPs. The data verification effort to assess laboratory performance will include a review of: completeness, chain-of-custody, holding times, QC results reported on summary forms (LCS, Method blanks, MS/MSD, equipment blank), detection and reporting limits, and other contractual items.
3. Full level data validation suitable for risk assessment purposes will be performed in addition to the verification on all MC support samples for explosives, perchlorate, and TAL metals and on the LTM groundwater samples for TAL metals. This includes detailed evaluations of the data such as calibrations, calibration check standards, quantitation verifications, instrument tunes, interference check samples, surrogates, MS/MSD, LCS, method and calibration blanks, holding times and preservation. Data will be validated in accordance with criteria as specified in Worksheets 12, 15, 19, and 28 which is based upon:

    - *DoD Quality Systems Manual for Environmental Laboratories, Final Version 4.2, October 25, 2010* (DoD, 2010),
    - *DoD Perchlorate Handbook August, Rev1, Change 1, 2007* (DoD, 2007),
    - Cited *USEPA SW-846* and *USEPA Methods for Chemical Analysis for Water and Wastes* methodology.

Validation qualifiers will be consistent with the USEPA Region II SOPs (if required). This includes:

- *USEPA Region II Evaluation of Metals Data for the Contract Laboratory Program, Revision 13* (SOP HW-2, September 2006).
- *USEPA Region II Validation of Data Nitroaromatics and Nitroamines by HPLC, SW-846, Method 8330A, Revision 2* (SOP HW-16, September 2006).

4. The TCLP concrete/dust/chip characterization samples and IDW samples are disposal characterization parameters and will require only the limited validation verification reviews. Criteria for QC results will be compared work plan requirements as per QAPP Worksheets 12, 15, 19, and 28 based on DOD QSM V4.2 and cited USEPA SW-846 or other methodology (as applicable).
5. Analytical results will be evaluated by the Shaw technical staff to evaluate nature and extent of contamination and in a quantitative HHRA and SLERA. The following approach will be made.
    a. Analytical results will be evaluated by the Shaw technical staff to evaluate nature and extent of contamination and in a quantitative HHRA and SLERA. The Site Cleanup Levels (SCLs) for the soil and surface water samples are being established in the decision documents for the site. The Draft Feasibility Study for the site indicates that the NYS Commercial SCOs will be used as the basis for the SCLs. Both the existing chemical analytical data set and the additional soil samples will be compared to the SCLs as established in the FS, PP, and ROD for the site. A Screening Level Ecological Risk assessment (SLERA), including an estimation of COPEC doses to wildlife and associated hazards, as well as a direct-contact hazard assessment for terrestrial plants, soil invertebrates, and aquatic biota will be performed using the chemical data. This type of detail is required because ecological screening levels should not be used as cleanup levels. A Screening Level Human Health Risk Assessment (SLHHRA), including simple comparisons of site data with SCLs and scaling to estimate risks and hazards, will be performed to assess potential human receptor impacts, This HHRA screening approach (compared with the more detailed SLERA approach) is appropriate given NY's position on HHRAs (i.e., NYSDEC does not typically accept detailed HHRAs).

b. The decision documents for the site indicate that New York State Commercial Cleanup Objectives will be used as the final action levels for determining which soils are placed under the cap. To determine soils required to be placed under the landfill cap, concentrations of detected compounds in soil will be screened against New York State Unrestricted Use Soil Cleanup Objectives (SCOs) and USEPA Regional Screening Levels [Priority for Selection of Soil Ecological Screening Values (ESVs): 1) EPA Eco-SSL; 2) EPA Region 4 ESVs for Soil] (shown in **Table 1**). The metals soil concentrations will be first compared to background concentrations. Specifically, the 95% UCL of the regional background levels for metals will be used for comparison purposes. If greater than these, levels, then further risk-based comparisons will be performed. The unrestricted SCOs and USEPA Regional Screening Levels are presented here-in for comparison purposes and to ensure the laboratory provides adequate detection limits. Concentration of contaminants detected in surface water will be screened against NYS Human Health Surface Water Screening Values (Fish Consumption) - Class C Waters [Ref.: *NYS DEC Section 703.5; Table 1 Water Quality Standards for Surface Water and Groundwater* (2008)] and Selected Surface Water ESV [Priority for Selection of Surface Water ESVs: 1) NYS WQS; 2) EPA Region 3 ESV; 3) EPA Region 4 ESV) (shown in **Table 1**). Concentration of contaminants detected in groundwater will be screened against NYS Human Health Groundwater Screening Values - Class GA [Ref.: *NYS DEC Section 703.5; Table 1 Water Quality Standards for Surface Water and Groundwater* (2008)]; Tap water Regional Screening Level (RSL) [Screening toxicity values are from the NYS SCOs (unrestricted, Table 375-6.8[a]) and USEPA RSL Table for November 2011. RSL value based on a cancer risk of 1.0E-06 and a hazard quotient of 0.1.]; and Drinking Water Maximum Contaminant Levels (MCLs) [Ref.: USEPA National Primary Drinking Water Standards (January 2011)] (shown in **Table 1**). The concentrations of analytes detected in the waste characterization samples collected from the Open Burning Tray materials will be compared to State and Federal Land Disposal Restrictions (LDRs) to determine the acceptable off-site disposal options for the materials.

QAPP Worksheet 15 - Reference Limits and Evaluation Table
Worksheet 15.1 Environmental Sampling for TAL Metals (Solid)
Page 1 of 2

Matrix: Soil
Analytical Group: TAL Metals - SW-846 3050B/6020A/7471B
Concentration Level: Low

Analyte	Abbreviation	CAS Number	Project Action Limit[1] (mg/kg) *Equal to or Less Than* Minimum Solid Criteria	Project Quantitation Limit Goal[1] (mg/kg)	Project Action Limit Reference	Achievable Laboratory Limits[2] MDLs (mg/kg)	LODs (mg/kg)	LOQs (mg/kg)	Precision and Accuracy Method Performance Criteria[3] LCS Control Limit (%R)	MS/MSD Control Limit (%R)	MS/MSD Precision Limit (RPD)	Surrogate Control Limit (%R)	Project Field Precision Limit (RPD)
Aluminum	Al	7429-90-5	7700	0.80	See work plan, Table 3-6 and QAPP Table 1.	0.238	0.80	0.80	80-120	80-120	20	NA	35
Antimony	Sb	7440-36-0	0.27	0.04		0.007	0.02	0.04	80-120	80-120	20	NA	35
Arsenic	As	7440-38-2	0.39	0.04		0.0092	0.03	0.04	80-120	80-120	20	NA	35
Barium	Ba	7440-39-3	330	0.04		0.0066	0.02	0.04	80-120	80-120	20	NA	35
Beryllium	Be	7440-41-7	7.2	0.04		0.0022	0.008	0.04	80-120	80-120	20	NA	35
Cadmium	Cd	7440-43-9	0.36	0.04		0.0029	0.01	0.04	80-120	80-120	20	NA	35
Calcium	Ca	7440-70-2	NA	4.0		1.66	4.0	4.0	80-120	80-120	20	NA	35
Chromium	Cr	7440-47-3	26	0.04		0.0099	0.03	0.04	80-120	80-120	20	NA	35
Cobalt	Co	7440-48-4	2.3	0.04		0.0021	0.008	0.04	80-120	80-120	20	NA	35
Copper	Cu	7440-50-8	28	0.04		0.0039	0.04	0.04	80-120	80-120	20	NA	35
Iron	Fe	7439-89-6	5500	4.0		1.42	4.0	4.0	80-120	80-120	20	NA	35
Lead	Pb	7439-92-1	11	0.04		0.0054	0.02	0.04	80-120	80-120	20	NA	35
Magnesium	Mg	7439-95-4	NA	4.0		0.107	0.40	4.0	80-120	80-120	20	NA	35
Manganese	Mn	7439-96-5	180	0.20		0.0071	0.10	0.20	80-120	80-120	20	NA	35
Mercury	Hg	7439-97-6	0.1	0.01		0.0033	0.01	0.01	80-120	80-120	20	NA	35

QAPP Worksheet 15 - Reference Limits and Evaluation Table
Worksheet 15.1 Environmental Sampling for TAL Metals (Solid)
Page 2 of 2

Analyte	Abbreviation	CAS Number	Project Action Limit[1] (mg/kg) *Equal to or Less Than* Minimum Solid Criteria	Project Quantitation Limit Goal[1] (mg/kg)	Project Action Limit Reference	Achievable Laboratory Limits[2] MDLs (mg/kg)	LODs (mg/kg)	LOQs (mg/kg)	Precision and Accuracy Method Performance Criteria[3] LCS Control Limit (%R)	MS/MSD Control Limit (%R)	MS/MSD Precision Limit (RPD)	Surrogate Control Limit (%R)	Project Field Precision Limit (RPD)
Nickel	Ni	7440-02-0	30	0.04	See work plan, Table 3-6 and QAPP Table 1.	0.013	0.04	0.04	80-120	80-120	20	NA	35
Potassium	K	7440-09-7	NA	4.0		0.614	2.0	4.0	80-120	80-120	20	NA	35
Selenium	Se	7782-49-2	0.52	0.04		0.0132	0.04	0.04	80-120	80-120	20	NA	35
Silver	Ag	7440-22-4	2	0.04		0.0075	0.02	0.04	75-120	75-120	20	NA	35
Sodium	Na	7440-23-5	NA	4.0		0.324	1.0	4.0	80-120	80-120	20	NA	35
Thallium	Tl	7440-28-0	0.078	0.04		0.0027	0.01	0.04	80-120	80-120	20	NA	35
Vanadium	V	7440-62-2	7.8	0.04		0.006	0.02	0.04	80-120	80-120	20	NA	35
Zinc	Zn	7440-66-6	46	0.80		0.198	0.70	0.80	80-120	80-120	20	NA	35

mg/kg = milligrams per kilogram = parts per million

NA = Not Applicable or Not Available.

%R = percent recovery

[1] Project action limits are based on the screening values presented in Work Plan, Table 3-6 and QAPP Table 1.

[2] Achievable MDLs, LODs, and LOQs are limits that an individual laboratory can achieve when performing a specific analytical method. *Laboratory Generated Limits are subject to change, the laboratory will use the most current limits at the time of analysis.* The listed MDLs, LODs, and LOQs are based upon a wet weight basis and dilution factor of 1.

[3] The laboratory precision and accuracy method performance criteria shown are based upon the *DoD QSM*, Version 4.2, October 25, 2010. If a compound/analyte is not listed, then the established laboratory in-house limits are shown per DoD QSM guidance requirements.

QAPP Worksheet 15 - Reference Limits and Evaluation Table
Worksheet 15.2 Environmental Sampling for TAL Metals (Aqueous/Leachate)
Page 1 of 2

Matrix: Groundwater, Surface Water, and SPLP Leachate
Analytical Group: TAL Metals - SW-846 3010A/6020A/7470A and SW-846 1312/3010A/6020A/7470A
Concentration Level: Low

Analyte	Abbreviation	CAS Number	Project Action Limit[1] (µg/L) *Equal to or Less Than*			Project Quantitation Limit Goal[1] (µg/L)	Project Action Limit Reference	Achievable Laboratory Limits[2]			Precision and Accuracy Method Performance Criteria[3]				
			Minimum Groundwater Criteria	Minimum Surface Water Criteria	SPLP Screening Values			MDLs (µg/L)	LODs (µg/L)	LOQs (µg/L)	LCS Control Limit (%R)	MS/MSD Control Limit (%R)	MS/MSD Precision Limit (RPD)	Surrogate Control Limit (%R)	Project Field Precision Limit (RPD)
Aluminum	Al	7429-90-5	50	100	2000	20	See work plan, Table 3-6 and QAPP Table 1	1.67	6	20	80-120	80-120	20	NA	25
Antimony	Sb	7440-36-0	0.6	30	6	1.0		0.485	1.0	1.0	80-120	80-120	20	NA	25
Arsenic	As	7440-38-2	0.045	340	50	1.0		0.094	0.3	1.0	80-120	80-120	20	NA	25
Barium	Ba	7440-39-3	290	4	2000	1.0		0.077	0.3	1.0	80-120	80-120	20	NA	25
Beryllium	Be	7440-41-7	1.6	1100	NA	1.0		0.049	0.10	1.0	80-120	80-120	20	NA	25
Cadmium	Cd	7440-43-9	0.69	2.1	10	1.0		0.026	0.10	1.0	80-120	80-120	20	NA	25
Calcium	Ca	7440-70-2	NA	116000	NA	100		43.4	100	100	80-120	80-120	20	NA	25
Chromium	Cr	7440-47-3	100	74	NA	1.0		0.03	0.10	1.0	80-120	80-120	20	NA	25
Cobalt	Co	7440-48-4	0.47	5	NA	1.0		0.053	0.20	1.0	80-120	80-120	20	NA	25
Copper	Cu	7440-50-8	62	9	400	1.0		0.093	0.30	1.0	80-120	80-120	20	NA	25
Iron	Fe	7439-89-6	300	300	600	100		3.0	10	100	80-120	80-120	20	NA	25
Lead	Pb	7439-92-1	15	0.69	50	1.0		0.025	0.10	1.0	80-120	80-120	20	NA	25
Magnesium	Mg	7439-95-4	NA	82000	NA	100		5.22	20	100	80-120	80-120	20	NA	25
Manganese	Mn	7439-96-5	32	120	600	5.0		0.27	1.0	5.0	80-120	80-120	20	NA	25
Mercury	Hg	7439-97-6	0.16	0.0007	1.4	0.20		0.068	0.20	0.20	80-120	80-120	20	NA	25

QAPP Worksheet 15 - Reference Limits and Evaluation Table
Worksheet 15.2 Environmental Sampling for TAL Metals (Aqueous/Leachate)
Page 2 of 2

Matrix: Groundwater, Surface Water, and SPLP Leachate
Analytical Group: TAL Metals - SW-846 3010A/6020A/7470A and SW-846 1312/3010A/6020A/7470A
Concentration Level: Low

Analyte	Abbreviation	CAS Number	Project Action Limit[1] (µg/L) *Equal to or Less Than*			Project Quantitation Limit Goal[1] (µg/L)	Project Action Limit Reference	Achievable Laboratory Limits[2]			Precision and Accuracy Method Performance Criteria[3]				
			Minimum Groundwater Criteria	Minimum Surface Water Criteria	SPLP Screening Values			MDLs (µg/L)	LODs (µg/L)	LOQs (µg/L)	LCS Control Limit (%R)	MS/MSD Control Limit (%R)	MS/MSD Precision Limit (RPD)	Surrogate Control Limit (%R)	Project Field Precision Limit (RPD)
Nickel	Ni	7440-02-0	30	52	200	1.0	See work plan, Table 3-6 and QAPP Table 1	0.26	1.0	1.0	80-120	80-120	20	NA	25
Potassium	K	7440-09-7	NA	53000	NA	100		9.98	30	100	80-120	80-120	20	NA	25
Selenium	Se	7782-49-2	7.8	4.6	20	1.0		0.11	0.40	1.0	80-120	80-120	20	NA	25
Silver	Ag	7440-22-4	7.1	0.1	100	1000		8.0	30	1000	80-120	80-120	20	NA	25
Sodium	Na	7440-23-5	NA	680000	NA	1.0		0.017	0.6	1.0	80-120	80-120	20	NA	25
Thallium	Tl	7440-28-0	0.016	8	NA	1.0		0.06	0.20	1.0	80-120	80-120	20	NA	25
Vanadium	V	7440-62-2	7.8	14	NA	1.0		0.085	0.30	1.0	80-120	80-120	20	NA	25
Zinc	Zn	7440-66-6	4700	83	5000	20		1.3	5.0	20	80-120	80-120	20	NA	25

µg/L = micrograms per liter = parts per billion

NA = Not Applicable or Not Available.

%R = percent recovery

[1] Project action limits are based on the screening values presented in Work Plan, Table 3-6 and QAPP Table 1.

[2] Achievable MDLs, LODs, and LOQs are limits that an individual laboratory can achieve when performing a specific analytical method. *Laboratory Generated Limits are subject to change, the laboratory will use the most current limits at the time of analysis.* The listed MDLs, LODs, and LOQs are based upon a dilution factor of 1.

[3] The laboratory precision and accuracy method performance criteria shown are based upon the *DoD QSM*, Version 4.2, October 25, 2010. If a compound/analyte is not listed, then the established laboratory in-house limits are shown per DoD QSM guidance requirements.

QAPP Worksheet 15 - Reference Limits and Evaluation Table
QAPP Worksheet #15.3 - Environmental Sampling for Explosives
Page 1 of 2

Matrix: Soil
Analytical Group: Explosives - SW-846 8330B Modified (Discrete)
Concentration Level: Low

Analyte	Abbreviation	CAS Number	Project Action Limit[1] (mg/kg) Equal to or Less Than	Project Quantitation Limit Goal[1] (mg/kg)	Project Action Limit Reference	Achievable Laboratory Limits[2]			Precision and Accuracy Method Performance Criteria[3]				
			Minimum Solid Criteria			MDLs (mg/kg)	LODs (mg/kg)	LOQs (mg/kg)	LCS Control Limit (%R)	MS/MSD Control Limit (%R)	MS/MSD Precision Limit (RPD)	Surrogate Control Limit (%R)	Project Field Precision Limit (RPD)
Octahydro-1,3,5,7-tetranitro- 1,3,5,7-tetrazocine	HMX	2691-41-0		0.40	See work plan, Table 3-6 and QAPP Table 1	0.10	0.20	0.40	75-125	75-125	30	NA	50
Hexahydro-1,3,5-trinitro-1,3,5-triazine	RDX	121-82-4		0.40		0.10	0.20	0.40	70-135	70-135	30	NA	50
1,3,5-trinitrobenzene	1,3,5-TNB	99-35-4		0.40		0.10	0.20	0.40	75-125	75-125	30	NA	50
1,3-dinitrobenzene	1,3-DNB	99-65-0		0.40		0.10	0.20	0.40	80-125	80-125	30	NA	50
Trinitrophenylmethyl-nitramine	Tetryl	479-45-8		0.40		0.10	0.20	0.40	10-150	10-150	30	NA	50
Nitrobenzene	NB	98-95-3		0.40		0.10	0.20	0.40	75-125	75-125	30	NA	50
2,4,6-trinitrotoluene	2,4,6-TNT	118-96-7		0.40		0.10	0.20	0.40	55-140	55-140	30	NA	50
4-amino-2,6-dinitrotoluene	4-Am-DNT	19406-51-0		0.40		0.10	0.20	0.40	80-125	80-125	30	NA	50
2-amino-4,6-dinitrotoluene	2-Am-DNT	35572-78-2		0.40		0.10	0.20	0.40	80-125	80-125	30	NA	50
2,4-dinitrotoluene	2,4-DNT	121-14-2		0.40		0.10	0.20	0.40	80-125	80-125	30	NA	50
2,6-dinitrotoluene	2,6-DNT	606-20-2		0.40		0.10	0.20	0.40	80-125	80-125	30	NA	50
2-nitrotoluene	2-NT	88-72-2		0.40		0.10	0.20	0.40	80-125	80-125	30	NA	50
3-nitrotoluene	3-NT	99-08-1		0.40		0.10	0.20	0.40	75-120	75-120	30	NA	50

QAPP Worksheet 15 - Reference Limits and Evaluation Table
QAPP Worksheet #15.3 - Environmental Sampling for Explosives
Page 2 of 2

Analyte	Abbreviation	CAS Number	Project Action Limit[1] (mg/kg) Equal to or Less Than	Project Quantitation Limit Goal[1] (mg/kg)	Project Action Limit Reference	Achievable Laboratory Limits[2]			Precision and Accuracy Method Performance Criteria[3]				
			Minimum Solid Criteria			MDLs (mg/kg)	LODs (mg/kg)	LOQs (mg/kg)	LCS Control Limit (%R)	MS/MSD Control Limit (%R)	MS/MSD Precision Limit (RPD)	Surrogate Control Limit (%R)	Project Field Precision Limit (RPD)
4-nitrotoluene	4-NT	99-99-0		0.40		0.10	0.20	0.40	75-125	75-125	30	NA	50
Nitroglycerin	NG	55-63-0		0.40		0.10	0.20	0.40	50-150	50-150	30	NA	50
Pentaerythritol tetranitrate	PETN	78-11-5		0.40		0.10	0.20	0.40	30-140	30-140	30	NA	50
Laboratory Surrogate:													
1,2-Dinitrobenzene	1,2-DNB	528-29-0	NA		NA	NA	NA	NA	NA	NA	NA	50-150	NA

mg/kg = milligrams per kilogram = parts per million

NA = Not Applicable or Not Available.

%R = percent recovery

RPD = relative percent difference

[1] Project action limits are based on the lowest screening values presented in Tables 3-5 and 3-7 in the RI Work Plan and addresses both human health and ecological risk evaluation.

[2] Achievable MDLs, LODs, and LOQs are limits that an individual laboratory can achieve when performing a specific analytical method. *Laboratory Generated Limits are subject to change, the laboratory will use the most current limits at the time of analysis.* The listed MDLs, LODs, and LOQs are based upon a wet weight basis and dilution factor of 1.

[3] The laboratory precision and accuracy method performance criteria shown are based upon the *DoD QSM*, Version 4.2, October 25, 2010. If a compound/analyte is not listed, then the established laboratory in-house limits are shown per DoD QSM guidance requirements.

QAPP Worksheet 15 - Reference Limits and Evaluation Table
QAPP Worksheet #15.4 - Environmental Sampling for Perchlorate
Page 1 of 2

Matrix: Soil
Analytical Group: Perchlorate - SW-846 6850
Concentration Level: Low

Analyte	CAS Number	Project Action Limit[1] (mg/kg) Equal to or Less Than	Project Quantitation Limit Goal[1] (mg/kg)	Project Action Limit Reference	Achievable Laboratory Limits[2]			Precision and Accuracy Method Performance Criteria[3]				
		Minimum Solid Criteria			MDLs (mg/kg)	LODs (mg/kg)	LOQs (mg/kg)	LCS Control Limit (%R)	MS/MSD Control Limit (%R)	MS/MSD Precision Limit (RPD)	Surrogate Control Limit (%R)	Project Field Precision Limit (RPD)
Perchlorate	14797-73-0		4.0	See work plan, Table 3-6 and QAPP Table 1	1.0	2.0	4.0	80-120	80-120	20	NA	35

mg/kg = milligrams per kilogram = parts per million

NA = Not Applicable or Not Available.

%R = percent recovery

RPD = relative percent difference

[1] Project action limits are based on the lowest screening values presented in Tables 3-5 and 3-7 in the RI Work Plan and addresses both human health and ecological risk evaluation.

[2] Achievable MDLs, LODs, and LOQs are limits that an individual laboratory can achieve when performing a specific analytical method. *Laboratory Generated Limits are subject to change, the laboratory will use the most current limits at the time of analysis.* The listed MDLs, LODs, and LOQs are based upon a wet weight basis and dilution factor of 1.

[3] The laboratory precision and accuracy method performance criteria shown are based upon the *DoD QSM*, Version 4.2, October 25, 2010. If a compound/analyte is not listed, then the established laboratory in-house limits are shown per DoD QSM guidance requirements.

QAPP Worksheet 15 - Reference Limits and Evaluation Table
Worksheet 15.5 Environmental Sampling for TCLP Metals (Leachate)
Page 1 of 2

Matrix: TCLP Leachate
Analytical Group: TCLP Metals - SW-846 1311/6010C/7470A
Concentration Level: Low

Analyte	CAS Number	Project Action Limit[1] (mg/L) *Equal to or Less Than*	Project Quantitation Limit Goal[1] (mg/L)	Project Action Limit Reference	Achievable Laboratory Limits[2]			Precision and Accuracy Method Performance Criteria[3]				
					MDLs (mg/L)	LODs (mg/L)	LOQs (mg/L)	LCS Control Limit (%R)	MS/MSD Control Limit (%R)	MS/MSD Precision Limit (RPD)	Surrogate Control Limit (%R)	Project Field Precision Limit (RPD)
Arsenic	7440-38-2	5.0	0.20	USEPA TCLP Maximum Concentration of Contaminants 40 Code of Federal Regulations (CFR) 261 (June, 1996)	0.003	0.010	0.20	80-120	NA	NA	NA	NA
Barium	7440-39-3	100	0.01		0.00071	0.003	0.01	80-120	NA	NA	NA	NA
Cadmium	7440-43-9	1.0	0.005		0.0002	0.0006	0.005	80-120	NA	NA	NA	NA
Chromium	7440-47-3	5.0	0.01		0.00026	0.001	0.01	80-120	NA	NA	NA	NA
Lead	7439-92-1	5.0	0.015		0.002	0.008	0.015	80-120	NA	NA	NA	NA
Mercury	7439-97-6	0.20	0.0002		0.00007	0.0002	0.0002	80-120	NA	NA	NA	NA
Selenium	7782-49-2	1.0	0.04		0.0044	0.015	0.04	80-120	NA	NA	NA	NA
Silver	7440-22-4	5.0	0.01		0.0007	0.0025	0.01	80-120	NA	NA	NA	NA

mg/L = milligrams per liter = parts per million

NA = Not Applicable or Not Available.

%R = percent recovery

[1]Project action limits are based upon USEPA TCLP Maximum Concentration of Contaminants 40 CFR 261 (June, 1996).

[2]Achievable MDLs, LODs, and LOQs are limits that an individual laboratory can achieve when performing a specific analytical method. *Laboratory Generated Limits are subject to change; the laboratory will use the most current limits at the time of analysis.*

[3] The laboratory precision and accuracy method performance criteria shown are based upon the *DoD QSM*, Version 4.2, October 25, 2010. If a compound/analyte is not listed, then the established laboratory in-house limits are shown per DoD QSM guidance requirements. No field duplicate or MS/MSD are required for TCLP analysis.

QAPP Worksheet 15 - Reference Limits and Evaluation Table
Worksheet 15.6 Environmental Sampling for TCLP VOCs (Leachate)
Page 2 of 2

Matrix: TCLP Leachate
Analytical Group: TCLP VOCs - SW-846 1311/5030B/8260B
Concentration Level: Low

Analyte	CAS Number	Project Action Limit[1] (mg/L) *Equal to or Less Than*	Project Quantitation Limit Goal[1] (mg/L)	Project Action Limit Reference	Achievable Laboratory Limits[2]			Precision and Accuracy Method Performance Criteria[3]				
					MDLs (mg/L)	LODs (mg/L)	LOQs (mg/L)	LCS Control Limit (%R)	MS/MSD Control Limit (%R)	MS/MSD Precision Limit (RPD)	Surrogate Control Limit (%R)	Project Field Precision Limit (RPD)
Benzene	71-43-2	0.50	0.005	USEPA TCLP Maximum Concentration of Contaminants 40 CFR 261 (June, 1996)	0.00011	0.0002	0.005	80-120	NA	NA	NA	NA
Chlorobenzene	108-90-7	100	0.005		0.00008	0.0002	0.005	80-120	NA	NA	NA	NA
Chloroform	67-66-3	6.0	0.005		0.00016	0.0002	0.005	65-135	NA	NA	NA	NA
Carbon tetrachloride	56-23-5	0.50	0.005		0.00025	0.0005	0.005	65-140	NA	NA	NA	NA
1,1-Dichloroethylene	75-35-4	0.70	0.005		0.00021	0.0005	0.005	70-130	NA	NA	NA	NA
1,2-Dichloroethane	107-06-2	0.50	0.005		0.00012	0.0002	0.005	80-120	NA	NA	NA	NA
1,4-Dichlorobenzene	106-46-7	7.5	0.005		0.00008	0.0002	0.005	75-125	NA	NA	NA	NA
Methyl ethyl ketone	78-93-3	200	0.005		0.00014	0.0005	0.005	30-150	NA	NA	NA	NA
Tetrachloroethylene	127-18-4	0.70	0.005		0.00019	0.0005	0.005	45-150	NA	NA	NA	NA
Trichloroethylene	79-01-6	0.50	0.005		0.00016	0.0002	0.005	70-125	NA	NA	NA	NA
Vinyl chloride	75-01-4	0.20	0.005		0.00013	0.0002	0.005	50-145	NA	NA	NA	NA
Laboratory Surrogates												
Dibromofluoromethane	1868-53-7	NA	NA	NA	NA	NA	NA	NA	NA	NA	85-115	NA
Toluene-D8	2037-26-5	NA	NA	NA	NA	NA	NA	NA	NA	NA	85-120	NA
4-Bromofluorobenzene	460-00-4	NA	NA	NA	NA	NA	NA	NA	NA	NA	75-120	NA
1,2-Dichloroethane-D4	17060-07-0	NA	NA	NA	NA	NA	NA	NA	NA	NA	70-120	NA

mg/L = milligrams per liter = parts per million

NA = Not Applicable or Not Available.

%R = percent recovery

[1]Project action limits are based upon USEPA TCLP Maximum Concentration of Contaminants 40 CFR 261 (June, 1996).

[2]Achievable MDLs, LODs, and LOQs are limits that an individual laboratory can achieve when performing a specific analytical method. *Laboratory Generated Limits are subject to change; the laboratory will use the most current limits at the time of analysis.*

[3] The laboratory precision and accuracy method performance criteria shown are based upon the *DoD QSM*, Version 4.2, October 25, 2010. If a compound/analyte is not listed, then the established laboratory in-house limits are shown per DoD QSM guidance requirements. No field duplicate or MS/MSD are required for TCLP analysis.

QAPP Worksheet 15 - Reference Limits and Evaluation Table
Worksheet 15.7 Environmental Sampling for TCLP SVOCs (Leachate)
Page 1 of 2

Matrix: TCLP Leachate
Analytical Group: TCLP SVOCs - SW-846 1311/3510C/8270C
Concentration Level: Low

Analyte	CAS Number	Project Action Limit[1] (mg/L) *Equal to or Less Than*	Project Quantitation Limit Goal[1] (mg/L)	Project Action Limit Reference	Achievable Laboratory Limits[2]			Precision and Accuracy Method Performance Criteria[3]				
					MDLs (mg/L)	LODs (mg/L)	LOQs (mg/L)	LCS Control Limit (%R)	MS/MSD Control Limit (%R)	MS/MSD Precision Limit (RPD)	Surrogate Control Limit (%R)	Project Field Precision Limit (RPD)
2-Methylphenol	95-48-7	200	0.010	USEPA TCLP Maximum Concentration of Contaminants 40 CFR 261 (June, 1996)	0.00018	0.0005	0.010	40-110	NA	NA	NA	NA
3&4-Methylphenol	NA	200	0.010		0.00013	0.0005	0.010	30-110	NA	NA	NA	NA
Pentachlorophenol	87-86-5	100	0.050		0.00032	0.0005	0.050	40-115	NA	NA	NA	NA
2,4,5-Trichlorophenol	95-95-4	400	0.010		0.00027	0.0005	0.010	50-110	NA	NA	NA	NA
2,4,6-Trichlorophenol	88-06-2	2.0	0.010		0.00049	0.0005	0.010	50-115	NA	NA	NA	NA
1,4-Dichlorobenzene	106-46-7	7.5	0.010		0.00033	0.0005	0.010	30-100	NA	NA	NA	NA
2,4-Dinitrotoluene	121-14-2	0.13	0.010		0.00043	0.0005	0.010	50-120	NA	NA	NA	NA
Hexachlorobenzene	118-74-1	0.13	0.010		0.00044	0.0005	0.010	50-110	NA	NA	NA	NA
Hexachlorobutadiene	87-68-3	0.50	0.010		0.00041	0.0005	0.010	25-105	NA	NA	NA	NA
Hexachloroethane	67-72-1	3.0	0.010		0.00039	0.0005	0.010	30-100	NA	NA	NA	NA
Nitrobenzene	98-95-3	2.0	0.010		0.00014	0.0005	0.010	45-110	NA	NA	NA	NA
Pyridine	110-86-1	5.0	0.010		0.0030	0.0050	0.010	50-150	NA	NA	NA	NA
Laboratory Surrogates												
2-Fluorophenol	367-12-4	NA	NA	NA	NA	NA	NA	NA	NA	NA	50-110	NA
Phenol-d5	4165-62-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	10-115	NA
2,4,6-Tribromophenol	118-79-6	NA	NA	NA	NA	NA	NA	NA	NA	NA	40-125	NA
Nitrobenzene-d5	4165-60-0	NA	NA	NA	NA	NA	NA	NA	NA	NA	40-110	NA
2-Fluorobiphenyl	321-60-8	NA	NA	NA	NA	NA	NA	NA	NA	NA	50-110	NA
Terphenyl-d14	1718-51-0	NA	NA	NA	NA	NA	NA	NA	NA	NA	50-135	NA

QAPP Worksheet 15 - Reference Limits and Evaluation Table
Worksheet 15.7 Environmental Sampling for TCLP SVOCs (Leachate)
Page 2 of 2

mg/L = milligrams per liter = parts per million

NA = Not Applicable or Not Available.

%R = percent recovery

[1]Project action limits are based upon USEPA TCLP Maximum Concentration of Contaminants 40 CFR 261 (June, 1996).

[2]Achievable MDLs, LODs, and LOQs are limits that an individual laboratory can achieve when performing a specific analytical method. *Laboratory Generated Limits are subject to change; the laboratory will use the most current limits at the time of analysis.*

[3] The laboratory precision and accuracy method performance criteria shown are based upon the *DoD QSM*, Version 4.2, October 25, 2010. If a compound/analyte is not listed, then the established laboratory in-house limits are shown per DoD QSM guidance requirements. No field duplicate or MS/MSD are required for TCLP analysis.

QAPP Worksheet 15 - Reference Limits and Evaluation Table
Worksheet 15.8 Environmental Sampling for TCLP Pesticides (Leachate)
Page 1 of 1

Matrix: TCLP Leachate
Analytical Group: TCLP Pesticides - SW-846 1311/3510C/8081B
Concentration Level: Low

Analyte	CAS Number	Project Action Limit[1] (mg/L) *Equal to or Less Than*	Project Quantitation Limit Goal[1] (mg/L)	Project Action Limit Reference	Achievable Laboratory Limits[2]			Precision and Accuracy Method Performance Criteria[3]				
					MDLs (mg/L)	LODs (mg/L)	LOQs (mg/L)	LCS Control Limit (%R)	MS/MSD Control Limit (%R)	MS/MSD Precision Limit (RPD)	Surrogate Control Limit (%R)	Project Field Precision Limit (RPD)
gamma-BHC (Lindane)	58-89-9	0.40	0.00005	USEPA TCLP Maximum Concentration of Contaminants 40 CFR 261 (June, 1996)	0.0000024	0.00001	0.00005	25-135	NA	NA	NA	NA
Chlordane	12789-03-6	0.030	0.00025		0.00002	0.00005	0.00025	60-125	NA	NA	NA	NA
Endrin	72-20-8	0.020	0.00010		0.0000018	0.00001	0.00010	55-135	NA	NA	NA	NA
Heptachlor	76-44-8	0.0080	0.00005		0.0000029	0.00001	0.00005	40-130	NA	NA	NA	NA
Heptachlor epoxide	1024-57-3	0.0080	0.00005		0.0000019	0.00001	0.00005	60-130	NA	NA	NA	NA
Methoxychlor	72-43-5	10	0.0005		0.0000027	0.00001	0.0005	55-150	NA	NA	NA	NA
Toxaphene	8001-35-2	0.50	0.0050		0.00055	0.0010	0.0050	50-150	NA	NA	NA	NA
Laboratory Surrogates												
Tetrachloro-m-xylene	877-09-8	NA	NA	NA	NA	NA	NA	NA	NA	NA	25-140	NA
Decachlorobiphenyl	2051-24-3	NA	NA	NA	NA	NA	NA	NA	NA	NA	30-135	NA

mg/L = milligrams per liter = parts per million

NA = Not Applicable or Not Available.

%R = percent recovery

[1] Project action limits per project directed NJDEP regulations are based on USEPA TCLP Maximum Concentration of Contaminants 40 CFR 261 (June, 1996).

[2]Achievable MDLs, LODs, and LOQs are limits that an individual laboratory can achieve when performing a specific analytical method. *Laboratory Generated Limits are subject to change; the laboratory will use the most current limits at the time of analysis.*

[3] The laboratory precision and accuracy method performance criteria shown are based upon the *DoD QSM*, Version 4.2, October 25, 2010. If a compound/analyte is not listed, then the established laboratory in-house limits are shown per DoD QSM guidance requirements. No field duplicate or MS/MSD are required for TCLP analysis.

QAPP Worksheet 15 - Reference Limits and Evaluation Table
Worksheet 15.9 Environmental Sampling for TCLP Herbicides (Leachate)
Page 1 of 1

Matrix: TCLP Leachate
Analytical Group: TCLP Herbicides - SW-846 1311/3510C/8151A
Concentration Level: Low

Analyte	CAS Number	Project Action Limit[1] (mg/L) *Equal to or Less Than*	Project Quantitation Limit Goal[1] (mg/L)	Project Action Limit Reference	Achievable Laboratory Limits[2]			Precision and Accuracy Method Performance Criteria[3]				
					MDLs (mg/L)	LODs (mg/L)	LOQs (mg/L)	LCS Control Limit (%R)	MS/MSD Control Limit (%R)	MS/MSD Precision Limit (RPD)	Surrogate Control Limit (%R)	Project Field Precision Limit (RPD)
2,4-D	94-75-7	10	0.0005	USEPA TCLP Max Conc. of Contaminants 40 CFR 261 (June, 1996)	0.000074	0.00015	0.0005	35-115	NA	NA	NA	NA
2,4,5-TP (Silvex)	93-72-1	1.0	0.0005		0.000064	0.00015	0.0005	50-115	NA	NA	NA	NA
Laboratory Surrogate												
2,4-Dichlorophenylacetic acid	19719-28-9	NA	NA	NA	NA	NA	NA	NA	NA	NA	18-136	NA

NA = Not Applicable.

[1] Project action limits per project directed NJDEP regulations are based on USEPA TCLP Maximum Concentration of Contaminants 40 CFR 261 (June, 1996).

[2]Achievable MDLs, LODs, and LOQs are limits that an individual laboratory can achieve when performing a specific analytical method. *Laboratory Generated Limits are subject to change; the laboratory will use the most current limits at the time of analysis.*

[3] The laboratory precision and accuracy method performance criteria shown are based upon the *DoD QSM*, Version 4.2, October 25, 2010. If a compound/analyte is not listed, then the established laboratory in-house limits are shown per DoD QSM guidance requirements. No field duplicate or MS/MSD are required for TCLP analysis.

QAPP Worksheet 15 - Reference Limits and Evaluation Table
Worksheet 15.10 Environmental Sampling for Reactivity, pH, and Ignitability
Page 1 of 1

Matrix: Aqueous and Solids
Analytical Group: Reactive Cyanide/Sulfide SW-846 Sec. 7.3, Ignitability (Flashpoint) SW-846 1010A/1030, and pH SW-846 9040C/9045D
Concentration Level: Low

Analyte	CAS Number	Project Action Limit[1] (mg/kg) *Equal to or Less Than*	Project Quantitation Limit Goal[1] (mg/kg)	Project Action Limit Reference	Achievable Laboratory Limits[2]			Precision and Accuracy Method Performance Criteria[3]				
					MDLs (mg/kg)	LODs (mg/kg)	LOQs (mg/kg)	LCS Control Limit (%R)	MS/MSD Control Limit (%R)	MS/MSD Precision Limit (RPD)	Surrogate Control Limit (%R)	Project Field Precision Limit (RPD)
Reactive Cyanide	57-12-5	250	250	USEPA 40CFR 261 (June, 1996) and USEPA SW-846 Chapter 7.3.3 and 7.3.4	250	250	250	1-25	1-25	20	NA	NA
Reactive Sulfide	7783-06-4	500	80		80	80	80	20-114	20-114	20	NA	NA
Ignitability (Flashpoint)	Ignit.	<200 Deg. F	±0.1 Deg. F		±0.1 Deg. F	±0.1 Deg. F	±0.1 Deg. F	NA	NA	NA	NA	NA
Corrosivity as pH	pH	≥12.5 and <2.0 pH units	±0.05 pH units		±0.05 pH units	±0.05 pH units	±0.05 pH units	±0.05	NA	NA	NA	NA

NA = Not Applicable.

[1] Project action limits per project directed NJDEP regulations are based on USEPA TCLP Maximum Concentration of Contaminants 40 CFR 261 (June, 1996).

[2]Achievable MDLs, LODs, and LOQs are limits that an individual laboratory can achieve when performing a specific analytical method. *Laboratory Generated Limits are subject to change; the laboratory will use the most current limits at the time of analysis.*

[3] The laboratory precision and accuracy method performance criteria shown are based upon the *DoD QSM*, Version 4.2, October 25, 2010. If a compound/analyte is not listed, then the established laboratory in-house limits are shown per DoD QSM guidance requirements. No field duplicate or MS/MSD are required for RCRA disposal analysis.

QAPP Worksheet 16 - Project Schedule / Timeline Table

1.0 Activities	2.0 Organization	3.0 Dates (MM/DD/YY)		4.0 Deliverable	5.0 Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
MEC Clearance Work Plan Preparation	Shaw	12/2011	6/2013	MEC Clearance Work Plan	June 2013
QAPP Preparation	Shaw	1/2012	6/2013	QAPP Document	June 2013
Sample Collection and Laboratory Analysis	Shaw GCAL Microbac	6/2013	11/2013	Analytical Report	November 2013
Landfill Design	Shaw	8/2013	2/2014	Landfill Design Work Plan	February 2014
Develop Long-term Monitoring Requirements	Shaw	1/2014	6/2014	Long-Term Monitoring Plan	June 2014
RAR Preparation	Shaw	4/2014	9/2014	Final RAR	September 2014

Sampling Program (see Worksheets 18, 19, and 20 for analytical tests and methods):

The purpose of the remedial effort sampling and analysis effort are: 1) to determine the nature and extent of environmental contamination (soil and surface water) associated with former military munitions activities at the OD Grounds; 2) to collect data to support off-site disposal requirements and closure of the Open Burning Tray; and 3) to complete long-term monitoring of groundwater as required to support the landfill cap. The number and location of soil, surface water, and groundwater samples will be presented in a memo report and/or long-term monitoring plan following completion of the MEC clearance and/or landfill cap as appropriate.

MC sampling included in the scope of work is that associated with characterization of the 0- to 1,000-ft radius after the completion of the munitions remedial action and the closure of the Open Burning Tray. This sampling will be performed IAW the approved work plan (Parsons, 2005), Generic Site-Wide SAP (Parsons, 2006), and this UFP-QAPP. Because the sampling locations for the 0- to 1,000-ft radius will be dependent upon the results of the munitions removal, sampling locations are unknown at this time. After completion of the munitions removal, sampling locations will be selected and a sample location map produced. The sample location map will be provided for approval prior to sample collection.

The sampling program includes the following:

1. For support sampling, the number and locations of the samples are currently TBD and will be selected and proposed in a subsequent memorandum report or in the long-term groundwater monitoring plan. The support sampling soils are to be analyzed for TAL Metals, explosives (discrete), perchlorate (select samples), and SPLP TAL Metals. The surface water samples are to be analyzed for TAL Metals to evaluate whether migration has occurred and impacted the stream. The purpose of the support sampling and analysis effort is to determine the nature and extent of environmental contamination (soil and surface water) associated with former military munitions activities at the OD Grounds and to confirm that all contaminated soils are placed beneath the landfill cap. The SPLP data will be used to augment the totals data to determine the potential for groundwater impact from metals contamination in soil. The surface water sampling is to be downgradient of the landfill cap.
2. The confirmatory concrete dust/chip samples will be collected from the concrete pad from the Open Burning Tray in accordance with the *Closure Plan for the Open Burning Tray in Solid Waste Management Unit – SEAD-23* (Parsons, 2005). Sampling pre-removal and post removal of the Open Burning Tray will support closure of this area and to characterize the Open Burning Tray materials for off-site disposal. The concrete powder/dust chip samples will be analyzed for TCLP VOCs, TCLP SVOCs, TCLP Pesticides, TCLP Herbicides, and TCLP Metals.
3. Investigative derived waste (IDW) samples may be required to be collected to characterize for off-site disposal from site activities. It is anticipated that materials requiring a waste disposal would include materials generated from decontamination of the Burn Tray, drill cuttings, purge water, and decontamination water. Characterization samples will be analyzed for TCLP VOCs, TCLP SVOCs, TCLP Pesticides, TCLP Herbicides, and TCLP Metals, Reactivity (CN & S), Ignitability, and pH.

Sampling Program (see Worksheets 18, 19, and 20 for analytical tests and methods) (continued):.

4. For groundwater LTM sampling, the number and locations of the samples are currently TBD and will be selected and proposed in a subsequent memorandum report or in the long-term groundwater monitoring plan. At the present time, this monitoring is assumed to be for TAL metals. It is noted that the long-term monitoring requirements will be assessed in a Long-Term Monitoring Plan following completion of the MEC clearance activities. Field PID (equipped with an 10.6 eV lamp) screening for VOCs will be performed at each groundwater well location the first time the newly installed wells are sampled as standard health and safety practice. After the wells are screened, if there is indication of contamination with VOCs, it will be added to the analytical program. If there is no indication of contamination with VOCs the practice of screening the headspace will be discontinued. The field testing will include the water quality parameters pH, conductivity, turbidity, temperature, dissolved oxygen, and oxidation/reduction potential and will be performed for each well location
5. Blind field duplicates pairs are to be collected for all parameters at a frequency of 10 percent (1 per 10) and MSs at 5 percent (1 per 20) of the total number of samples collected per matrix. Equipment (rinse) blanks are not required as disposable equipment will be used; else, if needed will be collected at 5 percent (1 per 20) of the field sample parameters per equipment type per matrix.

A description of the field methods to be used for collection of the environmental samples is presented in the Section 3.13 of the *Work Plan for MEC Clearance at Open Detonation (OD) Grounds Seneca Army Depot Activity, New York* (USACE, 2013). All field sampling will be conducted IAW the Facility-Wide FSP (Parsons, 2006).

QAPP Worksheet 18 - Sampling Locations and Methods/SOP Requirements Table
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Sampling Location / ID Number	Matrix	Depth (ft)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference	Rationale for Sampling Location
Support Sampling						
RODSW30001 up to RODSW300## and/or RODSS10001 up to RODSS100## (Blind Field duplicates RODSW01D up to RODSW##D and RODSS01D up to RODSS##D frequency of 1 per 10)	Surface Water	0.0-0.5	TAL ICPMS Metals	SW: TBD[1] (Blind Field Duplicates 1 per 10 per matrix): TBD	All field sampling SOPs may be found within: *SEDA Generic Site-Wide SAP* (Parsons, July 2006), Section 16. See Worksheet 21.	The purpose support sampling and analysis effort is to determine the nature and extent of environmental contamination (soil and surface water) associated with former military munitions activities at the OD Grounds. The area where remedial actions will be performed as part of this contract include the 0-1000 ft radius of the OD Grounds and the Open Burning Tray. Sample locations will be selected based on results from previous characterization efforts performed by Parsons for the OD Grounds (Parsons, 2012) as well as on the results from the MEC clearance activities. The final sample locations will be proposed in a memo work plan following completion of the MEC clearance activities. The samples will be collected and analyzed for TAL metals.
	Surface Water	0.0-0.5	TAL Mercury	SW: TBD[1] (Blind Field Duplicates 1 per 10 per matrix): TBD		
	Soil	0.0-0.5	TAL ICPMS Metals	Soil: TBD[1] (Blind Field Duplicates 1 per 10 per matrix): TBD		
	Soil	0.0-0.5	TAL Mercury	Soil: TBD[1] (Blind Field Duplicates 1 per 10 per matrix): TBD		
	Soil	0.0-0.5	Explosives	Soil: TBD[1] (Blind Field Duplicates 1 per 10 per matrix): TBD		
	Soil	0.0-0.5	Perchlorate	Soil: TBD[1] (Blind Field Duplicates 1 per 10 per matrix): TBD		
	Soil	0.0-0.5	TAL SPLP ICPMS Metals	SW: TBD[1] (Blind Field Duplicates 1 per 10 per matrix): TBD	All field sampling SOPs may be found within: *SEDA Generic Site-Wide SAP* (Parsons, July 2006), Section 16. See Worksheet 21.	The SPLP data may be used to augment the totals data to determine the potential for groundwater impact from metals contamination in soil. The potential for groundwater impact (or lack thereof) will be factored into the design of the cap and the long term monitoring program. The LTM plan will contain decision statements for groundwater monitoring. Samples will be collected from the OD Grounds following MEC removal to determine the potential for soils to impact groundwater. This information will be factored into the remedial design for the landfill cap. Samples will be collected and analyzed for SPLP TAL Metals.
	Soil	0.0-0.5	TAL SPLP Mercury	Soil: TBD[1] (Blind Field Duplicates 1 per 10 per matrix): TBD		

QAPP Worksheet 18 - Sampling Locations and Methods/SOP Requirements Table
Page 2 of 3

Sampling Location / ID Number	Matrix	Depth (ft)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference	Rationale for Sampling Location
Groundwater Sampling						
RODMW20000 up to RODMW200## (Blind Field duplicates RODMW01 up to RODMW##D at frequency of 1 per 10)	Groundwater	TBD	TAL ICPMS Metals	Groundwater: TBD[1] (Blind Field Duplicates 1 per 10 per matrix): TBD	All field sampling SOPs may be found within: *SEDA Generic Site-Wide SAP* (Parsons, July 2006), Section 16. See Worksheet 21.	Long-term monitoring of groundwater will be performed following completion of the MEC clearance and landfill capping tasks. The sampling locations will be developed and presented in a long-term monitoring plan. At present, it is assumed that the samples will be analyzed for TAL Metals. If additional parameters are required, an amendment to this QAPP will be prepared.
	Groundwater	TBD	TAL Mercury	Groundwater: TBD[1] (Blind Field Duplicates 1 per 10 per matrix): TBD		
Concrete and Dust/Chip Characterization (Pre-Removal) and Confirmatory (Post-Removal) Sampling						
RODDS50001 up to RODDS50012 (No Field duplicates)	Concrete and Dust/Chip; IDW	0.0-0.1667 (2 inches); NA	TCLP VOCs	Concrete and Dust/Chip: 12 (Blind Field Duplicates): NA	All field sampling SOPs may be found within: *SEDA Generic Site-Wide SAP* (Parsons, July 2006), Section 16. See Worksheet 21.	Samples will be collected to characterize the Open Burning Tray materials for off-site disposal. Characterization samples will be analyzed for TCLP VOCs, TCLP SVOCs, TCLP Pesticides, TCLP Herbicides, and TCLP Metals.
	Concrete and Dust/Chip; IDW	0.0-0.1667 (2 inches); NA	TCLP SVOCs	Concrete and Dust/Chip: 12 (Blind Field Duplicates): NA		
	Concrete and Dust/Chip; IDW	0.0-0.1667 (2 inches); NA	TCLP Pesticides	Concrete and Dust/Chip: 12 (Blind Field Duplicates): NA		
	Concrete and Dust/Chip; IDW	0.0-0.1667 (2 inches); NA	TCLP Herbicides	Concrete and Dust/Chip: 12 (Blind Field Duplicates): NA		
	Concrete and Dust/Chip; IDW	0.0-0.1667 (2 inches); NA	TCLP ICP Metals	Concrete and Dust/Chip: 12 (Blind Field Duplicates): NA		
	Concrete and Dust/Chip; IDW	0.0-0.1667 (2 inches); NA	TCLP Mercury	Concrete and Dust/Chip: 12 (Blind Field Duplicates): NA		
	IDW	NA	Reactivity (CN & S)	IDW: TBD[1] (Blind Field Duplicates): NA		
	IDW	NA	Ignitability	IDW: TBD[1] (Blind Field Duplicates): NA		
	IDW	NA	pH	IDW: TBD[1] (Blind Field Duplicates): NA		

QAPP Worksheet 18 - Sampling Locations and Methods/SOP Requirements Table
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Sampling Location / ID Number	Matrix	Depth (ft)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference	Rationale for Sampling Location
IDW Sampling						
RODDS500## up to RODDS500## (No Field duplicates)	IDW	NA	TCLP VOCs	IDW: TBD[1] (Blind Field Duplicates): NA	All field sampling SOPs may be found within: *SEDA Generic Site-Wide SAP* (Parsons, July 2006), Section 16. See Worksheet 21.	IDW samples may be required to be collected to characterize for off-site disposal. They are included here to give the field team flexibility if further IDW is warranted. It is anticipated that materials requiring a waste disposal would include materials generated from decontamination of the Burn Tray, drill cuttings, purge water, and decontamination water. Characterization samples will be analyzed for TCLP VOCs, TCLP SVOCs, TCLP Pesticides, TCLP Herbicides, and TCLP Metals, Reactivity (CN & S), Ignitability, and pH.
	IDW	NA	TCLP SVOCs	IDW: TBD[1] (Blind Field Duplicates): NA		
	IDW	NA	TCLP Pesticides	IDW: TBD[1] (Blind Field Duplicates): NA		
	IDW	NA	TCLP Herbicides	IDW: TBD[1] (Blind Field Duplicates): NA		
	IDW	NA	TCLP ICP Metals	IDW: TBD[1] (Blind Field Duplicates): NA		
	IDW	NA	TCLP Mercury	IDW: TBD[1] (Blind Field Duplicates): NA		
	IDW	NA	Reactivity (CN & S)	IDW: TBD[1] (Blind Field Duplicates): NA		
	IDW	NA	Ignitability	IDW: TBD[1] (Blind Field Duplicates): NA		
	IDW	NA	pH	IDW: TBD[1] (Blind Field Duplicates): NA		

[1]The locations and number of samples to be analyzed will be determined following completion of the MEC investigation in conjunction with the Project Delivery Team based on the results of the surface surveys to be presented in subsequent memorandum report or long-term groundwater monitoring plan. The IDW samples are included here to give the field team flexibility if further IDW is warranted.
NA = Not Applicable
TBD = To be determined

QAPP Worksheet 19 - Analytical SOP Requirements Table

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Matrix	Analytical Group	Analytical and Preparation Method / SOP Reference[2]	Sample Size	Containers (number, size, and type)[1]	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation / analysis)[3]
Support Sampling						
Surface Water	TAL ICPMS Metals	SW-846 3010A/6020A GCAL MET-005 & MET-021	100 mL	(1) 500mL HDPE	Cool 4ºC ± 2ºC; HNO3 pH<2	6 months
	TAL Mercury	SW-846 7470A GCAL MET-006 & MET-008	50 mL			28 days
Soil	TAL ICPMS Metals	SW-846 3050B/6020A GCAL MET-004 & MET-021	20 grams	(1) 8oz jar	None	6 months
	TAL Mercury	SW-846 7471B GCAL MET-006 & MET-008	5 grams	(1) 8oz jar	Cool 4ºC ± 2ºC	28 days
	Explosives	SW-846 8330B Mod; EXTNT02, HPLC02	125 grams	(1) 4oz. glass jar	Cool 4ºC ± 2ºC	14 days / 40 days
	Perchlorate	SW-846 6850; HPLC06	60 grams	(1) 4oz. amber jar	Cool 4ºC ± 2ºC	28 days
Soil SPLP Support Sampling						
Soil	SPLP TAL ICPMS Metals	SW-846 1312/3010A/6020A GCAL EXT-070, MET-005, & MET-021	200 grams	(1) 16oz jar	None	6 months SPLP Extr. / 6 months
	SPLP TAL Mercury	SW-846 1312/7470A GCAL EXT-070, MET-006, & MET-008				28 days SPLP Extr. / 28 days
Concrete and Dust/Chip Characterization (Pre-Removal), Confirmatory (Post-Removal) Sampling						
Concrete and Dust/Chip	TCLP VOCs	SW-846 1311/8260B GCAL EXT-036 & GCMSV-003	200 grams	(1) 16oz jar	None	14 days TCLP Extr. / 14 days
	TCLP SVOCs	SW-846 1311/8270C GCAL EXT-026, EXT-003, & GCMSSV-001				14 days TCLP Extr. / 7 days / 40 days
	TCLP Pesticides	SW-846 1311/8081A GCAL EXT-026, EXT-010, & GC-013				14 days TCLP Extr. / 7 days / 40 days
	TCLP Herbicides	SW-846 1311/8151A GCAL EXT-026, EXT-017, & GC-011				14 days TCLP Extr. / 7 days / 40 days
	TCLP ICP Metals	SW-846 1311/3010A/6010C GCAL EXT-026, MET-005, & MET-010				6 months TCLP Extr. / 6 months
	TCLP Mercury	SW-846 1311/7470A GCAL EXT-026, MET-006, & MET-008				28 days TCLP Extr. / 28 days
Groundwater Sampling						
Groundwater	TAL ICPMS Metals	SW-846 3010A/6020A GCAL MET-005 & MET-021	100 mL	(1) 500mL HDPE	Cool 4ºC ± 2ºC; HNO3 pH<2	6 months
	TAL Mercury	SW-846 7470A GCAL MET-006 & MET-008	50 mL			28 days

QAPP Worksheet 19 - Analytical SOP Requirements Table

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Matrix	Analytical Group	Analytical and Preparation Method / SOP Reference[2]	Sample Size	Containers (number, size, and type)[1]	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation / analysis)[3]
IDW Sampling (Aqueous)						
IDW (If needed)	TCLP VOCs	SW-846 1311/8260B GCAL EXT-036 & GCMSV-003	44mL	(1) 1L Clear	Cool 4ºC ± 2ºC; Minimum Headspace	14 days TCLP Extr. / 14 days
	TCLP SVOCs	SW-846 1311/8270C GCAL EXT-026, EXT-003, & GCMSSV-001	200mL	(2) 1L Clear	Cool 4ºC ± 2ºC	14 days TCLP Extr. / 7 days / 40 days
	TCLP Pesticides	SW-846 1311/8081A GCAL EXT-026, EXT-010, & GC-013	200mL			14 days TCLP Extr. / 7 days / 40 days
	TCLP Herbicides	SW-846 1311/8151A GCAL EXT-026, EXT-017, & GC-011	200mL			14 days TCLP Extr. / 7 days / 40 days
	TCLP ICP Metals	SW-846 1311/3010A/6010C GCAL EXT-026, MET-005, & MET-010	100mL			6 months TCLP Extr. / 6 months
	TCLP Mercury	SW-846 1311/7470A GCAL EXT-026 & MET-008	50mL			28 days TCLP Extr. / 28 days
	Reactivity (CN & S)	SW-846 Sec 7.3 GCAL WL-054, WL-051, & WL-015	50mL	(1) 1L Clear	Cool 4ºC ± 2ºC	14 Days
	Ignitability	SW-846 1010A GCAL WL-060	75mL			28 Days
	pH	SW-846 9040C GCAL EXT-033	50mL			ASAP

QAPP Worksheet 19 - Analytical SOP Requirements Table

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Matrix	Analytical Group	Analytical and Preparation Method / SOP Reference[2]	Sample Size	Containers (number, size, and type)[1]	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation / analysis)[3]
IDW Sampling (Solid)						
IDW (If needed)	TCLP VOCs	SW-846 1311/8260B GCAL EXT-036 & GCMSV-003	200 grams	(1) 16oz jar	None	14 days TCLP Extr. / 14 days
	TCLP SVOCs	SW-846 1311/8270C GCAL EXT-026, EXT-003, & GCMSSV-001				14 days TCLP Extr. / 7 days / 40 days
	TCLP Pesticides	SW-846 1311/8081A GCAL EXT-026, EXT-010, & GC-013				14 days TCLP Extr. / 7 days / 40 days
	TCLP Herbicides	SW-846 1311/8151A GCAL EXT-026, EXT-017, & GC-011				14 days TCLP Extr. / 7 days / 40 days
	TCLP ICP Metals	SW-846 1311/3010A/6010C GCAL EXT-026, MET-005, & MET-010				6 months TCLP Extr. / 6 months
	TCLP Mercury	SW-846 1311/7470A GCAL EXT-026 & MET-008				28 days TCLP Extr. / 28 days
	Reactivity (CN & S)	SW-846 Sec 7.3 GCAL WL-054, WL-051, & WL-015	15 grams	(1) 8oz jar	None	14 Days
	Ignitability	SW-846 1030 GCAL WL-066	5 grams			28 Days
	pH	SW-846 9045D GCAL EXT-032	5 grams			ASAP

[1] Sample size is a minimum; the containers listed will be filled to compensate for any required re-analysis or re-extractions. For samples requiring MS/MSD containers listed should be tripled.

[2] Laboratory Standard Operating Procedures are subject to revision and updates during duration of the project, lab will use the most current revision of the SOP at the time of analysis.

QAPP Worksheet 20 - Field Quality Control Sample Summary Table

Page 1 of 2

Matrix	Analytical Group	Analytical and Preparation SOP Reference	No. of Sampling Locations	No. of Field Duplicate Pairs[1]	No. of MS/MSDs[1]	No. of Trip Blanks	No. of Equip. Blanks[2]	Total No. of Field Samples to Lab
Support Sampling								
Surface Water	TAL ICPMS Metals	SW-846 3010A/6020A GCAL MET-005 & MET-021	TBD[4]	TBD[4]	TBD[4]	NA	TBD[4]	TBD[4]
	TAL Mercury	SW-846 7470A GCAL Met-006 & MET-008	TBD[4]	TBD[4]	TBD[4]	NA	TBD[4]	TBD[4]
Soil	TAL ICPMS Metals	SW-846 3050B/6020A GCAL MET-004 & MET-021	TBD[4]	TBD[4]	TBD[4]	NA	TBD[4]	TBD[4]
	TAL Mercury	SW-846 7471B GCAL MET-006 & MET-008	TBD[4]	TBD[4]	TBD[4]	NA	TBD[4]	TBD[4]
	Explosives	SW-846 8330B Mod; EXTNT02, HPLC02	TBD[4]	TBD[4]	TBD[4]	NA	TBD[4]	TBD[4]
	Perchlorate	SW-846 6850; HPLC06	TBD[4]	TBD[4]	TBD[4]	NA	TBD[4]	TBD[4]
	SPLP TAL ICPMS Metals	SW-846 1312/3010A/6020A GCAL EXT-070, MET-005, & MET-021	TBD[4]	TBD[4]	TBD[4]	NA	TBD[4]	TBD[4]
	SPLP TAL Mercury	SW-846 1312/7470A GCAL EXT-070, MET-006, & MET-008	TBD[4]	TBD[4]	TBD[4]	NA	TBD[4]	TBD[4]
Concrete and Dust/Chip Characterization and Confirmatory Sampling								
Concrete and Dust/Chip	TCLP VOCs	SW-846 1311/8260B GCAL EXT-036 & GCMSV-003	TBD[4]	NA	NA	NA	NA	TBD[4]
	TCLP SVOCs	SW-846 1311/8270C GCAL EXT-026, EXT-003, & GCMSSV-001	TBD[4]	NA	NA	NA	NA	TBD[4]
	TCLP Pesticides	SW-846 1311/8081A GCAL EXT-026, EXT-010, & GC-013	TBD[4]	NA	NA	NA	NA	TBD[4]
	TCLP Herbicides	SW-846 1311/8151A GCAL EXT-026, EXT-017, & GC-011	TBD[4]	NA	NA	NA	NA	TBD[4]
	TCLP ICP Metals	SW-846 1311/3010A/6010C GCAL EXT-026, MET-005, & MET-010	TBD[4]	NA	NA	NA	NA	TBD[4]
	TCLP Mercury	SW-846 1311/7470A GCAL EXT-026 & MET-008	TBD[4]	NA	NA	NA	NA	TBD[4]
Groundwater Environmental Sampling								
Groundwater[3]	TAL ICPMS Metals	SW-846 3010A/6020A GCAL MET-005 & MET-010	TBD[4]	TBD[4]	TBD[4]	NA	TBD[4]	TBD[4]
	TAL Mercury	SW-846 7470A GCAL MET-008	TBD[4]	TBD[4]	TBD[4]	NA	TBD[4]	TBD[4]

QAPP Worksheet 20 - Field Quality Control Sample Summary Table
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Matrix	Analytical Group	Analytical and Preparation SOP Reference	No. of Sampling Locations	No. of Field Duplicate Pairs[1]	No. of MS/MSDs[1]	No. of Trip Blanks	No. of Equip. Blanks[2]	Total No. of Field Samples to Lab
IDW Sampling								
IDW	TCLP VOCs	SW-846 1311/8260B GCAL EXT-036 & GCMSV-003	TBD[4]	NA	NA	NA	NA	TBD[4]
	TCLP SVOCs	SW-846 1311/8270C GCAL EXT-026, EXT-003, & GCMSSV-001	TBD[4]	NA	NA	NA	NA	TBD[4]
	TCLP Pesticides	SW-846 1311/8081A GCAL EXT-026, EXT-010, & GC-013	TBD[4]	NA	NA	NA	NA	TBD[4]
	TCLP Herbicides	SW-846 1311/8151A GCAL EXT-026, EXT-017, & GC-011	TBD[4]	NA	NA	NA	NA	TBD[4]
	TCLP ICP Metals	SW-846 1311/3010A/6020A GCAL EXT-026, MET-005, & MET-010	TBD[4]	NA	NA	NA	NA	TBD[4]
	TCLP Mercury	SW-846 1311/7470A GCAL EXT-026 & MET-008	TBD[4]	NA	NA	NA	NA	TBD[4]
	Reactivity (CN & S)	SW-846 Sec 7.3 GCAL WL-054, WL-051, & WL-015	TBD[4]	NA	NA	NA	NA	TBD[4]
	Ignitability	SW-846 1010A/1030 GCAL WL-060 & WL-066	TBD[4]	NA	NA	NA	NA	TBD[4]
	pH	SW-846 9040C/9045D EXT-033 & EXT-032	TBD[4]	NA	NA	NA	NA	TBD[4]

NA = Not Applicable.

TBD = To Be Determined.

[1] Blind field duplicates pairs are collected at a frequency of 10 percent (1 per 10) and MS/MSDs at 5 percent (1 per 20) of the total number of samples collected per matrix.

[2] Equipment (rinse) blanks are not required as disposable equipment will be used; else, if needed will be collected at 1 per 20 field samples per matrix.

[3] The water quality parameters pH, conductivity, turbidity, temperature, dissolved oxygen, and oxidation/reduction potential will be performed for each groundwater well location. Field PID (equipped with an 10.6 eV lamp) screening for VOCs will be performed at each groundwater well location.

[4]The locations and number of samples to be analyzed will be determined following completion of the MEC investigation in conjunction with the Project Delivery Team based on the results of the surface surveys to be presented in subsequent memorandum report or long-term groundwater monitoring plan.

QAPP Worksheet 21 - Project Sampling SOP References Table

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Reference Number	Title, Revision Date and / or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comments
1	Record Keeping - SEDA Generic Site-Wide SAP (Parsons, July 2006), Section 16.9.	Parsons	NA	N	Documents observations, sampling information, and other pertinent information on project sites. Document single location/event information on project sites.
2	Sample Custody - SEDA Generic Site-Wide SAP (Parsons, July 2006), Sections 5.3.4 and 16.6.	Parsons	NA	N	Provides requirements for the completion of COC documentation. Includes procedure for completion and attachment of custody seals on environmental samples and shipping containers. Provides requirements for completion and attachment of sample labels on environmental sample containers.
3	Sample Handling - SEDA Generic Site-Wide SAP (Parsons, July 2006), Section 16.5.	Parsons	NA	N	Establishes method for sample identification, handling, packing and shipping requirements for Non Hazardous samples.
4	Composite Sampling - SEDA Generic Site-Wide SAP (Parsons, July 2006), Section 16.4.7.	Parsons	NA	N	Establishes method for compositing soil and other solid/semi-solid matrices so that a uniform matrix is available for sampling.
5	Equipment Decontamination - SEDA Generic Site-Wide SAP (Parsons, July 2006), Section 16.3.11.	Parsons	NA	N	Standard to be implemented for decontamination of contact sampling equipment.
6	Data Usability Assessment - SEDA Generic Site-Wide SAP (Parsons, July 2006), Section 8.7.	Parsons	NA	N	Establish the means by which all subcontracted environmental analytical data will be reviewed for completeness and usability.
7	Subsurface Soil Sampling With Standard Hollow-Stem Auger Drilling Rig Equipment - SEDA Generic Site-Wide SAP (Parsons, July 2006), Section 16.4.2.	Parsons	Drill Rig / split spoon	N	Methods/procedures for sampling of subsurface soils using drill rig and split spoon.

QAPP Worksheet 21 - Project Sampling SOP References Table
Page 2 of 2

Reference Number	Title, Revision Date and / or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comments
8	Core Sample Collection - SEDA Generic Site-Wide SAP (Parsons, July 2006), Section 16.4.13.	Parsons	Soil Probe or Core Type	N	Methods/procedures for sampling of subsurface soils using soil probe or core-type sampler.
9	Surface Soil and Dry Sediment Sampling - SEDA Generic Site-Wide SAP (Parsons, July 2006), Section 16.4.3.	Parsons	Trowel / Spoon /Hand Auger	N	Methods/procedures for sampling of surface soils using trowels/spoons/hand auger.
10	Field Measurements - SEDA Generic Site-Wide SAP (Parsons, July 2006), Section 16.8	Parsons	Tape Measure w/ Sounder; Water Quality Meters and Probes	N	Methods/procedures for measuring water levels and water quality parameters in monitoring wells.
11	Surface Water Sampling - SEDA Generic Site-Wide SAP (Parsons, July 2006), Section 16.4.4.	Parsons	Bottles	N	Methods/procedures for sampling of surface water using bottles.
12	Groundwater Sampling – Low Flow Purging and Sampling from Monitoring Well - SEDA Generic Site-Wide SAP (Parsons, July 2006), Section 16.4.1.	Parsons	Low Flow Pump; Tape Measure w/ Sounder; Water Quality Meters and Probes	N	Methods/procedures for sampling of groundwater using low flow techniques including purging and procedures for measuring water levels and water quality parameters in monitoring wells.

NA = Not Applicable.

QAPP Worksheet 22 - Field Equipment Calibration, Maintenance, Testing, and Inspection Table
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Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Resp. Person	SOP Reference
Organic Vapor Monitor or Photo-ionization Detector	Daily calibration before use with 100 parts per million isobutylene gas	As required by manufacturer specifications	Screen for VOCs.	Check all sensors and battery charge.	At beginning of work activity before use	Within ±10% of calibration gas	Replace sensors if damaged Replace battery if not charged If calibration not within ±10%, repeat or tag as "out of calibration – do not use."	Shaw Site Mgr./ Field Sampler	Manufacturer's Instrument Operating and Calibration Manual
Electronic Water Level Meter	Minimum: Calibrate with steel tape annually	As required by manufacturer specifications	Ground-water level measure-ment	Check all sensors, cables, and battery charge if applicable. Check for proper instrument response by inserting probe into water. Instrument typically indicates water with an intermittent light and tone.	At beginning of work activity before use	Meets specification. Cable must have graduations to 0.01 feet.	Replace battery if not charged. If meter doesn't register water, replace and tag as "needs service – do not use."	Shaw Site Mgr./ Field Sampler	Manufacturer's Instrument Operating and Calibration Manual
Electrical Conductivity Probe/Meter	Minimum: Daily calibration before use and at conclusion of the day's sample event with two standards that bracket range of measurements	As required by manufacturer specifications	Measure groundwater quality field parameters (electrical conductivity) during purging and sampling.	Check all sensors, cable and battery charge.	Minimum: At beginning of work activity before use and at the conclusion of the day's sampling event	Within ±10% of calibration solution	Replace probe if damaged. Replace battery if not charged. If calibration not within ±10%, repeat or tag as "out of calibration – do not use."	Shaw Site Mgr./ Field Sampler	Manufacturer's Instrument Operating and Calibration Manual

QAPP Worksheet 22 - Field Equipment Calibration, Maintenance, Testing, and Inspection Table
Page 2 of 3

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Resp. Person	SOP Reference
pH Probe/Meter	Minimum: Daily calibration before use and at conclusion of the day's sampling event, with two buffer solutions that bracket range of measurements	As required by manufacturer specifications	Measure groundwater quality field parameter (pH) during purging and sampling.	Check all sensors, cable, and battery charge.	Minimum: At beginning of work activity before use and at the conclusion of the day's sampling event	Within ±0.5 pH unit of calibration solution	Replace probe if damaged Replace battery if not charged If calibration not within ±0.5 pH unit, repeat or tag as "out of calibration – do not use."	Shaw Site Mgr./ Field Sampler	Manufacturer's Instrument Operating and Calibration Manual
Temperature Probe/Meter	Self calibrating	As required by manufacturer specifications	Measure groundwater quality field parameter (temp.) during purging and sampling.	Check all sensors, cable, and battery charge.	Minimum: At beginning of work activity before use and at the conclusion of the day's sampling event	Meets internal specification	Replace sensor if damaged Replace battery if not charged If meter doesn't record temperature, repeat, or tag as "needs service – do not use."	Shaw Site Mgr./ Field Sampler	Manufacturer's Instrument Operating and Calibration Manual
Dissolved Oxygen Probe/Meter	Minimum: Daily calibration before use and at the conclusion of the day's sampling event with temperature-corrected, air-saturated water	As required by manufacturer specifications	Collect groundwater quality field parameters (dissolved oxygen) during purging and sampling.	Check all sensors, cable, and battery charge.	Minimum: At beginning of work activity before use and at the conclusion of the day's sampling event	Within ±25% of calibration solution	Replace probe if damaged Replace battery if not charged If calibration not within ±25% repeat, or tag as "out of calibration – do not use."	Shaw Site Mgr./ Field Sampler	Manufacturer's Instrument Operating and Calibration Manual

QAPP Worksheet 22 - Field Equipment Calibration, Maintenance, Testing, and Inspection Table
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Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Resp. Person	SOP Reference
Turbidity Probe/Meter	Minimum: Daily calibration before use and at the conclusion of the day's sampling event, with standard within range of measurements	As required by manufacturer specifications	Collect groundwater quality field parameter (turbidity) during purging and sampling.	Check all sensors, cable, and battery charge.	Minimum: At beginning of work activity before use and at the conclusion of the day's sampling event	Within ±10% of calibration solution	Replace probe if damaged. Replace battery if not charged. If calibration not within ±10%, repeat or tag as "out of calibration – do not use."	Shaw Site Mgr./ Field Sampler	Manufacturer's Instrument Operating and Calibration Manual
Oxidation Reduction Potential (ORP)	Minimum: Daily calibration before use and at the conclusion of the day's sampling event, with standard within range of measurements	As required by manufacturer specifications	Collect groundwater quality field parameter (ORP) during purging and sampling.	Check all sensors, cable, and battery charge.	Minimum: At beginning of work activity before use and at the conclusion of the day's sampling event	Within ±10% of calibration solution	Replace probe if damaged. Replace battery if not charged. If calibration not within ±10%, repeat or tag as "out of calibration – do not use."	Shaw Site Mgr./ Field Sampler	Manufacturer's Instrument Operating and Calibration Manual
Hand-Held Metal Detection Instrument	Calibrate in accordance with manufacturer's requirements Check sensitivity against surrogate verification strip-surrogates	As required by manufacturer specifications	Detection of ferrous MEC anomalies	Check all sensors, cables, and battery charge if applicable. Check for proper instrument response by screening known metal object.	At beginning of work activity before use	Meets specification Instrument must respond to known metal object Instrument must detect all three surrogates in verification strip	Replace battery if not charged If instrument fails to respond to known metal object, replace and tag as "needs service – do not use." If instrument fails to detect all three surrogates in verification strip, check/adjust sensitivity and repeat	Shaw UXO Specialis t	Manufacturer's Instrument Operating and Calibration Manual

QAPP Worksheet 23 - Analytical SOP References Table

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Reference Number	Title, Revision Date, and / or Number [1]	Definitive or Screening Data	Matrix	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
Preparatory SOPs							
GCAL EXT-070	SOP for SPLP, 2/1/10, Revision 3, 2/1/10	Definitive	Soil	SPLP TAL Metals	Not Applicable	GCAL	No
GCAL EXT-026	SOP for TCLP Method 1311, 3/1/11, Revision 9	Definitive	Concrete and Dust/Chip and IDW	TCLP Extraction	Not Applicable	GCAL	No
GCAL EXT-036	SOP for TCLP Volatiles, 1/6/10, Revision 7	Definitive	Concrete and Dust/Chip and IDW	TCLP VOC Extraction	Zero Headspace Extractor	GCAL	No
GCAL MET-004	SOP for Metals Digestion 3050B, 8/1/12, Revision 15	Definitive	Soil	TAL ICPMS Metals	Not Applicable	GCAL	No
GCAL EXT-003	SOP for BNA Using Separatory Funnel, 11/18/11, Revision 21	Definitive	TCLP Leachate	TCLP SVOCs	Not Applicable	GCAL	No
GCAL EXT-017	SOP for Preparation of Aqueous Samples for Herbicides by 8151A, 03/11/11, Revision 21	Definitive	TCLP Leachate	TCLP Herbicides	Not Applicable	GCAL	No
GCAL EXT-010	SOP for Preparation of Pesticides/ polychlorinated biphenyls (PCBs) sample Extraction Using Separatory Funnel by Method 8081B, 04/7/10, Revision 14	Definitive	TCLP Leachate	TCLP Pesticides	Not Applicable	GCAL	No
GCAL MET-006	SOP for Sample Preparation – Mercury, 5/9/10, Revision 19	Definitive	Soil	TAL Mercury	Not Applicable	GCAL	No
GCAL MET-005	SOP for ICPMS Water Preparation, 3/28/11, Revision 14	Definitive	Surface Water, Groundwater, and SPLP	TAL and SPLP ICPMS Metals	Not Applicable	GCAL	No
EXTNT02	SOP Solid Extraction of Nitroaromatics and Nitramines Method 8330 Issue/Implementation Date: 15 March 2010 Last Review Date: 15 March 2012 Revision 11	Definitive	Soil	Explosives	Not Applicable	Microbac	No
Analysis SOPs							
GCAL MET-021	SOP for Analysis of Samples by ICP-MS; Date: 08/24/12, Revision 3	Definitive	Surface Water, Groundwater, SPLP, and Soil	TAL and SPLP ICPMS Metals	Agilent 7700 ICP-MS	GCAL	No

QAPP Worksheet 23 - Analytical SOP References Table
Page 2 of 2

Reference Number	Title, Revision Date, and / or Number [1]	Definitive or Screening Data	Matrix	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
Analysis SOPs (Continued)							
GCAL MET-010	SOP for ICP, 11/25/11, Revision 19	Definitive	TCLP Leachate	TCLP ICP Metals	Perkin Elmer 5300DV Perkin Elmer 4300DV	GCAL	No
GCAL MET-008	SOP for Mercury Analysis, 9/21/10, Revision 17	Definitive	Surface Water, Groundwater, Leachate, and Soil	TAL, SPLP, and TCLP Mercury	Perkin-Elmer FIMS400	GCAL	No
GCAL GCMSV-003	SOP for SW-846 8260B, Revision 23, 9/14/11	Definitive	Leachate	TCLP VOCs	Agilent GC/MS 6890/5973 and 6890/5975	GCAL	No
GCAL GCMSSV-001	SOP for Method 8270C, 04/11/11, Revision 19	Definitive	Leachate	TCLP SVOCs	Agilent GC/MS 7890/5975 and 6890/5975	GCAL	No
GCAL GC-013	SOP for Pesticides by Method 8081B, 10/1/11, Revision 14	Definitive	Leachate	TCLP Pesticides	Agilent 6890 Dual ECDs	GCAL	No
GCAL GC-011	SOP for Herbicides by 8151A, 10/1/11, Revision 10	Definitive	Leachate	TCLP Herbicides	Agilent 6890 Dual ECDs	GCAL	No
HPLC02	SOP Nitroaromatics and Nitramines by High Performance Liquid Chromatography Method 8330 Issue/Implementation Date: 15 September 2012 Last Review Date: 15 September 2012 Revision 16	Definitive	Soil	Explosives	HPLC	Microbac	No
HPLC06	SOP Perchlorate Method 6850/331.0 Issue/Implementation Date: 15 April 2012 Last Review Date: 15 September 2012 Revision 4	Definitive	Soil	Perchlorate	LCMSMS	Microbac	No
WL-054	Reactivity Sample Prep, 5/18/10, Revision 9	Definitive	IDW	Reactivity	NA	GCAL	No
WL-051	Sulfide by Titration, 3/10/11, Revision 8	Definitive	IDW	Reactivity	Titration	GCAL	No
WL-015	Cyanide Determination by FIA, 5/18/10, Revision 9	Definitive	IDW	Reactivity	Lachat	GCAL	No
WL-066	Ignitability of Solid Waste, 3/10/11, Revision 4	Definitive	IDW	Ignitability	Sample train	GCAL	No
WL-060	Automated Flashpoint Determination, 9/24/12, Revision 7	Definitive	IDW	Ignitability	Flashcup	GCAL	No
EXT-032	Corrosivity in soil as pH, June 2006, 8/30/12, Revision 11	Definitive	IDW	pH	Probe	GCAL	No
EXT-033	pH Determination in Aqueous Samples, 8/30/12, Revision 9	Definitive	IDW	pH	Probe	GCAL	No

[1] Laboratory Standard Operating Procedures are subject to revision and updates during duration of the project, lab will use the most current revision of the SOP at the time of analysis.

QAPP Worksheet 24 - Analytical Instrument Calibration Table
Page 1 of 3

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
GC/MS	SW-846 8260B, and 8270C	ICAL prior to sample analysis. Second-source initial calibration verification (ICV) immediately following initial daily calibration. Continuing calibration verification (CCV) analyzed before sample analysis, after every 10 samples, and at the end of the analysis sequence. See Worksheets 28.4 and 28.5 for Details.	1. Average response factor (RF) for SPCCs: volatile organic compounds (VOCs) ≥ 0.30 for chlorobenzene and 1,1,2,2-tetrachlorolethane; ≥0.1 for chloromethane, bromoform, and 1,1-dichloroethane. Semi-volatile organic compounds (SVOCs) ≥ 0.050. 2. Relative standard deviation (RSD) for RFs for CCCs: VOCs and SVOCs ≤ 30% and one option below: Option 1: RSD for each analyte ≤ 15%; Option 2: linear least squares regression r ≥ 0.995; Option 3: non-linear regression–coefficient of determination (COD) r2 ≥ 0.99 (6 points shall be used for second order, 7 points shall be used for third order). 3. For CCVs, %Difference/Drift for all target compounds and surrogates: VOCs and SVOCs ≤ 20%D (Note: D = difference when using RFs or drift when using least squares regression or non-linear calibration). See Worksheets 28.4 and 28.5 for Details.	Correct problem then repeat ICAL. Flagging criteria are not appropriate. Problem must be corrected. No samples may be run until ICAL has passed. Calibration may not be forced through the origin.	Laboratory Analyst and Quality Assurance Officer (QAO)	GCAL SOP-GCMSV-003, GCMSSV-001
GC	SW-846 8081B and 8151A	ICAL prior to sample analysis. Second-source ICV immediately following initial daily calibration. CCV analyzed before sample analysis, after every 10 samples, and at the end of the analysis sequence. See Worksheets 28.6 and 28.7 for Details.	One of the options below: Option 1: RSD for each analyte ≤ 20%; Option 2: linear least squares regression: r ≥ 0.995; Option 3: non-linear regression: coefficient of determination (COD) r2 ≥ 0.99 (6 points shall be used for second order, 7 points shall be shall be used for third order). All project analytes within established retention time windows. GC methods: All project analytes within ± 20% of expected value from the ICAL; HPLC methods: All project analytes within ± 15% of expected value from the ICAL. See Worksheets 28.6 and 28.7 for Details.	Correct problem then repeat ICAL. Flagging criteria are not appropriate. Problem must be corrected. No samples may be run until ICAL, ICV, and CCV have passed or verified. Calibration may not be forced through the origin. Quantitation for multi-component analytes such as chlordane, toxaphene, and Aroclors must be performed using a 5-point calibration. Results may not be quantitated using a single point.	Laboratory Analyst and QAO	GCAL SOP-GC-011, GC-013

QAPP Worksheet 24 - Analytical Instrument Calibration Table
Page 2 of 3

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
HPLC	SW-846 8330B Modified	Initial calibration (ICAL) prior to sample analysis and performed once per year minimum. Second-source calibration verification (ICV) immediately following initial daily calibration. Continuing calibration verification (CCV) analyzed before sample analysis, after every 10 samples, and at the end of the analysis sequence. See Worksheet 28.2 for Details	Min. of 5 calibration standards with the lowest standard concentration at or below the RL. Once calibration curve or line is generated, the lowest calibration standard must be re-analyzed. The apparent signal-to-noise ratio at the RL must be at least 5:1. If linear reg. is used, r≥0.995 or r^2≥0.99. If using internal standardization, ICAL RSD≤15%. All standards within retention time (RT) windows. All CCVs and second source standards ≤20%D. See Worksheet 28.2 for Details	Correct problem then repeat initial calibration. Flagging criteria are not appropriate. Problem must be corrected. No samples may be run until calibration has passed. For ICV/CCV and RT, repeat calibration and re-analyze all samples since last successful calibration and RT.	Laboratory Analyst and QAO	HPLC02
LC/MS/MS	SW-846 6850	Initial calibration prior to sample analysis as needed. Second-source calibration verification (ICV) immediately following initial daily calibration. CCV prior to sample analysis, after every 10 field samples, and at the end of the analysis sequence. See Worksheet 28.3 for Details	Minimum of 5 calibration standards with the lowest standard concentration at or below the RL. Once calibration curve or line is generated, the lowest calibration standard must be re-analyzed. The apparent signal-to-noise ratio at the RL must be at least 5:1. If linear regression is used, r ≥ 0.995. If using Internal Standardization, RSD ≤ 15%. For ICV/CCVs, all target analytes and surrogates within ± 20% of the expected value from the ICAL. See Worksheet 28.3 for Details	Correct problem then repeat initial calibration. Flagging criteria are not appropriate. Problem must be corrected. No samples may be run until calibration has passed. For ICV/CCV and RT, repeat calibration and re-analyze all samples since last successful calibration and RT.	Laboratory Analyst and QAO	HPLC06
Trace ICP & ICPMS	SW-846 6020A and SW-846 6010C	ICAL and interference check sample (ICS) prior to sample analysis and performed daily. Second-source calibration verification immediately following initial daily calibration. CCV analyzed before sample analysis, after every 10 samples, and at the end of the analysis sequence. Calibration blank at once per initial daily calibration. See Worksheet 28.1 for Details.	If more than one calibration standard is used, r ≥ 0.995 or r^2 ≥ 0.99. ICV and CCV within 10% of expected value. ICS within 20% of expected value. For calibration blank, must be <3 times the IDL or the average of 3 CB must be <3 times the IDL. See Worksheet 28.1 for Details.	For ICAL, correct problem then repeat ICAL. Flagging criteria are not appropriate. Problem must be corrected. No samples may be run until ICAL, ICS, and blank have passed. For CCV, repeat calibration and re-analyze all samples since last successful calibration. For ICS, re-analyze all affected samples.	Laboratory Analyst and QAO	GCAL SOP-MET-010 and SOP-MET-021

QAPP Worksheet 24 - Analytical Instrument Calibration Table
Page 3 of 3

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
CVAA	SW-846 7471B and 7470A	ICAL prior to sample analysis and performed daily. Second-source calibration verification immediately following initial daily calibration. CCV analyzed before sample analysis, after every 10 samples, and at the end of the analysis sequence. Calibration blank at once per initial daily calibration. See Worksheet 28.1 for Details.	If more than one initial calibration standard is used, $r \geq 0.995$ or $r^2 \geq 0.99$. ICV and CCV within 10% of expected value. For calibration blank, no analytes detected ≥MDL. See Worksheet 28.1 for Details.	Correct problem then repeat initial calibration. Flagging criteria are not appropriate. Problem must be corrected. No samples may be run until ICAL has passed. For ICV/CCV, repeat calibration and re-analyze all samples since last successful calibration.	Laboratory Analyst and QAO	GCAL SOP-Met-008
Colorimeter	Sw 846 Ch7.3	Initial calibration for all analytes prior to sample analysis and performed daily: CN: Minimum 6 standards and a calibration blank with linear least squares regression: R≥0.995. See Worksheet 28.8 for Details.	If more than one initial calibration standard is used, $r \geq 0.995$ or $r^2 \geq 0.99$. ICV and CCV within 10% of expected value. For calibration blank, no analytes detected ≥MDL. See Worksheet 28.8 for Details.	Correct problem then repeat initial calibration. Flagging criteria are not appropriate. Problem must be corrected. No samples may be run until ICAL has passed. For ICV/CCV, repeat calibration and re-analyze all samples since last successful calibration.	Laboratory Analyst and QAO	GCAL SOP WL-015
pH Probe	SW-846 9040C and 9045D	Initial calibration prior to sample analysis. See Worksheet 28.8 for Details.	±0.05 pH units See Worksheet 28.8 for Details	Correct problem, then repeat ICAL. Flagging criteria are not appropriate. Problem must be corrected. No samples may be run until calibration has passed.	Laboratory Analyst and QAO	GCAL SOP EXT-033 and EXT-032

[1] Laboratory Standard Operating Procedures are subject to revision and updates during duration of the project, lab will use the most current revision of the SOP at the time of analysis.
Source: DoD QSM, Version 4.2, October 25, 2010.

QAPP Worksheet 25 - Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Page 1 of 2

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
GC/MS	Lamp and guard column inspection. Pump maintenance.	SW-846 8260B and 8270C	Leak and pressure test, guard column and lamp performance	Frequency determined by instrument remaining in calibration and free of interference.	Passing calibration and tune	Replace lamp, replace guard column, tighten fittings, column clipping and/or reconditioning, seal and liners replacement, filaments and insulators as needed, recalibrate, reanalyze.	Laboratory Analyst	GCAL SOP-GCMSV-003, GCMSSV-001
GC	Lamp and guard column inspection. Pump maintenance. Injector port, column maintenance.	SW-846 8081B and 8151A	Leak test, column and injector port inspection	As needed, Frequency determined by instrument remaining in calibration and free of interference	Passing calibration.	Replace lamp, replace guard column, tighten fittings, Column clipping, seals and liners replacement, recalibrate and reanalyze affected samples.	Laboratory Analyst	GCAL SOP-GC-011, GC-013
HPLC	Lamp and guard column inspection. Pump maintenance. Replace columns, DAD flow cell windows and ball-valve cartridges as needed, clean/change filters, check eluent reservoirs	SW-846 8330B Modified	Leak and pressure test, guard column and lamp performance	As needed, Frequency determined by instrument remaining in calibration and free of interference	Passing calibration	Replace lamp, replace guard column, tighten fittings, recalibrate, reanalyze	Laboratory Analyst	HPLC02
LC/MS/MS	Injector port, column maintenance, source cleaning	SW-846 6850	Leak test, column and injector port inspection, source insulator integrity	Need for maintenance determined by passing calibration and tune	Passing tune etc. and CCV, passing Internal Standard response	Column clipping and/or reconditioning, seal and liners replacement, filaments and insulators as needed	Laboratory Analyst	HPLC06
ICP and ICPMS	Torch, nebulizer, spray chamber, Perform Hg alignment, check purge windows. Replace pump windings and gas tanks, check standard and sample flow.	SW-846 6020A	Check connections, flush lines, clean nebulizer	As needed, Frequency determined by instrument remaining in calibration and free of interference	Passing calibration; Intensity of 1PPM Manganese STD within criteria; Monitor ISTD counts for variation.	Replace, investigate injector, Reconnect sample pathways, recalibrate, reanalyze affected samples Replace windings	Laboratory Analyst	GCAL SOP-MET-010 and SOP-MET-021

QAPP Worksheet 25 - Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Page 2 of 2

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
CVAA	Pump tubing, absorption cell, and lens cleaning.	SW-846 7471B / 7470A	Check connections, flush sample lines	As needed, Frequency determined by instrument remaining in calibration and free of interference	Passing calibration	Reconnect sample pathways, recalibrate, reanalyze affected samples	Laboratory Analyst	GCAL SOP-Met-008
Colorimeter	Pump maintenance, photocell cleaning	SW-846 Ch7.3 (CN)	Clean or replace tubing, check connections	Frequency determined by instrument remaining in calibration and free of interference.	Passing calibration	Reconnect tubes, check pump rate. Rerun calibration and samples	Laboratory Analyst	GCAL SOP WL-015
pH Probe	Probe and solution inspection	SW-846 9045D	Check buffer and probe solutions	As needed, Frequency determined by instrument remaining in calibration and free of interference	Passing calibration	Remake or purchase new buffer standards, replace probe solutions, re-analyze	Laboratory Analyst	GCAL SOP EXT-033 and EXT-032

[1] Laboratory Standard Operating Procedures are subject to revision and updates during duration of the project, lab will use the most current revision of the SOP at the time of analysis.

QAPP Worksheet 26 - Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): Kevin Gerdes / Shaw
Sample Packaging (Personnel/Organization): Kevin Gerdes / Shaw
Coordination of Shipment (Personnel/Organization): Kevin Gerdes / Shaw
Type of Shipment/Carrier: Federal Express or United Parcel Service – Priority Overnight
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Sample Receipt Technicians for all labs with oversight from Brenda Martinez, Project Manager, GCAL and Stephanie Mossburg, Project Manager Microbac.
Sample Custody and Storage (Personnel/Organization): Sample Management Technicians with oversight from Brenda Martinez, Project Manager, GCAL and Stephanie Mossburg, Project Manager Microbac.
Sample Preparation (Personnel/Organization): Sample Prep Technicians with oversight from Scott Bailey, Laboratory Director, GCAL and David Vandenberg, Laboratory Director, Microbac.
Sample Determinative Analysis (Personnel/Organization): Sample Analysts with oversight from laboratory supervisors and Scott Bailey, Laboratory Director, GCAL and David Vandenberg, Laboratory Director, Microbac.
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): minimum 30 days after final report sent to the Shaw
Sample Extract/Digestate Storage (No. of days from extraction/digestion): minimum 30 days after final report sent to the Shaw
Biological Sample Storage (No. of days from sample collection): Not Required, No biological samples
SAMPLE DISPOSAL
Personnel/Organization: Sample Management Technicians, with oversight from Sample Management Supervisor and from Brenda Martinez, Project Manager, GCAL and Stephanie Mossburg, Project Manager Microbac.
Number of Days from Analysis: minimum 30 days after final report sent to the Shaw

QAPP Worksheet 27 - Sample Custody Requirements Table

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory):

Sample custody can be defined as physical possession of samples, having samples within visual range, or having samples located in a restricted access area. Sample possession during all sampling efforts must be traceable from the time of collection until the results are verified and reported. The sample custody procedures provide a mechanism for documentation of all information related to sample collection and handling. The primary piece of documentation to ensure sample custody is the Chain of Custody (COC) Form. Shaw personnel are responsible for providing evidence of sample custody from the time of collection until the laboratory receives the samples. The laboratory will be able to provide documentation of sample custody from that point to sample disposal.

As part of appropriate documentation, all sample bottles will be adequately labeled. The label will present sample identification and collection information. It will be pre-printed from the sample tracking system or completed with indelible ink. At a minimum, all sample labels will include the following sample information:

- Field sample location and unique sample identifier.
- Project name and number.
- Analysis requested for each bottle.
- Method of preservation for each bottle.
- Date and time of collection.
- Initials of sample technician.

Transfer of custody and shipping procedures will include:

- The Shaw PM instructing sampling team personnel in the proper COC procedures before sampling begins.
- A COC entry made in the field for each sample. This document will accompany the samples in shipment, and a copy will be maintained at the site for placement in the project files at the conclusion of field activities. The custody of individual sample containers will be documented by recording each sample identification number and the number of bottles on the appropriate COC form.
- COC records initiated in the field will be placed in a plastic bag and taped to the underside of the top of the shipping cooler used for sample transport.
- Each time responsibility for custody of the sample changes, the new custodian will sign and date the record.
- All coolers must be secured at the site with two custody seals prior to transport. Custody seals should be signed and dated by the person relinquishing custody of the samples being shipped. They should be placed over the opening of each cooler so that the cooler cannot be opened without breaking the seal.

Sample packaging and shipment:
Samples that are collected for off-site laboratory analysis that require overnight shipment will be generally prepared by:

- Making sure all containers are sealed and zero headspace if volatile samples are collected.
- Securely wrapping and taping each collected bottle in bubble wrap (or other similar shock-adsorbing material).
- A temperature blank will be included in each cooler. The temperature will be recorded upon receipt at the laboratory to verify sample temperatures during transport.
- At least three sides of the container must be wrapped or surrounded with material when placing the samples into the shipping cooler. Adequate ice will be placed in doubled, sealed bags and added to the cooler around and over the top of the sample containers to form a cooling layer to help ensure proper preservation during shipment.
- Samples should be pre-cooled to the desired temperature prior to packing for shipment.
- Temperature blanks are nalgene bottles containing water that will be included in each sample cooler.
- Completed and signed COCs will be placed into the cooler in a protective ziplock bag and taped to the underside of the cooler lid. A minimum of two custody seals will be applied across the opening of the cooler and the lid secured by wrapping the cooler with clear plastic packing tape.
- The cooler will then be ready for shipment according to the methods required by the overnight delivery service. At a minimum, the laboratory address, telephone number, and contact name should be included on the original air bill and, if multiple packages are sent, on each sample cooler.

Laboratory Sample Custody Procedures (receipt of samples, archiving, and disposal):

All samples to be analyzed by the fixed-base laboratory will be shipped via overnight courier service. Upon receipt, per the attached Laboratory SOP, a representative of the laboratory shall check the integrity of the custody seals, then locate, sign, and date the COC. The temperature will be recorded to verify the sample temperatures during transport. The laboratory is responsible for verifying that the COC and containers are in agreement. The COC, a Cooler Receipt Form, and information regarding any discrepancies between the COC and bottle labels will be faxed to the Shaw Project Chemist prior to preparation for analysis. The Laboratory Information Management System will provide evidence of sample custody from receipt by the laboratory until appropriate disposal (see Worksheet 26 and laboratory SOPs).

Sample Identification Procedures:

A sample numbering system will be utilized in the field to uniquely identify each sample collected at SEDA. The sample identification scheme will be consistent with Sample Handling - SEDA Generic Site-Wide SAP (Parsons, July 2006), Section 16.5, with the following addition. The event code will be added as a prefix to the standard nomenclature. The sample number will be traceable to the site, location, and depth (where applicable). The sample identification and description will be recorded by the Environmental Sampling Lead or representative in the sample collection logs.

Sampling Nomenclature as follows:

Support Samples: RODSW30000 up to RODSW30017 and/or RODSS10000 up to RODSS10017
Blind Field Duplicate Samples: RODSW##D and RODSS##D at frequency of 1 per 10.

Concrete and Dust/Chip Characterization Samples: RODDS50000 up to RODDS50012
Blind Field Duplicate Samples: Not Applicable for TCLP Characterization.

SPLP Samples: RODEX10000 up to RODEX10017
Blind Field Duplicate Samples: RODEX##D at frequency of 1 per 10

Groundwater Samples: RODMW20000 up to RODMW20012
Blind Field Duplicate Samples: RODMW##D at frequency of 1 per 10

Event:
- R = Remedial Action (RA) Sample

Site Location:
- OD = Open Detonation Grounds

Media Type:
- SW = Surface Water
- SS = Surface Soil
- SB = Soil Boring
- DS = Solid for Disposal Characterization
- MW = Groundwater Monitoring Well

Sample Identification Procedures (Continued):

Sample Number:

00101-00199	= Rinse Blanks (If Needed)
10000-19999	= Soil Samples
20000-29999	= Groundwater Samples
30000-39999	= Surface Water Samples
50000-59999	= Miscellaneous Samples (Concrete/Dust/Chip)

QC Sample:

D = Blind Field Duplicate Sample

Chain of Custody Procedures:

- Project Name will be identified on the COC form.
- Project Number will be identified on the COC form.
- Shaw contact information will be listed on the COC form. This information should include Shaw PM; Shaw Project Chemist; and Shaw address, telephone numbers and facsimile number.
- Analysis and required analytical methods should be listed on the COC form (refer to Worksheet 19).
- Required turnaround time and report format will be listed on the COC form.
- Each sample should be listed on the COC form using the sampling nomenclature listed above, sample description, date of sampling, time of sampling, and number of containers being submitted to the laboratory.
- Sampler will sign and relinquish COC form, and dates and times of relinquishment will be included.

Example Field Logsheet

Shaw® Shaw Environmental & Infrastructure, Inc.

Shaw Project Number: _____ **Site:** _____

Item Number: _____

Field Sample Identification Number: _____
Date Sample: _____ (Month/Date/Year)
Time Sample: _____ (Military Time)
Sample Depth: _____ (Ft/bgs)

Sample Location:
☐ Wall of Excavation ☐ Floor of Excavation ☐ Well ☐ Other (list):_____
Sample Matrix:
☐ Soil ☐ Sediment ☐ Water ☐ Tissue ☐ Air
Physical Description of the field sample: _____
_____

Sampling Conditions:
☐ Rain ☐ Snow ☐ Extreme Heat ☐ Extreme Cold ☐ Other (list):_____
Temperature: _____ °F

Sample Collection Tools:
☐ Trowel ☐ Pump ☐ Other (list): _____

Sample Collection Process:
☐ Discrete Grab ☐ Composite_____ (Describe Composite Method used example: 5 point)

Is Sample a Field Quality Control Sample?:
☐ **Field Duplicate Sample** (Typically, duplicates are collected one per ten field samples check you site FSAP or QAPP for Frequency) Duplicate or replicate samples are defined as a sample collected from the same sample point or location)
☐ If a Field Duplicate Sample list the Sample Identification of the duplicated sample: _____.
☐ **Field Blank** (Defined as a blank sample exposed to the sampling conditions at the site and transported to the laboratory and treated as an environmental sample).
Was Field Blank collected using laboratory grade deionized water? ☐ YES ☐ NO (if no, note source of water :_____)
☐ **Equipment Blank** (Defined as sample created by pouring water over or through decontaminated field sampling equipment that is considered ready to collect or process an additional sample.)
Was Equipment Blank collected using laboratory grade deionized water? ☐ YES ☐ NO (if no, note source of water :_____) Equipment blank collected following field sample number:_____.
☐ **Trip Blank** (Defined as a sample prepared by the laboratory using laboratory grade deionized water and shipped with the sample containers to the site and returned to the laboratory with the field samples for analysis. Trip blanks have not been exposed to the environment or the sampling procedures and should be carried with the sample bottles in the field. Trip blanks are only necessary when collecting volatile samples.

Sample Control:
Field Custody maintained throughout the sampling process?
☐ Yes ☐ No (if no list why):_____
Field sample listed on Chain-of-Custody Record?
☐ Yes ☐ No (if no list why):_____
All required analysis and analytical methods for this field sample have been listed on the Chain-of-Custody?
☐ Yes ☐ No (if no list why):_____
Analytical requirements for this field sample have been reviewed against the site FSAP, Workplan, or QAPP?
☐ Yes ☐ No (if no list why):_____

Comments:_____
_____
_____

Signature of Sampler: _____ Name Printed: _____

QC Reviewed
Initials:_____ Date :_____(Month/Day/Year)
*It is not necessary for every field logbook to be quality control checked.

Shaw® Shaw Environmental & Infrastructure, Inc.

Site Name: _____ **Shaw Project Number:**_____

Sample Number: _____	**Sample Location Sketch**
Date Sampled: _____ (Month/Day/Year)	
Time Sampled: _____ (Military Time)	
Laboratory Analysis Requested: (Methods Must be Listed on the Chain-of-Custody)	
☐ Volatiles ☐ Pesticides ☐ Semivolatiles ☐ PCBs	
☐ Metals ☐ TPH DRO ☐ Cyanide ☐ TPH GRO	
☐ Full TCLP ☐ Explosives ☐ RCI	
Other List:_____ _____	
Sample Type: ☐ Investigative ☐ Confirmation ☐ IDW	
Analytical Laboratory: _____	**Photograph Log Number:** _____
GPS Coordinates: _____(If Available)	**Scale of Sample Sketch:** **Each Grid Equals** _____ ft^2
PID:	**Calibration Date:**_____(Month/Day/Year)
O2/LEL:	**Calibration Date:**_____(Month/Day/Year)
Sketch Legend:	
= Road ¦ Boundary of Excavation | Wall × Sample Point Ø Well △ Tree	
Equipment Decontamination Technique:	
Comments:	
Sampler Name:_____ (Printed)_____ **Date** (Month/Date/Year)	

Example Chain of Custody Form

GCAL
GULF COAST ANALYTICAL LABORATORIES, INC

7979 GSRI AVE, BATON ROUGE LA 70820-7402
(225) 769-4900 FAX (225) 767-5717

Chain of Custody Record

Lab use only			
Client Name	Client #	Group#	Due Date

Report to:	**Bill to:**
Client:	Client:
Address:	Address:
Contact:	Contact:
Phone:	Phone:
Fax:	Fax:

P.O. Number	Project Name/Number
Sampled By:	

Analytical Requests & Methods

Matrix	Date	Time (2400)	Comp	Grab	Sample Description	Pre-serva-tives	No. Con-tainers	Remarks:	Lab ID

Turn Around Time: ___ 24 - 48 hrs ___ 3 days ___ 1 week ___ standard other _____

Relinquished by: (Signature)	Received by: (Signature)	Date:	Time:
Relinquished by: (Signature)	Received by: (Signature)	Date:	Time:
Relinquished by: (Signature)	Received by: (Signature)	Date:	Time:

Note:

By submitting these samples, you agree to the terms and conditions contained in our most recent schedule of services.

Matrix: W = water, S=Soil, SD=Solid, L=Liquid, SL=Sludge, O=Oil, CT=Charcoal Tube, OVM=Organic Vapor Monitor, XT=XAD Tube, A=Air Bag, SUM=Summa Canister

Example Custody Seal

GCAL

GULF COAST ANALYTICAL LABORATORIES, INC.

CUSTODY SEAL

Date Sealed: _____

This package confirms to the conditions and limitations specified in 49 CFR 173.4

Sealed By: _____

GCAL-17

QAPP Worksheet 27 - Sample Custody Requirements Table
Page 7 of 7
Example Laboratory Sample Receipt Checklist

GCAL

SAMPLE RECEIVING CHECKLIST

Workorder: _____ Client:

Profile: Line Item:

Received by: Received Date/Time:

Samples Received via: Number of Coolers Received: _____

Cooler tracking number(s): _____

Cooler temperature(s): _____

Were all coolers received at a temperature of 0 - 6° C?	☐ Yes	☐ No	☐ N/A
Were all custody seals intact?	☐ Yes	☐ No	☐ N/A
Were all samples received in proper containers?	☐ Yes	☐ No	☐ N/A
Were all samples properly preserved?	☐ Yes	☐ No	☐ N/A
Was preservative added to any container at the lab?	☐ Yes	☐ No	☐ N/A
Were all containers received in good condition?	☐ Yes	☐ No	☐ N/A
Were all VOA vials received with no head space?	☐ Yes	☐ No	☐ N/A
Do all sample labels match the Chain of Custody?	☐ Yes	☐ No	☐ N/A
Did the Chain of Custody list the sampling technician?	☐ Yes	☐ No	☐ N/A
Was the client notified about any discrepancies?	☐ Yes	☐ No	☐ N/A

Containers preserved at the laboratory:

Notes/Comments: _____

_____

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Matrix	Soil, Surface Water, Groundwater, Concrete, Dust/Chip, IDW
Analytical Group	TAL Metals, TCLP Metals, and SPLP Metals
Concentration Level	Low
Analytical Method / SOP Reference	Aq:3010A/6020A/7470A So:3050B/6020A/7471B TCLP:1311/6010C/7470A SPLP: 1312/6020A/7470A AQ: GCAL MET-005, MET-006, MET-008, MET-010, & MET-021 SO: GCAL EXT-070, MET-004, MET-006, MET-008, MET-010, & MET-021
Field Sampling Organization	Shaw
Analytical Organization	GCAL

QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Equipment Blank and/or Field Blank	1 per 20 field samples per matrix per sampling technique. Not needed if disposable equipment is used.	All Target Compounds <1/2 RL. Project QLs for all target compounds are specified in: Worksheet 15.1 for TAL metals solids. Worksheet 15.2 for TAL metals aqueous. Not applicable for TCLP and SPLP metals.	If the criterion is not met for the field blanks, a careful examination of the sampling techniques, sample media, and analytical procedure in conjunction with other analytical QC criteria will be conducted to identify the cause of the blank contamination and usefulness of the data. Apply validation U-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch using the 5x/10x rule.	Field Personnel / Shaw Chemist / Data Validator	Field Representativeness (Absence of interference / contamination)	See Method / SOP QC Acceptance Limits
Field Duplicate	1 per 10 field samples per matrix	QC acceptance criteria for all target compounds as specified in: Worksheet 15.1 for TAL metals solids. Worksheet 15.2 for TAL metals aqueous. Not applicable for TCLP and SPLP metals.	If the criterion is not met for the field duplicates, a careful examination of the sampling techniques, sample media, and analytical procedure in conjunction with other analytical QC criteria will be conducted to identify the cause of the high RPD and the usefulness of the data. If one of the duplicate pair is detected above the method RL and the remaining pair is non-detect, then the data will be qualified as estimated "J" or rejected "R" depending upon the severity (i.e., >2RL).	Field Personnel / Shaw Chemist / Data Validator	Field Precision	See Method / SOP QC Acceptance Limits

QAPP Worksheet 28 - QC Samples Table

Worksheet 28.1 - Metals

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QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
ICAL	Initial calibration prior to sample analysis.	If more than one calibration standard is used, r ≥ 0.995. ICP and ICPMS: minimum one high standard and a calibration blank; CVAA: minimum 5 standards and a calibration blank.	Correct problem then repeat initial calibration. Flagging criteria are not appropriate. Problem must be corrected. No samples may be run until ICAL has passed.	Analyst	Laboratory Precision	See Method / SOP QC Acceptance Limits
MS Tuning (ICPMS)	Prior to initial calibration	ICPMS: Mass calibration ≤ 0.1 amu from the true value; Resolution < 0.9 amu full width at 10% peak height; For stability, RSD ≤ 5% for at least four replicate analyses.	Retune instrument then reanalyze tuning solutions. Flagging criteria are not appropriate. No analysis shall be performed without a valid MS tune.	Analyst	Laboratory Accuracy and Precision	See Method / SOP QC Acceptance Limits
Internal standards (IS) (ICPMS)	Every sample.	IS intensity within 30-120% of intensity of the IS in the ICAL (ICPMS).	Reanalyze sample at 5-fold dilution with addition of appropriate amounts of internal standards. Flagging criteria are not appropriate.	Analyst	Accuracy	See Method / SOP QC Acceptance Limits
Linear dynamic range or High-level calibration check standard (ICP/ICPMS Only)	Every 6 months	Within ± 10% of true value (ICP/ICPMS only).	Not Applicable	Analyst	Laboratory Accuracy	See Method / SOP QC Acceptance Limits
Low-level calibration check standard	Daily, after one-point ICAL.	Within ± 20% of true value. Low-level calibration check standard should be less than or equal to the reporting limit.	Correct problem, then reanalyze. Flagging criteria are not appropriate. No samples may be analyzed without a valid low-level calibration check standard.	Analyst	Laboratory Accuracy	See Method / SOP QC Acceptance Limits
ICV (Second Source)	Once after each ICAL, prior to beginning a sample run.	Value of second source for all analyte(s) within ± 10% of true value.	Correct problem and verify second source standard. Rerun ICV. If that fails, correct problem and repeat ICAL. Flagging criteria are not appropriate. Problem must be corrected. No samples may be run until calibration has been verified.	Analyst	Laboratory Accuracy	See Method / SOP QC Acceptance Limits

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QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
CCV	After every 10 field samples and at the end of the analysis sequence.	ICP/ICPMS: within ± 10% of true value; CVAA: within ± 20% of true value.	Correct problem, rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification. Problem must be corrected. Results may not be reported without a valid CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Analyst	Laboratory Accuracy	See Method / SOP QC Acceptance Limits
Calibration blanks	Before beginning a sample run, after every 10 samples, and at end of the analysis sequence.	No analytes detected > LOD.	Correct problem. Re-prep and reanalyze calibration blank. All samples following the last acceptable calibration blank must be reanalyzed. Apply lab B-flag (validation U-flag) to all results for specific analyte(s) in all samples associated with the blank.	Analyst	Laboratory Representativeness (Absence of interference/ contamination)	See Method / SOP QC Acceptance Limits
MB	One per preparatory batch per matrix	No analytes detected > ½ RL and greater than 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. Project QLs for all target compounds are specified in: Worksheet 15.1 for TAL metals solids. Worksheet 15.2 for TAL metals aqueous and SPLP metals. Worksheet 15.3 for TCLP metals.	The source of the contamination is investigated and eliminated before proceeding with further analysis. Correct the problem. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply lab B-flag (validation U-flag) to all results for the specific analyte(s) in all samples in the associated preparatory batch. Problem must be corrected. Results may not be reported without a valid method blank. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Analyst/Prep analyst	Laboratory Representativeness (Absence of interference / contamination)	See Method / SOP QC Acceptance Limits

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QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
LCS	One LCS per preparatory batch per matrix	QC acceptance criteria specified by DoD, if available. QC acceptance criteria for all target compounds as specified in: Worksheet 15.1 for TAL metals solids. Worksheet 15.2 for TAL metals aqueous and SPLP metals. Worksheet 15.3 for TCLP metals. %Recovery = (Calculated Value / True Value) *100%	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch. Problem must be corrected. Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Analyst/Prep analyst	Laboratory Accuracy	See Method / SOP QC Acceptance Limits
MS	One MS per preparatory batch per matrix	For matrix evaluation, use QC acceptance criteria specified by DoD for LCS. QC acceptance criteria for all target compounds as specified in: Worksheet 15.1 for TAL metals solids. Worksheet 15.2 for TAL metals aqueous. Not applicable for TCLP and SPLP metals %Recovery = (Calculated Value - Sample Value / True Value) *100%	Examine the project-specific DQOs. If the MS falls outside of DoD criteria, additional QC tests are required to evaluate matrix effects. Perform post-digestion spike (PDS) addition. For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met. For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.	Analyst/Prep analyst	Accuracy (field samples)	See Method / SOP QC Acceptance Limits

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QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
MSD or Sample Duplicates	One per preparatory batch per matrix	MSD: For matrix evaluation use QC acceptance criteria specified by DoD for LCS. MSD or sample duplicate: RPD ≤ 20% (between MS and MSD or sample and sample duplicate). QC acceptance criteria for all target compounds as specified in: Worksheet 15.1 for TAL metals solids. Worksheet 15.2 for TAL metals aqueous. Not applicable for TCLP and SPLP metals. %Recovery = (Calculated Value - Sample Value / True Value) *100% RPD = (Difference between MS and MSD) * 100 / (Average of MS and MSD)	Examine the project-specific DQOs. Perform post-digestion spike (PDS) addition. Contact the client as to additional measures to be taken. For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met. The data shall be evaluated to determine the source of difference.	Analyst	Precision and Accuracy (field samples)	See Method / SOP QC Acceptance Limits
ICS (ICP/ICPMS only)	At the beginning of an analytical run.	ICS-A: Absolute value of concentration for all non-spiked analytes < LOD (unless they are a verified trace impurity from one of the spiked analytes); ICS-AB: Within ± 20% of true value.	Terminate analysis; locate and correct problem; reanalyze ICS, reanalyze all samples. If corrective action fails, apply Q-flag to all results for specific analyte(s) in all samples associated with the ICS.	Analyst	Accuracy	See Method / SOP QC Acceptance Limits
Serial Dilution Test (ICP/ICPMS only)	Each preparatory batch	Five-fold dilution must agree within ± 10% of the original measurement. Only applicable for samples with concentrations >50x Level of Quantitation (LOQ) for ICP and >100x for ICPMS.	Perform post-digestion spike (PDS) addition. Flagging criteria are not appropriate.	Analyst	Precision (field samples)	See Method / SOP QC Acceptance Limits
PDS addition	When dilution test fails or analyte concentration in all samples <50x MDL	Recovery within 75-125% of expected result. The spike addition should produce a level between 10x to 100x LOQ.	Run all associated samples in the preparatory batch by method of standard additions (MSA). For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.	Analyst	Accuracy	See Method / SOP QC Acceptance Limits

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QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method of standard additions (MSA) or Internal Standard calibration	When matrix interference is confirmed.	Document use of MSA in the case narrative.	Not Applicable	Analyst	Accuracy	See Method / SOP QC Acceptance Limits
Results reported between LOD and LOQ	All positive results must be confirmed	Not Applicable	Apply J-flag to all results between LOD and LOQ.	Analyst	Representativeness	See Method / SOP QC Acceptance Limits

Ref: USEPA Test Methods for Evaluating Solid Waste Physical/Chemical Methods, Update IV (USEPA, 2007) and DoD Quality Systems Manual for Environmental Laboratories, Final Version 4.2 (DoD, 2010).

QAPP Worksheet 28 - QC Samples Table
Worksheet 28.2 - Explosives
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Matrix	Soil
Analytical Group	Explosives
Concentration Level	Low
Analytical Method / SOP Reference	So: 8330B Mod Solids: EXTNT02 & HPLC02
Field Sampling Organization	Shaw
Analytical Organization	Microbac Laboratories, Inc.

QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Equipment Blank and/or Field Blank	1 per 20 field samples per matrix per sampling technique. Not needed if disposable equipment is used	All Target Compounds <1/2 RL. Project QLs for all target compounds are specified in: Worksheet 15.3 for explosives for solids.	If the criterion is not met for the field blanks, a careful examination of the sampling techniques, sample media, and analytical procedure in conjunction with other analytical QC criteria will be conducted to identify the cause of the blank contamination and usefulness of the data. Apply U-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch using the 5x/10x rule.	Field Personnel / Shaw Chemist / Data Validator	Field Representativeness (Absence of interference / contamination)	See Method / SOP QC Acceptance Limits
Field Duplicate	1 per 10 field samples per matrix	QC acceptance criteria for all target compounds as specified in: Worksheet 15.3 for explosives for solids.	If the criterion is not met for the field duplicates, a careful examination of the sampling techniques, sample media, and analytical procedure in conjunction with other analytical QC criteria will be conducted to identify the cause of the high RPD and the usefulness of the data. If one of the duplicate pair is detected above the method reporting limit (RL) and the remaining pair is non-detect, then the data will be qualified as estimated or rejected depending upon the severity (i.e. >2RL). Apply J-flag to sample and duplicate pair.	Field Personnel / Shaw Chemist/Data Validator	Field Precision	See Method / SOP QC Acceptance Limits

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Worksheet 28.2 - Explosives
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QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Soil drying procedure (for solid matrix only)	Each sample and batch LCS.	Laboratory must have a procedure to determine when the sample is dry to constant weight. Record date, time, and ambient temperature on a daily basis while drying samples.	Flagging criteria are not appropriate.	Analyst	Laboratory Representativeness	See Method / SOP QC Acceptance Limits
Soil sieving procedure (for solid matrix only)	Each sample and batch LCS.	Weigh entire sample. Sieve entire sample with a 10 mesh sieve. Breakup pieces of soil (especially clay) with gloved hands. Do not intentionally include vegetation in the portion of the sample that passes through the sieve unless this is a project specific requirement. Collect and weigh any portion unable to pass through the sieve.	Flagging criteria are not appropriate.	Analyst	Laboratory Representativeness	See Method / SOP QC Acceptance Limits
Soil grinding procedure (for IS solid matrix sample only – if required)	Initial demonstration	The laboratory must initially demonstrate that the grinding procedure is capable of reducing the particle size to < 75 µm by passing representative portions of ground sample through a 200 mesh sieve (ASTM E11).	Flagging criteria are not appropriate.	Analyst	Laboratory Representativeness	See Method / SOP QC Acceptance Limits
Initial Calibration (ICAL)	Initial calibration prior to sample analysis as needed (see CCV passing criteria below)	Min. of 5 calibration standards with the lowest standard concentration at or below the RL. Once calibration curve or line is generated, the lowest calibration standard must be re-analyzed. The apparent signal-to-noise ratio at the RL must be at least 5:1. If linear reg. is used, r≥0.995. If using internal standardization, RSD≤15%.	Correct problem then repeat initial calibration. Flagging criteria are not appropriate.	Analyst	Laboratory Precision	See Method / SOP QC Acceptance Limits

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Worksheet 28.2 - Explosives
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QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Retention time window position establishment and verification for each analyte and surrogate	Once per ICAL and at the beginning of the analytical shift for position establishment. Each calibration verification standard for retention time verification.	Position shall be set using the midpoint standard of the calibration curve or the value in the CCV run at the beginning of the analytical shift. Analyte shall be within established window for each calibration verification. Each analyte shall be within established window.	Correct problem, and then reanalyze all samples analyzed since the last acceptable retention time check. If they fail, redo ICAL and reset retention time window. Flagging criteria are not appropriate for initial verification. For CCV, apply a Q-flag to all results for analytes outside the established window. No samples shall be run without a verified retention time window at the initial verification.	Analyst	Laboratory Representativeness	See Method / SOP QC Acceptance Limits
Initial calibration verification (ICV) (Second Source)	Immediately following ICAL.	All analyte(s) and surrogates within ± 20% of true value.	Correct problem and verify second source standard. Rerun ICV. If that fails, correct problem and repeat ICAL. Flagging criteria are not appropriate.	Analyst	Laboratory Precision	See Method / SOP QC Acceptance Limits
Continuing calibration verification (CCV)	Prior to sample analysis, after every 10 field samples, and at the end of the analysis sequence.	All target analytes and surrogates within ± 20% (±15% for 8330A) of the expected value from the ICAL.	Correct problem, rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification.	Analyst	Laboratory Precision	See Method / SOP QC Acceptance Limits
Retention time (RT) window width calculated for each analyte and surrogate	At method set-up and after major maintenance (e.g., column change)	RT width is ± 3 times standard deviation for each analyte RT from 72-hour study.	Correct problem, then rerun ICAL. Flagging criteria are not appropriate.	Analyst	Laboratory Representativeness	See Method / SOP QC Acceptance Limits
Method Blank (MB) and Grinding Blank (GB)	MB: One per preparatory batch per matrix GB: One per prep batch (for solid matrix IS Sample only)	No analytes detected > ½ RL and greater than 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. Project QLs for all target compounds are specified in: Worksheet 15.3 for explosives for solids.	The source of the contamination is investigated and eliminated before proceeding with further analysis. Correct the problem. Any sample associated with a blank that fail these criteria checks shall be reprocessed in a subsequent preparation batch, except when the sample analysis resulted in a non-detect. If no sample volume remains for reprocessing, the results shall be reported with appropriate data qualifying code "B" (validation "U" flag).	Analyst/Prep analyst	Laboratory Representativeness (Absence of interference / contamination)	See Method / SOP QC Acceptance Limits

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Worksheet 28.2 - Explosives
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QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Laboratory Control Sample (LCS)	One LCS per preparatory batch per matrix	A solid reference material containing all reported analytes must be prepared (e.g., ground and subsampled) and analyzed in exactly the same manner as a field sample. In-house laboratory control limits for the LCS must demonstrate the laboratory's ability to meet the project's MQOs. QC acceptance criteria for all target compounds as specified in: Worksheet 15.3 for explosives for solids. %Recovery = (Calculated Value / True Value) *100%	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Analyst/Prep analyst	Laboratory Accuracy	See Method / SOP QC Acceptance Limits
Matrix Spike (MS)	One MS per preparatory batch per matrix	For matrix evaluation only, therefore is taken post grinding from same ground sample as parent subsample is taken. Percent recovery must meet LCS limits. QC acceptance criteria for all target compounds as specified in: Worksheet 15.3 for explosives for solids. %Recovery = (Calculated Value / True Value) *100%	Examine the project-specific DQOs. Contact the client as to additional measures to be taken. For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met. For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.	Analyst/Prep analyst	Accuracy (field samples)	See Method / SOP QC Acceptance Limits

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Worksheet 28.2 - Explosives
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QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Matrix Spike Duplicates (MSD) or Sample Duplicates (SD)	One MSD or SD per preparatory batch per matrix	For matrix evaluation only, therefore is taken post grinding from same ground sample as parent subsample is taken. Percent recovery must meet LCS limits and relative percent difference (RPD) < 20%. QC acceptance criteria for all target compounds as specified in: Worksheet 15.3 for explosives for solids. %Recovery = (Calculated Value – Sample Value / True Value) *100% RPD = (Difference between MS and MSD) * 100 / (Average of MS and MSD)	Examine the project-specific DQOs. Contact the client as to additional measures to be taken. For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met. The data shall be evaluated to determine the source of difference.	Analyst	Precision and Accuracy (field samples)	See Method / SOP QC Acceptance Limits
Surrogate Spikes	All field and QC samples	QC acceptance criteria specified by DoD, if available. Otherwise, use in-house control limits. QC acceptance criteria for all target compounds as specified in: 1-Chloro-3-nitrobenzene 55-140% for explosives for solids. %Recovery = (Calculated Value / True Value) *100%	For QC and field samples, correct problem then re-prep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary. Apply Q-flag to all associated analytes if acceptance criteria are not met. Alternative surrogates are recommended when there is obvious chromatographic interference.	Analyst/Prep analyst	Accuracy (Individual sample preparation efficiency control)	See Method / SOP QC Acceptance Limits

QAPP Worksheet 28 - QC Samples Table
Worksheet 28.2 - Explosives
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QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Quantitation Verification and Confirmation	When target analytes are detected on the primary column using the UV Detector (HPLC) at concentrations exceeding the Limit of Detection (LOD). Confirmation analysis is not needed if LC/MS or LC/MS/MS was used for the primary analysis.	Calibration and QC criteria are the same as for initial or primary column analysis. Results between primary and second column RPD ≤ 40%.	Report from both columns. If there is a > 40% RPD between the two column results, data must be J-flagged accordingly. Secondary column – Must be capable of resolving (separating) all of the analytes of interest and must have a different retention time order relative to the primary column. Any HPLC column used for confirmation analysis must be able to resolve and quantify all project analytes. Detection by HPLC UV, LC/MS or LC/MS/MS. Calibration and calibration verification acceptance criteria is the same as for the primary analysis.	Analyst	Representativeness and Precision	See Method / SOP QC Acceptance Limits
Soil sample triplicate	Not required for SEDA. If needed for IS sample, at the sub-sampling step, one sample per batch. Cannot be performed on any type of blank sample.	Three 10 g subsamples are taken from a sample expected to contain the highest levels of explosives within the quantitation range of the method. The RSD for results above the RL must not exceed 20%.	Corrective action must be taken if this criterion is not met (e.g., the grinding process should be investigated to ensure that the samples are being reduced to a sufficiently small particle size). Apply J-flag if corrective action does not solve problem and no sample available.	Analyst	Representativeness and Precision	See Method / SOP QC Acceptance Limits
Results reported between LOD and LOQ	All positive results between LOD and LOQ	Not Applicable	Apply J-flag to all results between LOD and LOQ.	Analyst	Representativeness	See Method / SOP QC Acceptance Limits

Ref: USEPA Test Methods for Evaluating Solid Waste Physical/Chemical Methods, Update IV (USEPA, 2007) and DoD Quality Systems Manual for Environmental Laboratories, Final Version 4.2 (DoD, 2010).

QAPP Worksheet 28 - QC Samples Table
Worksheet 28.3 - Perchlorate
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Matrix	Soil
Analytical Group	Perchlorate
Concentration Level	Low
Analytical Method / SOP Reference	Soil: SW 6850 SOP: HPLC06
Field Sampling Organization	Shaw
Analytical Organization	Microbac Laboratories, Inc.

QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Field Blank	1 per 20 field samples or per day	All Target Compounds <LOD. Project QLs for all target compounds are specified in: Worksheet 15.4 for perchlorate soil.	If the criterion is not met for the field blanks, a careful examination of the sampling techniques, sample media, and analytical procedure in conjunction with other analytical QC criteria will be conducted to identify the cause of the blank contamination and usefulness of the data.	Field Personnel / Shaw Chemist	Field Representativeness (Absence of interference / contamination)	See Method / SOP Acceptance Limits
Equipment Blank	1 per 20 field samples or per day per matrix per sampling technique	All Target Compounds <LOD. Project QLs for all target compounds are specified in: Worksheet 15.4 for perchlorate soil.	If the criterion is not met for the field blanks, a careful examination of the sampling techniques, sample media, and analytical procedure in conjunction with other analytical QC criteria will be conducted to identify the cause of the blank contamination and usefulness of the data.	Field Personnel / Shaw Chemist	Field Representativeness (Absence of interference / contamination)	See Method / SOP Acceptance Limits

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Worksheet 28.3 - Perchlorate
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QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Field Duplicate	1 per 10 field samples per matrix	QC acceptance criteria for all target compounds as specified in: Worksheet 15.4 for perchlorate soil.	If the criterion is not met for the field duplicates, a careful examination of the sampling techniques, sample media, and analytical procedure in conjunction with other analytical QC criteria will be conducted to identify the cause of the high RPD and the usefulness of the data. If one of the duplicate pair is detected above the method reporting limit (RL) and the remaining pair is non-detect, then the data will be qualified as estimated or rejected depending upon the severity (i.e., >2RL).	Field Personnel/ Shaw Chemist	Field Precision	See Method / SOP Acceptance Limits
Initial Calibration (ICAL)	Initial calibration prior to sample analysis.	Initial calibration for all analytes (ICAL) Minimum 5 standards and a calibration blank with linear least squares regression: R≥0.995 or RSD ≤ 20%. The concentration corresponding to the absolute value of the calibration curve's Y-intercept must be ≤ LOD.	Correct problem then repeat initial calibration. Flagging criteria are not appropriate. Problem must be corrected. No samples may be run until ICAL has passed. The calibration is linear and shall not be forced through the origin.	Analyst	Laboratory Precision	See Method / SOP Acceptance Limits
Interference threshold study	At initial setup and when major changes occur in the method's operating procedures (e.g., addition of cleanup procedures, column changes, mobile phase changes).	Measure the threshold of common suppressors (chloride, sulfate, carbonate, bicarbonate) that can be present in the system without affecting the quantitation of perchlorate. The threshold is the concentration of the common suppressors where perchlorate recovery falls outside an 85-115% window.	This study and site history will determine the concentration at which the ICS suppressors should be set. Flagging criteria are not appropriate.	Analyst	Laboratory Accuracy	See Method / SOP Acceptance Limits

QAPP Worksheet 28 - QC Samples Table
Worksheet 28.3 - Perchlorate
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QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Mass calibration	Instrument must have a valid mass calibration prior to any sample analysis. The mass calibration is updated on an as-needed basis (e.g., QC failures, ion masses show large deviations from known masses, major instrument maintenance is performed, or the instrument is moved).	Mass calibration range must bracket the ion masses of interest without greatly exceeding the range. The most recent mass calibration must be used for an analytical run, and the same mass calibration must be used for all data files in an analytical run. Mass calibration must be verified by acquiring a full scan continuum mass spectrum of a perchlorate stock standard. Perchlorate ions should be within ± 0.3 m/z of mass 99, 101, and 107 or their respective daughter ion masses (83, 85, and 89), depending on which ions are quantitated.	If the mass calibration fails, recalibrate. If it still fails, consult manufacturer instructions on corrective maintenance. Flagging criteria are not appropriate. Problem must be corrected. No samples may be analyzed under a failing mass calibration.	Analyst	Laboratory Accuracy	See Method / SOP Acceptance Limits
Initial Calibration Verification [ICV]	Once after each ICAL, analysis of a second source standard at the midpoint of the calibration.	ICV within ±15% of expected value	Correct problem and verify second source standard. Rerun ICV. If that fails, correct problem and repeat ICAL. Flagging criteria are not appropriate. No samples may be run until calibration has been verified.	Analyst	Laboratory Accuracy	See Method / SOP Acceptance Limits
Continuing Calibration Verification [CCV]	Analysis of mid-level standard after every 10 field samples. All samples must be bracketed by the analysis of a standard demonstrating that the system was capable of accurately detecting and quantifying perchlorate.	CCV within ±15% of expected value.	Correct problem, rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification. Problem must be corrected. Results may not be reported without a valid CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Analyst	Laboratory Accuracy	See Method / SOP Acceptance Limits

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Worksheet 28.3 - Perchlorate
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QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Limit of detection verification (LODV) (per batch)	Prior to sample analysis and at the end of the analysis sequence. It can be analyzed after every 10 samples in order to reduce the reanalysis rate.	Within ± 30% of true value. Perchlorate spike concentration is approximately 2 times the limit of detection.	Correct problem and rerun LODV and all samples analyzed since last successful LODV. If a sample with perchlorate concentration at or between the LOD and RL is bracketed by a failing LODV, it must be reanalyzed. A sample with concentration above the RL can be reported. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable LODV. Problem must be corrected. Results may not be reported without a valid LODV. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Analyst	Laboratory Accuracy	See Method / SOP Acceptance Limits
Isotope ratio 35Cl/37Cl	Every sample, batch QC sample, and standard.	Monitor for either the parent ion at masses 99/101 or the daughter ion at masses 83/85 depending on which ions are quantitated. Theoretical ratio ~ 3.06. Must fall within 2.3 to 3.8.	If criteria are not met, the sample must be rerun. If the sample was not pretreated, the sample should be reextracted using cleanup procedures. If, after cleanup, the ratio still fails, use alternative techniques to confirm presence of perchlorate (i.e., a post spike sample, dilution to reduce any interference, etc.). Decision to report data failing ratio check should be thoroughly documented in case narrative.	Analyst	Laboratory Precision	See Method / SOP Acceptance Limits

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QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Internal standard (IS)	Addition of 18O-labeled perchlorate to every sample, batch QC sample, standard, instrument blank, and method blank.	Measured 18O IS area within ± 50% of the value from the average of the IS area counts of the ICAL. RRT of the perchlorate ion must be 1.0 ± 2% (0.98 – 1.02).	Rerun the sample at increasing dilutions until the ± 50% acceptance criteria are met. If criteria cannot be met with dilution, the interference are suspected and the sample must be reprepped using additional pretreatment steps. Apply Q-flag and discuss in the case narrative. If peak is not within retention time window, presence is not confirmed. Use for quantitation and to ensure identification. Failing internal standard should be thoroughly documented in the case narrative.	Analyst	Laboratory Accuracy	See Method / SOP Acceptance Limits
Tuning	Prior to ICAL and after any mass calibration or maintenance is performed.	Tuning standards must contain the analytes of interest and meet acceptance criteria outlined in the laboratory SOP.	Retune instrument. If the tuning will not meet acceptance criteria, an instrument mass calibration must be performed and the tuning redone. Flagging criteria are not appropriate. Problem must be corrected. Sample analysis shall not proceed without acceptable tuning.	Analyst	Laboratory Accuracy	See Method / SOP Acceptance Limits
Laboratory Reagent Blank	Prior to calibration, after samples with overrange concentration of perchlorate, and at the end of the analytical sequence.	All Target Compounds <LOD.	Reanalyze reagent blank (until no carryover is observed) and all samples processed since the contaminated blank. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag (validation “U” flag) to all results for the specific analyte(s) in all samples in the associated batch. Problem must be corrected. Results may not be reported without a valid reagent blank. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Analyst	Laboratory Representativeness (Absence of interference / contamination)	See Method / SOP Acceptance Limits

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QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank (MB)	One per preparatory batch per matrix	All Target Compounds <LOD. Project QLs for all target compounds are specified in: Worksheet 15.4 for perchlorate soil.	The source of the contamination is investigated and eliminated before proceeding with further analysis. Correct the problem. Any sample associated with a blank that fail these criteria checks shall be reprocessed in a subsequent preparation batch, except when the sample analysis resulted in a non-detect. If no sample volume remains for reprocessing, the results shall be reported with appropriate data qualifying code "B" (validation "U" flag).	Analyst/Prep Analyst	Laboratory Representativeness (Absence of interference / contamination)	See Method / SOP Acceptance Limits
Laboratory Control Sample (LCS)	One per preparatory batch. LCS must be spiked at the RL.	Recovery within method requirements, laboratory-generated limits, or 80-120% (whichever is more stringent) to verify calibration and to check method performance. QC acceptance criteria for all target compounds as specified in: Worksheet 15.4 for perchlorate soil. Ref.: DoD QSM, if available, otherwise laboratory's own in-house criteria. %Recovery = (Calculated Value/True Value) *100%%Recovery = (Calculated Value/True Value) *100%	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch. Problem must be corrected. Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed. LCS must undergo the same preparation and pretreatment steps as the samples in the batch.	Analyst/Prep Analyst	Laboratory Accuracy	See Method / SOP Acceptance Limits

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QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Matrix Spike (MS)	One per preparatory batch per matrix. The MS must be spiked at the RL.	Recovery within 80-120% or within laboratory generated limits, whichever is more stringent. QC acceptance criteria for all target compounds as specified in: Worksheet 15.4 for perchlorate soil. %Recovery = (Calculated Value - Sample Value / True Value) *100%	Examine the project-specific DQOs. Contact the client as to additional measures to be taken. For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met. For matrix evaluation only. If MS results are outside the limits, the data must be evaluated to determine the source of the difference and to determine if there is a matrix effect or analytical error. MS must undergo the same preparation and pretreatment steps as the samples in the batch.	Analyst/Prep Analyst	Accuracy (field samples)	See Method / SOP Acceptance Limits
Matrix Spike Duplicates (MSD) or Sample Duplicates	One per preparatory batch per matrix. The MS must be spiked at the RL.	MSD: Recovery within 80-120% or within laboratory generated limits, whichever is more stringent. MSD or laboratory duplicate: RPD < 15%. QC acceptance criteria for all target compounds as specified in: Worksheet 15.4 for perchlorate soil. %Recovery = (Calculated Value – Sample Value / True Value) *100% RPD = (Difference between MS and MSD) * 100 / (Average of MS and MSD)	See MS corrective actions noted above. The data shall be evaluated to determine the source of difference.	Analyst	Precision and Accuracy (field samples)	See Method / SOP Acceptance Limits

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QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Interference check sample (ICS)	One ICS is prepared with every batch of 20 samples and must undergo the same preparation and pretreatment steps as the samples in the batch. It verifies the method performance at the matrix conductivity threshold (MCT). At least one ICS must be analyzed daily.	Within ± 30% of true value.	Correct problem and then reanalyze all samples in that batch. If poor recovery from the cleanup filters is suspected, a different lot of filters must be used to reextract all samples in the batch. If column degradation is suspected, a new column must be calibrated before the samples can be reanalyzed. Flagging criteria are not appropriate. Analysis of a standard containing perchlorate at the RL and interfering anions at the concentration determined by the interference threshold study. Monitor recovery of perchlorate and retention time. No samples may be reported that are associated with a failing ICS.	Analyst	Laboratory Accuracy	See Method / SOP Acceptance Limits
Results reported between LOD and LOQ	All positive results must be confirmed	Not Applicable	Apply J-flag to all results between LOD and LOQ.	Analyst	Representativeness	See Method / SOP Acceptance Limits

Ref: USEPA Test Methods for Evaluating Solid Waste Physical/Chemical Methods, Update IV (USEPA, 2007), DoD Quality Systems Manual for Environmental Laboratories, Final Version 4.2 (DoD, 2010), and DoD Perchlorate Handbook August, Rev1, Change 1, 2007 (DoD, 2007).

QAPP Worksheet 28 - QC Samples Table

Worksheet 28.4 - VOCs

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Matrix	Concrete and Dust/Chip and IDW
Analytical Group	TCLP VOCs
Concentration Level	Low
Analytical Method / SOP Reference	TCLP: 1311/5030B/8260B GCAL EXT-036, & GCMSV-003
Field Sampling Organization	Shaw
Analytical Organization	GCAL

QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Equipment Blank and/or Field Blank	1 per 20 field samples per matrix per sampling technique. Not needed if disposable equipment is used	All Target Compounds <1/2 RL. Project QLs for all target compounds are specified in: Not applicable for TCLP VOCs.	If the criterion is not met for the field blanks, a careful examination of the sampling techniques, sample media, and analytical procedure in conjunction with other analytical QC criteria will be conducted to identify the cause of the blank contamination and usefulness of the data. Apply validation U-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch using the 5x/10x rule.	Field Personnel / Shaw Chemist / Data Validator	Field Representativeness (Absence of interference / contamination)	See Method / SOP QC Acceptance Limits
Trip Blank	1 per cooler containing aqueous VOC field samples	All Target Compounds <1/2 RL. Project QLs for all target compounds are specified in: Not applicable for TCLP VOCs.	If the criterion is not met for the field blanks, a careful examination of the sampling techniques, sample media, and analytical procedure in conjunction with other analytical QC criteria will be conducted to identify the cause of the blank contamination and usefulness of the data. Apply validation U-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch using the 5x/10x rule.	Field Personnel / Shaw Chemist / Data Validator	Field Representativeness (Absence of interference / contamination)	See Method / SOP QC Acceptance Limits

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Worksheet 28.4 - VOCs

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QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Field Duplicate	1 per 10 field samples per matrix	QC acceptance criteria for all target compounds as specified in: Not applicable for TCLP VOCs.	If the criterion is not met for the field duplicates, a careful examination of the sampling techniques, sample media, and analytical procedure in conjunction with other analytical QC criteria will be conducted to identify the cause of the high RPD and the usefulness of the data. If one of the duplicate pair is detected above the method RL and the remaining pair is non-detect, then the data will be qualified as estimated or rejected depending upon the severity (i.e., >2RL).	Field Personnel / Shaw Chemist / Data Validator	Field Precision	See Method / SOP QC Acceptance Limits
MS Tuning	Prior to initial calibration and every 12 hours during sample analysis	Refer to method for specific ion criteria.	Retune instrument and verify. Rerun affected samples. Flagging criteria are not appropriate and problem must be corrected. No samples may be accepted without a valid tune.	Analyst	Laboratory Accuracy	See Method / SOP QC Acceptance Limits
ICAL	Initial calibration prior to sample analysis. Minimum of 5 point.	Average RF for SPCCs: VOCs ≥ 0.050 (per validation guidance). RSD for RFs for CCCs: VOCs - RSD≤30%and one option below: Option 1: RSD for each analyte ≤15% Option 2: linear least squares regression r ≥0.995 Option 3: non-linear regression - coefficient of determination (COD) r^2 ≥0.99 (6 points shall be used for second order, 7 points shall be used for third order)	Correct problem then repeat ICAL. Flagging criteria are not appropriate. Problem must be corrected. No samples may be run until ICAL has passed. Calibration may not be forced through the origin.	Analyst	Laboratory Precision	See Method / SOP QC Acceptance Limits
ICV (Second Source)	Once after each initial calibration	Value of second source for all analytes within ±20% of true value.	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat initial calibration. Flagging criteria are not appropriate. No samples may be run until calibration has been verified.	Analyst	Laboratory Accuracy	See Method / SOP QC Acceptance Limits

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Worksheet 28.4 - VOCs

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QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Retention time window position establishment for each analyte and surrogate	Once per ICAL.	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used.	Not Applicable	Analyst	Laboratory Representativeness	See Method / SOP QC Acceptance Limits
Evaluation of relative retention times (RRT)	With each sample.	RRT of each target analyte within ± 0.06 RRT units. With each sample, the RRT shall be compared with the most recently updated RRT. If using selective ion monitoring (SIM) mode, at least two ions per analyte should be monitored unless confirmed in full scan.	Correct problem, then rerun ICAL. Flagging criteria are not appropriate. Laboratories may update the retention times based on the CCV to account for minor performance fluctuations or after routine system maintenance (such as column clipping). If the RRT has changed by more than ±0.06 RRT units since the last update, this indicates a significant change in system performance and the laboratory must take appropriate corrective actions as required by the method and rerun the ICAL to reestablish the retention times.	Analyst	Laboratory Representativeness	See Method / SOP QC Acceptance Limits
CCV	Daily, before sample analysis, and every 12 hours of analysis time	Average RF for SPCCs: VOCs ≥ 0.050. %Difference/Drift for CCCs: VOCs ≤ 20%D (Note: D = difference when using RFs or drift when using least squares regression or non-linear calibration.)	DoD project level approval must be obtained for each of the failed analytes or corrective action must be taken. Correct problem, then rerun CCV. If that fails, repeat initial calibration. Corrective action may include re-analysis of samples. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since last acceptable CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Analyst	Laboratory Precision	See Method / SOP QC Acceptance Limits
Internal standards verification	Every field sample, standard, and QC sample.	Retention time ± 30 seconds from retention time of the midpoint standard in the ICAL; EICP area within -50% to +100% of ICAL midpoint standard.	Inspect mass spectrometer and GC for malfunctions. Reanalysis of samples analyzed while system was malfunctioning is mandatory. If corrective action fails in field samples, apply Q-flag to analytes associated with the non-compliant IS. Flagging criteria are not appropriate for failed standards. Sample results are not acceptable without a valid IS verification.	Analyst	Laboratory Accuracy	See Method / SOP QC Acceptance Limits

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Worksheet 28.4 - VOCs

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QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
MB	One per preparatory batch	No analytes detected > ½ RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL. Project QLs for all target compounds are specified in: Worksheet 15.6 for TCLP VOCs.	The source of the contamination is investigated and eliminated before proceeding with further analysis. Correct problem. If required, re-prep and reanalyze method blank and all samples processed with the contaminated blank. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply lab B-flag (validation U-flag) to all results for the specific analyte(s) in all samples in the associated preparatory batch. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Analyst	Laboratory Representativeness (Absence of interference/ contamination)	See Method / SOP QC Acceptance Limits
LCS	One LCS per preparatory batch	Contains all analytes to be reported, including surrogates. QC acceptance criteria specified by DoD, if available. Otherwise, use in-house control limits. In-house control limits may not be greater than ± 3 times the standard deviation of the mean LCS recovery. QC acceptance criteria for all target compounds as specified in: Worksheet 15.6 for TCLP VOCs. %Recovery = (Calculated Value/True Value) *100%	Correct problem, then re-prep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch. Problem must be corrected. Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Analyst	Laboratory Accuracy	See Method / SOP QC Acceptance Limits

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Worksheet 28.4 - VOCs

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QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
MS	One MS per preparatory batch per matrix	For matrix evaluation, use LCS acceptance criteria specified by DoD, if available. Otherwise, use in-house LCS control limits. QC acceptance criteria for all target compounds as specified in: Not applicable for TCLP VOCs. %Recovery = (Calculated Value/True Value) *100%	Examine the project-specific DQOs. Contact the client as to additional measures to be taken. For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met. For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.	Analyst	Accuracy (Field Samples)	See Method / SOP QC Acceptance Limits
MSD or Sample Duplicates	One per preparatory batch per matrix	MSD: For matrix evaluation, use LCS acceptance criteria specified by DoD, if available. Otherwise, use in-house LCS control limits. MSD or sample duplicate: RPD ≤ 30% (between MS and MSD or sample and sample duplicate). QC acceptance criteria for all target compounds as specified in: Not applicable for TCLP VOCs. %Recovery = (Calculated Value – Sample Value/True Value) *100% RPD = (Difference between MS and MSD) * 100 / (Average of MS and MSD)	Examine the project-specific DQOs. Contact the client as to additional measures to be taken. For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met. The data shall be evaluated to determine the source of difference.	Analyst	Precision and Accuracy (Field Samples)	See Method / SOP QC Acceptance Limits

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QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Surrogate Spikes	All field and QC samples	QC acceptance criteria specified by DoD, if available. Otherwise, use in-house control limits. QC acceptance criteria for all target compounds as specified in: Worksheet 15.6 for TCLP VOCs. %Recovery = (Calculated Value/True Value) *100%	For QC and field samples, correct problem then re-prep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary. Apply Q-flag to all associated analytes if acceptance criteria are not met. Alternative surrogates are recommended when there is obvious chromatographic interference.	Analyst	Accuracy (Individual sample preparation efficiency control)	See Method / SOP QC Acceptance Limits
Breakdown check (DDT Method 8270 only)	At the beginning of each 12-hour period, prior to analysis of samples.	Degradation ≤ 20% for DDT. Benzidine and pentachlorophenol should be present at their normal responses, and should not exceed a tailing factor of 2.	Correct problem, then repeat the breakdown check. Flagging criteria are not appropriate.	Analyst	Laboratory Representativeness	See Method / SOP QC Acceptance Limits
Results reported between LOD and LOQ	All positive results between LOD and LOQ	Not Applicable	Apply J-flag to all results between LOD and LOQ.	Analyst	Representativeness	See Method / SOP QC Acceptance Limits

Ref: USEPA Test Methods for Evaluating Solid Waste Physical/Chemical Methods, Update IV (USEPA, 2007) and DoD Quality Systems Manual for Environmental Laboratories, Final Version 4.2 (DoD, 2010).

QAPP Worksheet 28 - QC Samples Table

Worksheet 28.5 - SVOCs

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Matrix	Concrete and Dust/Chip and IDW
Analytical Group	TCLP SVOCs
Concentration Level	Low
Analytical Method / SOP Reference	TCLP: 1311/3510C/8270C GCAL EXT-026, EXT-003 & GCMSSV-001
Field Sampling Organization	Shaw
Analytical Organization	GCAL

QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Equipment Blank and/or Field Blank	1 per 20 field samples per matrix per sampling technique. Not needed if disposable equipment is used	All Target Compounds <1/2 RL. Project QLs for all target compounds are specified in: Not Applicable for TCLP SVOCs.	If the criterion is not met for the field blanks, a careful examination of the sampling techniques, sample media, and analytical procedure in conjunction with other analytical QC criteria will be conducted to identify the cause of the blank contamination and usefulness of the data. Apply validation U-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch using the 5x/10x rule.	Field Personnel / Shaw Chemist / Data Validator	Field Representativeness (Absence of interference / contamination)	See Method / SOP QC Acceptance Limits
Field Duplicate	1 per 10 field samples per matrix	QC acceptance criteria for all target compounds as specified in: Not Applicable for TCLP SVOCs.	If the criterion is not met for the field duplicates, a careful examination of the sampling techniques, sample media, and analytical procedure in conjunction with other analytical QC criteria will be conducted to identify the cause of the high RPD and the usefulness of the data. If one of the duplicate pair is detected above the method RL and the remaining pair is non-detect, then the data will be qualified as estimated or rejected depending upon the severity (i.e., >2RL).	Field Personnel / Shaw Chemist / Data Validator	Field Precision	See Method / SOP QC Acceptance Limits

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Worksheet 28.5 - SVOCs
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QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
MS Tuning	Prior to initial calibration and every 12 hours during sample analysis	Refer to method for specific ion criteria.	Retune instrument and verify. Rerun affected samples. Flagging criteria are not appropriate and problem must be corrected. No samples may be accepted without a valid tune.	Analyst	Laboratory Accuracy	See Method / SOP QC Acceptance Limits
ICAL	Initial calibration prior to sample analysis. Minimum of 5 point.	Average RF for SPCCs: SVOCs ≥ 0.050. RSD for RFs for CCCs: SVOCs - RSD≤30%and one option below: Option 1: RSD for each analyte ≤15% Option 2: linear least squares regression r ≥0.995 Option 3: non-linear regression - coefficient of determination (COD) r^2 ≥0.99 (6 points shall be used for second order, 7 points shall be used for third order)	Correct problem then repeat ICAL. Flagging criteria are not appropriate. Problem must be corrected. No samples may be run until ICAL has passed. Calibration may not be forced through the origin.	Analyst	Laboratory Precision	See Method / SOP QC Acceptance Limits
ICV (Second Source)	Once after each initial calibration	Value of second source for all analytes within ±20% of true value.	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat initial calibration. Flagging criteria are not appropriate. No samples may be run until calibration has been verified.	Analyst	Laboratory Accuracy	See Method / SOP QC Acceptance Limits
Retention time window position establishment for each analyte and surrogate	Once per ICAL.	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used.	Not Applicable	Analyst	Laboratory Representativeness	See Method / SOP QC Acceptance Limits

QAPP Worksheet 28 - QC Samples Table

Worksheet 28.5 - SVOCs

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QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
RRT	With each sample.	RRT of each target analyte within ± 0.06 RRT units. With each sample, the RRT shall be compared with the most recently updated RRT. If using SIM mode, at least two ions per analyte should be monitored unless confirmed in full scan.	Correct problem, then rerun ICAL. Flagging criteria are not appropriate. Laboratories may update the retention times based on the CCV to account for minor performance fluctuations or after routine system maintenance (such as column clipping). If the RRT has changed by more than ±0.06 RRT units since the last update, this indicates a significant change in system performance and the laboratory must take appropriate corrective actions as required by the method and rerun the ICAL to reestablish the retention times.	Analyst	Laboratory Representativeness	See Method / SOP QC Acceptance Limits
CCV	Daily, before sample analysis, and every 12 hours of analysis time	Average RF for SPCCs: SVOCs ≥ 0.050. %Difference/Drift for CCCs: SVOCs ≤ 20%D (Note: D = difference when using RFs or drift when using least squares regression or non-linear calibration.)	DoD project level approval must be obtained for each of the failed analytes or corrective action must be taken. Correct problem, then rerun CCV. If that fails, repeat initial calibration. Corrective action may include re-analysis of samples. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since last acceptable CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Analyst	Laboratory Precision	See Method / SOP QC Acceptance Limits
Internal standards verification	Every field sample, standard, and QC sample.	Retention time ± 30 seconds from retention time of the midpoint standard in the ICAL; EICP area within -50% to +100% of ICAL midpoint standard.	Inspect mass spectrometer and GC for malfunctions. Reanalysis of samples analyzed while system was malfunctioning is mandatory. If corrective action fails in field samples, apply Q-flag to analytes associated with the non-compliant IS. Flagging criteria are not appropriate for failed standards. Sample results are not acceptable without a valid IS verification.	Analyst	Laboratory Accuracy	See Method / SOP QC Acceptance Limits

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Worksheet 28.5 - SVOCs

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QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
MB	One per preparatory batch	No analytes detected > ½ RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL. Project QLs for all target compounds are specified in: Worksheet 15.7 for TCLP SVOCs.	The source of the contamination is investigated and eliminated before proceeding with further analysis. Correct problem. If required, re-prep and reanalyze method blank and all samples processed with the contaminated blank. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply lab B-flag (validation U-flag) to all results for the specific analyte(s) in all samples in the associated preparatory batch. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Analyst	Laboratory Representativeness (Absence of interference/ contamination)	See Method / SOP QC Acceptance Limits
LCS	One LCS per preparatory batch	Contains all analytes to be reported, including surrogates. QC acceptance criteria specified by DoD, if available. Otherwise, use in-house control limits. In-house control limits may not be greater than ± 3 times the standard deviation of the mean LCS recovery. QC acceptance criteria for all target compounds as specified in: Worksheet 15.7 for TCLP SVOCs. %Recovery = (Calculated Value/True Value) *100%	Correct problem, then re-prep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch. Problem must be corrected. Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Analyst	Laboratory Accuracy	See Method / SOP QC Acceptance Limits

QAPP Worksheet 28 - QC Samples Table

Worksheet 28.5 - SVOCs

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QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
MS	One MS per preparatory batch per matrix	For matrix evaluation, use LCS acceptance criteria specified by DoD, if available. Otherwise, use in-house LCS control limits. QC acceptance criteria for all target compounds as specified in: Not Applicable for TCLP SVOCs. %Recovery = (Calculated Value/True Value) *100%	Examine the project-specific DQOs. Contact the client as to additional measures to be taken. For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met. For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.	Analyst	Accuracy (Field Samples)	See Method / SOP QC Acceptance Limits
MSD or Sample Duplicates	One per preparatory batch per matrix	MSD: For matrix evaluation, use LCS acceptance criteria specified by DoD, if available. Otherwise, use in-house LCS control limits. MSD or sample duplicate: RPD ≤ 30% (between MS and MSD or sample and sample duplicate). QC acceptance criteria for all target compounds as specified in: Not Applicable for TCLP SVOCs. %Recovery = (Calculated Value – Sample Value/True Value) *100% RPD = (Difference between MS and MSD) * 100 / (Average of MS and MSD)	Examine the project-specific DQOs. Contact the client as to additional measures to be taken. For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met. The data shall be evaluated to determine the source of difference.	Analyst	Precision and Accuracy (Field Samples)	See Method / SOP QC Acceptance Limits

QAPP Worksheet 28 - QC Samples Table

Worksheet 28.5 - SVOCs

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QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Surrogate Spikes	All field and QC samples	QC acceptance criteria specified by DoD, if available. Otherwise, use in-house control limits. QC acceptance criteria for all target compounds as specified in: Worksheet 15.7 for TCLP SVOCs. %Recovery = (Calculated Value/True Value) *100%	For QC and field samples, correct problem then re-prep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary. Apply Q-flag to all associated analytes if acceptance criteria are not met. Alternative surrogates are recommended when there is obvious chromatographic interference.	Analyst	Accuracy (Individual sample preparation efficiency control)	See Method / SOP QC Acceptance Limits
Breakdown check (DDT Method 8270 only)	At the beginning of each 12-hour period, prior to analysis of samples.	Degradation ≤ 20% for DDT. Benzidine and pentachlorophenol should be present at their normal responses, and should not exceed a tailing factor of 2.	Correct problem, then repeat the breakdown check. Flagging criteria are not appropriate.	Analyst	Laboratory Representativeness	See Method / SOP QC Acceptance Limits
Results reported between LOD and LOQ	All positive results between LOD and LOQ	Not Applicable	Apply J-flag to all results between LOD and LOQ.	Analyst	Representativeness	See Method / SOP QC Acceptance Limits

Ref: USEPA Test Methods for Evaluating Solid Waste Physical/Chemical Methods, Update IV (USEPA, 2007) and DoD Quality Systems Manual for Environmental Laboratories, Final Version 4.2 (DoD, 2010).

QAPP Worksheet 28 - QC Samples Table

Worksheet 28.6 - Pesticides

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Matrix	Concrete and Dust/Chip and IDW
Analytical Group	TCLP Pesticides
Concentration Level	Low
Analytical Method / SOP Reference	TCLP: 1311/3510C/8081B GCAL EXT-026, EXT-010, & GC-013
Field Sampling Organization	Shaw
Analytical Organization	GCAL

QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Equipment Blank and/or Field Blank	1 per 20 field samples per matrix per sampling technique. Not needed if disposable equipment is used	All Target Compounds <1/2 RL. Project QLs for all target compounds are specified in: Not Applicable for TCLP Pesticides.	If the criterion is not met for the field blanks, a careful examination of the sampling techniques, sample media, and analytical procedure in conjunction with other analytical QC criteria will be conducted to identify the cause of the blank contamination and usefulness of the data. Apply validation U-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch using the 5x/10x rule.	Field Personnel / Shaw Chemist / Data Validator	Field Representativeness (Absence of interference / contamination)	See Method / SOP QC Acceptance Limits
Field Duplicate	1 per 10 field samples per matrix	QC acceptance criteria for all target compounds as specified in: Not Applicable for TCLP Pesticides.	If the criterion is not met for the field duplicates, a careful examination of the sampling techniques, sample media, and analytical procedure in conjunction with other analytical QC criteria will be conducted to identify the cause of the high RPD and the usefulness of the data. If one of the duplicate pair is detected above the method RL and the remaining pair is non-detect, then the data will be qualified as estimated or rejected depending upon the severity (i.e. >2RL). Apply J-flag to sample and duplicate pair.	Field Personnel / Shaw Chemist/Data Validator	Field Precision	See Method / SOP QC Acceptance Limits

QAPP Worksheet 28 - QC Samples Table

Worksheet 28.6 - Pesticides

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QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
ICAL	ICAL prior to sample analysis.	Minimum five-point ICAL for all analytes. One of the options below: Option 1: RSD for each analyte ≤ 20%; Option 2: linear least squares regression: r ≥ 0.995; Option 3: non-linear regression: coefficient of determination (COD) r2 ≥ 0.99 (6 points shall be used for second order, 7 points shall be used for third order).	Correct problem then repeat initial calibration. Flagging criteria are not appropriate. Problem must be corrected. No samples may be run until ICAL has passed. Calibration may not be forced through the origin. Quantitation for multi-component analytes such as chlordane and toxaphene must be performed using a 5-point calibration. Results may not be quantitated using a single point.	Analyst	Laboratory Precision	See Method / SOP QC Acceptance Limits
RT window width calculated for each analyte and surrogate	At method setup and after major maintenance (e.g., column change).	RT width is ± 3 times standard deviation for each analyte RT from a 72-hour study.	Not Applicable	Analyst	Laboratory Representativeness	See Method / SOP QC Acceptance Limits
RT window position establishment for each analyte and surrogate	Once per ICAL and at the beginning of the analytical shift.	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used.	Not Applicable	Analyst	Laboratory Representativeness	See Method / SOP QC Acceptance Limits
Breakdown check (Endrin / DDT)	At the beginning of each 12-hour period, prior to analysis of samples.	Degradation ≤ 15% for both DDT and Endrin.	Correct the problem then repeat breakdown check. Flagging criteria are not appropriate. No samples shall be run until degradation ≤ 15% for both DDT and Endrin.	Analyst	Laboratory Precision	See Method / SOP QC Acceptance Limits
Second source calibration verification (ICV)	Immediately following ICAL.	All project analytes within established RT windows. GC methods: All project analytes within ± 20% of expected value from the ICAL.	Correct problem, rerun ICV. If that fails, repeat ICAL. Flagging criteria are not appropriate. Problem must be corrected. No samples may be run until calibration has been verified.	Analyst	Laboratory Precision	See Method / SOP QC Acceptance Limits

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Worksheet 28.6 - Pesticides

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QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
CCV	Prior to sample analysis, after every 10 field samples, and at the end of the analysis sequence	All project analytes within established RT windows. GC methods: All project analytes within ± 20% of expected value from the ICAL	Correct problem, then rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification. Problem must be corrected. Results may not be reported without a valid CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed. RT windows are updated per the method.	Analyst	Laboratory Precision	See Method / SOP QC Acceptance Limits
MB	One per preparatory batch per matrix	No analytes detected > ½ RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. Project QLs for all target compounds are specified in: Worksheet 15.8 for TCLP Pesticides.	The source of the contamination is investigated and eliminated before proceeding with further analysis. Correct problem. If required, re-prep and reanalyze MB and all samples processed with the contaminated blank. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag (validation U-flag) to all results for the specific analyte(s) in all samples in the associated preparatory batch. Problem must be corrected. Results may not be reported without a valid MB. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Analyst/Prep analyst	Laboratory Representativeness (Absence of interference / contamination)	See Method / SOP QC Acceptance Limits

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Worksheet 28.6 - Pesticides

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QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
LCS	One LCS per preparatory batch per matrix	LCS containing all analytes to be reported, including surrogates. QC acceptance criteria specified by DoD, if available. Otherwise, use in-house control limits. In-house control limits may not be greater than ± 3 times the standard deviation of the mean LCS recovery. QC acceptance criteria for all target compounds as specified in: Worksheet 15.8 for TCLP Pesticides. %Recovery = (Calculated Value / True Value) *100%	Correct problem, then re-prep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Analyst/Prep analyst	Laboratory Accuracy	See Method / SOP QC Acceptance Limits
MS	One MS per preparatory batch per matrix	For matrix evaluation, use LCS acceptance criteria specified by DoD, if available. Otherwise, use in-house LCS control limits. QC acceptance criteria for all target compounds as specified in: Not Applicable for TCLP Pesticides. %Recovery = (Calculated Value / True Value) *100%	Examine the project-specific DQOs. Contact the client as to additional measures to be taken. For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met. For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.	Analyst/Prep analyst	Accuracy (field samples)	See Method / SOP QC Acceptance Limits

QAPP Worksheet 28 - QC Samples Table

Worksheet 28.6 - Pesticides

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QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
MSDs or Sample Duplicate	One MSD or sample duplicate per preparatory batch per matrix	MSD: For matrix evaluation, use LCS acceptance criteria specified by DoD, if available. Otherwise, use in-house LCS control limits. MSD or sample duplicate: RPD ≤ 30% (between MS and MSD or sample and sample duplicate). QC acceptance criteria for all target compounds as specified in: Not Applicable for TCLP Pesticides. %Recovery = (Calculated Value – Sample Value / True Value) *100% RPD = (Difference between MS and MSD) * 100 / (Average of MS and MSD)	Examine the project-specific DQOs. Contact the client as to additional measures to be taken. For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met. The data shall be evaluated to determine the source of difference.	Analyst	Precision and Accuracy (field samples)	See Method / SOP QC Acceptance Limits
Surrogate Spikes	All field and QC samples	QC acceptance criteria specified by DoD, if available. Otherwise, use in-house control limits. QC acceptance criteria for all target compounds as specified in: Worksheet 15.8 for TCLP Pesticides. %Recovery = (Calculated Value / True Value) *100%	For QC and field samples, correct problem then re-prep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary. Apply Q-flag to all associated analytes if acceptance criteria are not met. Alternative surrogates are recommended when there is obvious chromatographic interference.	Analyst/Prep analyst	Accuracy (Individual sample preparation efficiency control)	See Method / SOP QC Acceptance Limits

QAPP Worksheet 28 - QC Samples Table

Worksheet 28.6 - Pesticides

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QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Confirmation of positive results (second column or second detector)	All positive results must be confirmed	Calibration and QC criteria same as for initial or primary column analysis. Results between primary and second column RPD ≤ 40%.	Apply J-flag if RPD > 40%. Discuss in the case narrative. Use project-specific reporting requirements if available; otherwise, use method reporting requirements; otherwise, report the result from the primary column.	Analyst	Representativeness and Precision	See Method / SOP QC Acceptance Limits
Results reported between LOD and LOQ	All positive results between LOD and LOQ	Not Applicable	Apply J-flag to all results between LOD and LOQ.	Analyst	Representativeness	See Method / SOP QC Acceptance Limits

Ref: USEPA Test Methods for Evaluating Solid Waste Physical/Chemical Methods, Update IV (USEPA, 2007) and DoD Quality Systems Manual for Environmental Laboratories, Final Version 4.2 (DoD, 2010).

QAPP Worksheet 28 - QC Samples Table

Worksheet 28.7 - Herbicides

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Matrix	Concrete and Dust/Chip and IDW
Analytical Group	TCLP Herbicides
Concentration Level	Low
Analytical Method / SOP Reference	TCLP: 1311/3510C/8151A GCAL EXT-026, EXT-017, & GC-011
Field Sampling Organization	Shaw
Analytical Organization	GCAL

QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Equipment Blank and/or Field Blank	1 per 20 field samples per matrix per sampling technique. Not needed if disposable equipment is used	All Target Compounds <1/2 RL. Project QLs for all target compounds are specified in: Not Applicable for TCLP Herbicides.	If the criterion is not met for the field blanks, a careful examination of the sampling techniques, sample media, and analytical procedure in conjunction with other analytical QC criteria will be conducted to identify the cause of the blank contamination and usefulness of the data. Apply validation U-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch using the 5x/10x rule.	Field Personnel / Shaw Chemist / Data Validator	Field Representativeness (Absence of interference / contamination)	See Method / SOP QC Acceptance Limits
Field Duplicate	1 per 10 field samples per matrix	QC acceptance criteria for all target compounds as specified in: Not Applicable for TCLP Herbicides.	If the criterion is not met for the field duplicates, a careful examination of the sampling techniques, sample media, and analytical procedure in conjunction with other analytical QC criteria will be conducted to identify the cause of the high RPD and the usefulness of the data. If one of the duplicate pair is detected above the method RL and the remaining pair is non-detect, then the data will be qualified as estimated or rejected depending upon the severity (i.e. >2RL). Apply J-flag to sample and duplicate pair.	Field Personnel / Shaw Chemist/Data Validator	Field Precision	See Method / SOP QC Acceptance Limits

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Worksheet 28.7 - Herbicides

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QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
ICAL	ICAL prior to sample analysis.	Minimum five-point ICAL for all analytes. One of the options below: Option 1: RSD for each analyte ≤ 20%; Option 2: linear least squares regression: r ≥ 0.995; Option 3: non-linear regression: coefficient of determination (COD) r2 ≥ 0.99 (6 points shall be used for second order, 7 points shall be used for third order).	Correct problem then repeat initial calibration. Flagging criteria are not appropriate. Problem must be corrected. No samples may be run until ICAL has passed. Calibration may not be forced through the origin. Results may not be quantitated using a single point.	Analyst	Laboratory Precision	See Method / SOP QC Acceptance Limits
RT window width calculated for each analyte and surrogate	At method setup and after major maintenance (e.g., column change).	RT width is ± 3 times standard deviation for each analyte RT from a 72-hour study.	Not Applicable	Analyst	Laboratory Representativeness	See Method / SOP QC Acceptance Limits
RT window position establishment for each analyte and surrogate	Once per ICAL and at the beginning of the analytical shift.	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used.	Not Applicable	Analyst	Laboratory Representativeness	See Method / SOP QC Acceptance Limits
Second source calibration verification (ICV)	Immediately following ICAL.	All project analytes within established RT windows. GC methods: All project analytes within ± 20% of expected value from the ICAL.	Correct problem, rerun ICV. If that fails, repeat ICAL. Flagging criteria are not appropriate. Problem must be corrected. No samples may be run until calibration has been verified.	Analyst	Laboratory Precision	See Method / SOP QC Acceptance Limits

QAPP Worksheet 28 - QC Samples Table

Worksheet 28.7 - Herbicides

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QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
CCV	Prior to sample analysis, after every 10 field samples, and at the end of the analysis sequence	All project analytes within established RT windows. GC methods: All project analytes within ± 20% of expected value from the ICAL	Correct problem, then rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification. Problem must be corrected. Results may not be reported without a valid CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed. Retention time windows are updated per the method.	Analyst	Laboratory Precision	See Method / SOP QC Acceptance Limits
MB	One per preparatory batch per matrix	No analytes detected > ½ RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. Project QLs for all target compounds are specified in: Worksheet 15.9 for TCLP Herbicides.	The source of the contamination is investigated and eliminated before proceeding with further analysis. Correct problem. If required, re-prep and reanalyze MB and all samples processed with the contaminated blank. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag (validation U-flag) to all results for the specific analyte(s) in all samples in the associated preparatory batch. Problem must be corrected. Results may not be reported without a valid MB. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Analyst/Prep analyst	Laboratory Representativeness (Absence of interference / contamination)	See Method / SOP QC Acceptance Limits

QAPP Worksheet 28 - QC Samples Table

Worksheet 28.7 - Herbicides

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QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
LCS	One LCS per preparatory batch per matrix	LCS containing all analytes to be reported, including surrogates. QC acceptance criteria specified by DoD, if available. Otherwise, use in-house control limits. In-house control limits may not be greater than ± 3 times the standard deviation of the mean LCS recovery. QC acceptance criteria for all target compounds as specified in: Worksheet 15.9 for TCLP Herbicides. %Recovery = (Calculated Value / True Value) *100%	Correct problem, then re-prep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Analyst/Prep analyst	Laboratory Accuracy	See Method / SOP QC Acceptance Limits
MS	One MS per preparatory batch per matrix	For matrix evaluation, use LCS acceptance criteria specified by DoD, if available. Otherwise, use in-house LCS control limits. QC acceptance criteria for all target compounds as specified in: Not Applicable for TCLP Herbicides. %Recovery = (Calculated Value / True Value) *100%	Examine the project-specific DQOs. Contact the client as to additional measures to be taken. For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met. For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.	Analyst/Prep analyst	Accuracy (field samples)	See Method / SOP QC Acceptance Limits

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QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
MSDs or SDs	One MSD or per preparatory batch per matrix	MSD: For matrix evaluation, use LCS acceptance criteria specified by DoD, if available. Otherwise, use in-house LCS control limits. MSD or : RPD ≤ 30% (between MS and MSD or sample and). QC acceptance criteria for all target compounds as specified in: Not Applicable for TCLP Herbicides. %Recovery = (Calculated Value – Sample Value / True Value) *100% RPD = (Difference between MS and MSD) * 100 / (Average of MS and MSD)	Examine the project-specific DQOs. Contact the client as to additional measures to be taken. For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met. The data shall be evaluated to determine the source of difference.	Analyst	Precision and Accuracy (field samples)	See Method / SOP QC Acceptance Limits
Surrogate Spikes	All field and QC samples	QC acceptance criteria specified by DoD, if available. Otherwise, use in-house control limits. QC acceptance criteria for all target compounds as specified in: Worksheet 15.9 for TCLP Herbicides. %Recovery = (Calculated Value / True Value) *100%	For QC and field samples, correct problem then re-prep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary. Apply Q-flag to all associated analytes if acceptance criteria are not met. Alternative surrogates are recommended when there is obvious chromatographic interference.	Analyst/Prep analyst	Accuracy (Individual sample preparation efficiency control)	See Method / SOP QC Acceptance Limits

QAPP Worksheet 28 - QC Samples Table

Worksheet 28.7 - Herbicides

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QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Confirmation of positive results (second column or second detector)	All positive results must be confirmed	Calibration and QC criteria same as for initial or primary column analysis. Results between primary and second column RPD ≤ 40%.	Apply J-flag if RPD > 40%. Discuss in the case narrative. Use project-specific reporting requirements if available; otherwise, use method reporting requirements; otherwise, report the result from the primary column.	Analyst	Representativeness and Precision	See Method / SOP QC Acceptance Limits
Results reported between LOD and LOQ	All positive results between LOD and LOQ	Not Applicable	Apply J-flag to all results between LOD and LOQ.	Analyst	Representativeness	See Method / SOP QC Acceptance Limits

Ref: USEPA Test Methods for Evaluating Solid Waste Physical/Chemical Methods, Update IV (USEPA, 2007) and DoD Quality Systems Manual for Environmental Laboratories, Final Version 4.2 (DoD, 2010).

QAPP Worksheet 28 - QC Samples Table

Worksheet 28.8 – Reactivity, Ignitability, and pH

Matrix	IDW
Analytical Group	Reactivity (CN & S), Ignitability, and pH
Analytical Method / SOP Reference	SW-846 Sec. 7.3, 9040C/9045D, and 1010A/1030 Aqueous: WL-054, WL-051, WL-015, WL-060, Solids: WL-054, WL-051, WL-015, WL-066, & EXT-032
Field Sampling Organization	Shaw
Analytical Organization	GCAL

QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Initial Calibration (ICAL)	Initial calibration prior to sample analysis.	Initial calibration for all analytes (ICAL): CN: Minimum 6 standards and a calibration blank with linear least squares regression: R≥0.995. Ignitability: p-Xylene, first source flash point of p-Xylene is 77 ± 4.3°F pH: Initial calibration for all analytes (ICAL): Minimum three standards. pH 4.00, 7.00, and 10.00. Percent recoveries for initial calibration must be within ±0.05 units of standard true value for pH.	Correct problem then repeat initial calibration. Flagging criteria are not appropriate. Problem must be corrected. No samples may be run until ICAL has passed. Ignitability: Second analyst witnessing flash. Calibrate thermometer.	Analyst	Laboratory Precision	See Method / SOP QC Acceptance Limits
Distilled standards (one high and one low)	Once per multipoint calibration	CN: Within ±15%R of true value. Not applicable for S, pH, or ignitability.	Correct problem, then repeat distilled standards. Flagging criteria are not appropriate. Problem must be corrected. No samples may be run until distilled standards have passed.	Analyst	Laboratory Accuracy	See Method / SOP QC Acceptance Limits
Initial calibration verification (ICV) (Second Source)	Once after each initial calibration, prior to sample analysis.	CN& S: Value of second source for all analyte(s) within ±15%D of expected value (initial source). Ignitability: p-Xylene, second source flash point of p-Xylene is 77 ± 4.3°F	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat initial calibration. Flagging criteria are not appropriate. Problem must be corrected. No samples may be run until calibration has been verified. Ignitability: Second analyst witnessing flash. Calibrate thermometer.	Analyst	Laboratory Precision	See Method / SOP QC Acceptance Limits

Matrix	IDW					
Continuing Calibration Verification (CCV)	Opening CCV, then every 10 samples, with closing CCV	CN & S: %D≤10% pH: Percent recoveries for continuing calibration must be within ±0.05 units of standard true value for pH.	Correct problem then repeat CCV and reanalyze all samples since last successful CCV. If that fails, then repeat initial calibration.	Analyst	Laboratory Precision	See Method / SOP QC Acceptance Limits

QAPP Worksheet 28 - QC Samples Table

Worksheet 28.8 - Reactivity, Ignitability, and pH

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QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank (MB)	One per preparatory batch per matrix	All Target Compounds <LOD. Project QLs for all target compounds are specified in: Worksheet 15.10 for React CN and S IDW	The source of the contamination is investigated and eliminated before proceeding with further analysis. Correct the problem. Any sample associated with a blank that fail these criteria checks shall be reprocessed in a subsequent preparation batch, except when the sample analysis resulted in a non-detect. If no sample volume remains for reprocessing, the results shall be reported with appropriate data qualifying code "U".	Analyst/Prep analyst	Laboratory Representativeness (Absence of interference/ contamination)	See Method / SOP QC Acceptance Limits
Laboratory Control Sample (LCS)	One LCS per preparatory batch per matrix	QC acceptance criteria for all target compounds as specified in: Worksheet 15.10 for React CN and S IDW Ref.: DoD QSM, if available, otherwise laboratory's own in-house criteria. %Recovery = (Calculated Value/True Value) *100%%Recovery = (Calculated Value/True Value) *100%	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. Source of poor recovery is investigated and eliminated before proceeding with further analysis. If corrective action fails or insufficient volumes, apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Analyst/Prep analyst	Laboratory Accuracy	See Method / SOP QC Acceptance Limits
Sample Duplicate	One per batch per matrix or every 20 samples	pH: QC acceptance criteria for all target compounds as: %RPD≤10% RPD = (Difference between S and SD) * 100 / (Average of S and SD)	If sufficient sample volume is available, reanalyze affected samples. Qualify data as needed.	Analyst/Prep analyst	Laboratory Precision	See Method / SOP QC Acceptance Limits
Results reported between LOD and LOQ	All positive results must be confirmed	Not Applicable	Apply J-flag to all results between LOD and LOQ.	Analyst	Representativeness	Not Applicable

Ref: USEPA Test Methods for Evaluating Solid Waste Physical/Chemical Methods, Update IV (USEPA, 2007) and DoD Quality Systems Manual for Environmental Laboratories, Final Version 4.2 (DoD, 2010).

QAPP Worksheet 29 - Project Documents and Records Table

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Sample Collection Documents and Records	On-Site Analysis Documents and Records	Off-Site Analysis Documents and Records	Data Assessment Documents and Records	Other
Field / Communication Logbooks and Logsheets	Not Applicable	Chain of Custody Records	Laboratory QSM Manual	Not Applicable
Daily Tailgate Safety Meeting Forms		Sample Receipt Confirmation Forms	Laboratory Accreditation Certificates or Letters	
Site Maps with Sampling Locations		Internal Sample Tracking Forms	Communication Logbooks	
Chain of Custody Records		Extraction and Prep Logs Books	Data Review-noted in Logbooks	
Custody Seals		Laboratory LIMs Login	EDDs with site specific goals evaluated and or entered	
Air Bill Records		Standard Logbooks	PDF and hardcopy of Final Laboratory Data Report	
		Non Conformance Records	Weekly H&S Communications	
		Communication Logbooks	Safety Audit Checklists (if performed)	
		Sample Chronology (time of receipt, extraction, and analysis)		
		Identification of QC Samples (Blanks, Duplicates, MS/MSD, LCS)		
		Definitions of Laboratory Data Qualifiers		
		Documentation of Lab QC Issues		
		Instrument Calibration Logbooks		
		Instrument Maintenance Logbooks		
		EDDs		
		Laboratory Name		
		Case Narrative		
		Laboratory Sample Accession Numbers		
		Reporting Forms		
		Reporting Checklists- for Completeness		
		Signature of laboratory sign-off		
		MDL Studies		
		Performance Evaluation Results		
		Laboratory Accreditation Certificates or Letters		
		Site UPF-QAPP		
		Sample Disposal Records		

QAPP Worksheet 30 - Analytical Services Table

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Matrix	Analytical Group	Sample Locations/ID Number	Analytical SOP	Data Package Turnaround Time	Laboratory / Organization[1] (name and address, contact person and telephone number)	Backup Laboratory / Organization [1] (name and address, contact person and telephone number)
Support Sampling Surface Water	TAL ICPMS Metals	RODSW30001 up to RODSW300## (Blind Field duplicates RODSW01D up to RODSW##D at frequency of 1 per 10)	SW-846 3010A/6020A GCAL MET-005 & MET-021	Form I's = 14 Calendar Days	Gulf Coast Analytical, Inc. Brenda Martinez 7979 GSRI Avenue Baton Rouge, LA 70820 Phone: 225-769-4900 Fax: 225-767-5717 brenda.martinez@gcal.com	Empirical Laboratories, LLC 621 Mainstreet Drive, Suite 270, Nashville, TN 37228 Sonya Gordon Phone: (615) 345-1115 ext. 238 sgordon@empirlabs.com
	TAL Mercury		SW-846 7470A GCAL MET-006 & MET-008	Hardcopy Shaw Level 4 CLP Like & EDD = 21 Calendar Days		
Support Sampling Soil	TAL ICPMS Metals	RODSS10000 up to RODSS100## (Blind Field duplicates RODSS01D up to RODSS##D at frequency of 1 per 10)	SW-846 3050B/6020A GCAL MET-004 & MET-021	Form I's = 14 Calendar Days Hardcopy Shaw Level 4 CLP Like & EDD = 21 Calendar Days	Gulf Coast Analytical, Inc. Brenda Martinez 7979 GSRI Avenue Baton Rouge, LA 70820 Phone: 225-769-4900 Fax: 225-767-5717 brenda.martinez@gcal.com	Empirical Laboratories, LLC 621 Mainstreet Drive, Suite 270, Nashville, TN 37228 Sonya Gordon Phone: (615) 345-1115 ext. 238 sgordon@empirlabs.com
	TAL Mercury		SW-846 7471B GCAL MET-006 & MET-008			
	Explosives		SW-846 8330B Mod; EXTNT02, HPLC02		Gulf Coast Analytical, Inc. Brenda Martinez 7979 GSRI Avenue Baton Rouge, LA 70820 Phone: 225-769-4900 Fax: 225-767-5717 brenda.martinez@gcal.com	
	Perchlorate		SW-846 6850; HPLC06			
	TAL SPLP ICPMS Metals		SW-846 1312/3010A/6020A GCAL EXT-070, MET-005, & MET-021		Gulf Coast Analytical, Inc. Brenda Martinez 7979 GSRI Avenue Baton Rouge, LA 70820 Phone: 225-769-4900 Fax: 225-767-5717 brenda.martinez@gcal.com	
	TAL SPLP Mercury		SW-846 1312/7470A GCAL EXT-070, MET-006, & MET-008			
Groundwater Sampling Groundwater	TAL ICPMS Metals	RODMW20000 up to RODMW200## (Field duplicates RODMW01D up to RODMW##D at frequency of 1 per 10)	SW-846 3010A/6020A GCAL MET-005 & MET-021	Form I's = 14 Calendar Days Hardcopy Shaw Level 4 CLP Like & EDD = 21 Calendar Days	Gulf Coast Analytical, Inc. Brenda Martinez 7979 GSRI Avenue Baton Rouge, LA 70820 Phone: 225-769-4900 Fax: 225-767-5717 brenda.martinez@gcal.com	Empirical Laboratories, LLC 621 Mainstreet Drive, Suite 270, Nashville, TN 37228 Sonya Gordon Phone: (615) 345-1115 ext. 238 sgordon@empirlabs.com
	TAL Mercury		SW-846 7470A GCAL MET-006 & MET-008			

QAPP Worksheet 30 - Analytical Services Table
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Concrete and Dust/Chip Characterization Sampling Concrete and Dust/Chip	TCLP VOCs	RODDS50000 up to RODDS500## (No Field duplicates)	SW-846 1311/8260B GCAL EXT-036 & GCMSV-003	Form I's = 14 Calendar Days Hardcopy Shaw Level 4 CLP Like & EDD = 21 Calendar Days	Gulf Coast Analytical, Inc. Brenda Martinez 7979 GSRI Avenue Baton Rouge, LA 70820 Phone: 225-769-4900 Fax: 225-767-5717 brenda.martinez@gcal.com	Empirical Laboratories, LLC 621 Mainstreet Drive, Suite 270, Nashville, TN 37228 Sonya Gordon Phone: (615) 345-1115 ext. 238 sgordon@empirlabs.com
	TCLP SVOCs		SW-846 1311/8270C GCAL EXT-026, EXT-003, & GCMSSV-001			
	TCLP Pesticides		SW-846 1311/8081A GCAL EXT-026, EXT-010, & GC-013			
	TCLP Herbicides		SW-846 1311/8151A GCAL EXT-026, EXT-017, & GC-011			
	TCLP ICP Metals		SW-846 1311/3010A/6010C GCAL EXT-026, MET-005, & MET-010			
	TCLP Mercury		SW-846 1311/7470A GCAL EXT-026 & MET-008			
IDW Sampling Aqueous and Solid	TCLP VOCs	RODDS50000 up to RODDS500## (No Field duplicates)	SW-846 1311/8260B GCAL EXT-036 & GCMSV-003	Form I's = 14 Calendar Days Hardcopy Shaw Level 4 CLP Like & EDD = 21 Calendar Days	Gulf Coast Analytical, Inc. Brenda Martinez 7979 GSRI Avenue Baton Rouge, LA 70820 Phone: 225-769-4900 Fax: 225-767-5717 brenda.martinez@gcal.com	Empirical Laboratories, LLC 621 Mainstreet Drive, Suite 270, Nashville, TN 37228 Sonya Gordon Phone: (615) 345-1115 ext. 238 sgordon@empirlabs.com
	TCLP SVOCs		SW-846 1311/8270C GCAL EXT-026, EXT-003, & GCMSSV-001			
	TCLP Pesticides		SW-846 1311/8081A GCAL EXT-026, EXT-010, & GC-013			
	TCLP Herbicides		SW-846 1311/8151A GCAL EXT-026, EXT-017, & GC-011			
	TCLP ICP Metals		SW-846 1311/3010A/6010C GCAL EXT-026, MET-005, & MET-010			
	TCLP Mercury		SW-846 1311/7470A GCAL EXT-026 & MET-008			
	Reactivity (CN & S)		SW-846 Sec 7.3 GCAL WL-054, WL-051, & WL-015			
	Ignitability		SW-846 1010A/1030 GCAL WL-060 & WL-066			
	pH		SW-846 9040C/9045D GCAL EXT-033 & EXT-032			

[1]GCAL will subcontract the Perchlorate and Explosives analysis to Microbac (ELAP accredidation). If a backup laboratory is required due to laboratory loading or any other issues, Empirical Laboratories, LLC. will serve as backup laboratory. Shelley A. Bourgeois (GCAL) will still serve as the Laboratory PM for this Shaw project. GCAL will notify the Shaw Project Chemist, Eric Malarek, prior to any sample transfers. All laboratories carry ELAP for the DoD program and have proper instrumentation and qualifications to perform the analysis required by this project.

QAPP Worksheet 31 - Planned Project Assessment Table

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (title and organizational affiliation)	Person(s) Responsible for Responding to Assessment Findings (title and organizational affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions (CA) (title and organizational affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA (title and organizational affiliation)
Review of QAPP with Field Staff	1/prior to sampling start up	Internal	Shaw	Douglas Schicho, PM, Shaw	Kevin Gerdes, Environmental Sampling Lead, Shaw	Kevin Gerdes, Environmental Sampling Lead, Shaw	Douglas Schicho, PM, Shaw
Daily QC Report	Daily	Internal	Shaw	Braden Livingstone, UXOQCS, Shaw	Douglas Schicho, PM, Shaw	Douglas Schicho, PM, Shaw	Braden Livingstone, UXOQCS, Shaw
Laboratory Assessment for Appropriate Certifications, Capacity and QAPP Review with Staff	1/prior to sampling start up	Internal	Shaw	Eric Malarek, Project Chemist, Shaw	Scott Bailey and David Vandenberg Laboratory Directors, GCAL and Microbac; Shelley Bourgeois and David Bumgarner , Laboratory QA Officers, GCAL and Microbac	Scott Bailey and David Vandenberg Laboratory Directors, GCAL and Microbac; Shelley Bourgeois and David Bumgarner , Laboratory QA Officers, GCAL and Microbac	Eric Malarek, Project Chemist, Shaw
Daily Tailgate Safety Meeting	Daily	Internal	Shaw	Bill Wren, UXOSO, Shaw	Douglas Schicho, PM, Shaw; Winston Russell, H&S Manager, Shaw	Douglas Schicho, PM, Shaw; Winston Russell, H&S Manager, Shaw	Bill Wren, UXOSO, Shaw
Field Sampling and COC Review Against QAPP Requirements	Daily	Internal	Shaw	Eric Malarek, Project Chemist, Shaw	Douglas Schicho, PM, Shaw; Mark Magness, Environmental Sampling Lead, Shaw	Douglas Schicho, PM, Shaw; Mark Magness, Environmental Sampling Lead, Shaw	Eric Malarek, Project Chemist, Shaw
Laboratory Report Deliverables and Analytical Results Against QAPP Requirements Data Verification	Per Sample Delivery Group	Internal	Shaw	Eric Malarek, Project Chemist, Shaw	Shelley Bourgeois and David Bumgarner , Laboratory QA Officers, GCAL and Microbac	Shelley Bourgeois and David Bumgarner , Laboratory QA Officers, GCAL and Microbac	Eric Malarek, Project Chemist, Shaw

QAPP Worksheet 32 - Assessment Findings and Corrective Action Responses

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Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (name, title, organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (name, title, organization)	Timeframe for Response
Review of QAPP with Field Staff	Contained with written Daily QC report for that day.	Douglas Schicho, PM, Shaw	Immediately, not to exceed 24 hours	Daily QC Report would be amended with corrective action	Douglas Schicho, PM, Shaw	Immediate within 24 hours
Laboratory Assessment for Appropriate Certifications, Capacity and QAPP Review with Staff	Receipt of copies of certifications. Email traffic concerning lab capacity prior to sampling start-up. QAPP sign-off sheet received from laboratory.	Douglas Schicho, PM, Shaw	Immediate	Response to email	Douglas Schicho, PM, Shaw	48 hours after notification
Daily Tailgate Safety Meeting	Verbal debriefing and daily sign-off log. If a safety violation occurs, a Supervisor Injury Employee Report is completed.	Douglas Schicho, PM, Shaw; Winston Russell, H&S Manager, Shaw	Immediately, not to exceed 24 hours	Included as part of the process of the Supervisor Injury Employee Report	Bill Wren, UXOSO, Shaw	Immediate within 24 hours
Daily QC Report	Contained in RA Report.	Douglas Schicho, PM, Shaw	Immediately, not to exceed 24 hours	Daily QC Report would be amended with corrective action	Braden Livingstone, Field Lead, Shaw	Immediate within 24 hours
Field Sampling and COC Review Against QAPP Requirements	Communication may be in the form of email traffic.	Douglas Schicho, PM, Shaw; Kevin Gerdes, Environmental Sampling Lead, Shaw	24 hours after sampling	Response to email	Douglas Schicho, PM, Shaw	48 hours after notification
Laboratory Report Deliverables and Analytical Results Against QAPP Requirements	Communication may be in the form of email traffic.	Douglas Schicho, PM, Shaw; Eric Malarek, Project Chemist, Shaw; Brenda Martinez, PM, GCAL	24 hours after completion of analytical work	If required laboratory reports will be amended and corrections noted in the analytical narrative	Douglas Schicho, PM, Shaw; Eric Malarek, Project Chemist Shaw	72 hours after notification
Data Verification	Communication may be in the form of email traffic requesting additional laboratory forms, back up data that may be missing and/or clarification of the analytical report.	Shelley Bourgeois, Laboratory QA Officer, GCAL	24 hours after finding deficiency	If required, laboratory reports will be amended and corrections noted in the analytical narrative and contained with the validation report	Eric Malarek, Project Chemist Shaw	Up to 7 days

QAPP Worksheet 32 - Assessment Findings and Corrective Action Responses
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Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (name, title, organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (name, title, organization)	Timeframe for Response
Validation	Communication may be in the form of email traffic requesting additional laboratory forms, back up data that may be missing, and/or clarification of the analytical report.	Shelley Bourgeois, Laboratory QA Officer, GCAL	24 hours after finding deficiency	If required, laboratory reports will be amended and corrections noted in the analytical narrative and contained with the validation report	Eric Malarek, Project Chemist Shaw	Up to 7 days

QAPP Worksheet 33 - QA Management Reports Table

Type of Report	**Frequency** (daily, weekly monthly, quarterly, annually, etc.)	**Projected Delivery Date(s)**	**Person(s) Responsible for Report Preparation** (title and organizational affiliation)	**Report Recipient(s)** (title and organizational affiliation)
Status Reports	Weekly while in the field	October 2012- September 2013	Jeff Tarr, Site Manager, Shaw	Stephen Absolom, BEC SEDA; Randy Battaglia, PM USACE NY District; Tom Battaglia, Tech Lead USACE NY District; John S. Nohrstedt, PM USAESCH; Kevin Healy, Tech Lead, USAESCH
Progress Reports	Monthly	Monthly after project start up	Douglas Schicho, PM, Shaw	Stephen Absolom, BEC SEDA; Randy Battaglia, PM USACE NY District; Tom Battaglia, Tech Lead USACE NY District; John S. Nohrstedt, PM USAESCH; Kevin Healy, Tech Lead, USAESCH
Final Report	Once at End of Project	September 2014	Douglas Schicho, PM, Shaw	Stephen Absolom, BEC SEDA; Randy Battaglia, PM USACE NY District; Tom Battaglia, Tech Lead USACE NY District; John S. Nohrstedt, PM USAESCH; Kevin Healy, Tech Lead, USAESCH Julio Vazquez, RPM, USEPA Kuldeep Gupta, NYSDEC;

QAPP Worksheet 34 - Sampling and Analysis Verification (Step I) Process Table

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Verification Input	Description	Internal / External	Responsible for Verification (name, organization)
Field Staff Training	Personnel assigned to the project, including field personnel and subcontractors, will be qualified to perform the tasks to which they are assigned. This includes but is not limited to basic sampling techniques, field testing methodology, task-specific sampling methods, maintenance of environmental paperwork, and how to avoid cross contamination. In addition to education and experience, specific training may be required to qualify individuals to perform certain activities. Training will be documented appropriately and the forms placed in the project file as a record. Project personnel will receive an orientation to the full QAPP, RA Work Plan, and the Site Safety and Health Plan (SSHP) as appropriate to their responsibilities before participation in project activities. Training of field personnel will be provided by the Senior UXO Supervisor (SUXOS), UXOQCS, or by a qualified designee.	Internal	Douglas Schicho / Shaw Braden Livingstone UXOQCS / Shaw Eric Malarek / Shaw
QAPP	A copy of the reviewed and approved version of the QAPP will be distributed to the laboratory and be available for review for all Shaw personnel involved in this project. It is the responsibility of the Shaw Project Chemist to ensure delivery of a copy of the QAPP to the laboratory. The Laboratory QA Officer is responsible for review of the QAPP with laboratory staff. The Shaw PM and the SUXOS are responsible for ensuring that all staff have reviewed the final QAPP.	Internal/External	Douglas Schicho / Shaw Eric Malarek / Shaw Braden Livingstone UXOQCS / Shaw Shelley Bourgeois / GCAL David Bumgarner / Microbac
Laboratory QSM	Gulf Coast Laboratories, Inc. has a detailed Quality Assurance Program Plan, Effective Date 09/29/11, Revision #30 that is designed to meet the quality program requirements of ELAP and ISO Guide 25. The QSM is included in Attachment C of this QAPP. Gulf Coast Laboratories, Inc will provide Shaw a copy of the latest QSM prior to project start up.	Internal/External	Shelley Bourgeois / GCAL David Bumgarner / Microbac Eric Malarek / Shaw

QAPP Worksheet 34 - Sampling and Analysis Verification (Step I) Process Table
Page 2 of 6

Verification Input	Description	Internal / External	Responsible for Verification (name, organization)
Laboratory Staff Training	Laboratory senior management staff retains oversight responsibility for the data integrity program and retains the ultimate responsibility for execution of the data integrity program elements. Senior laboratory management staff is responsible for providing the resources required to conduct SOPs, ethics training, and operate data integrity evaluation procedures. Laboratory employees receive technical ethics training during new employee orientation. All employees are required to attend ethics refresher training and to sign an ethical conduct agreement annually, which verifies their understanding of the laboratory's ethics policy and the analyst's ethical responsibilities. Training on data integrity procedures and SOPs are conducted by the individual departments' group leaders within the laboratory. All records of training are retained at the laboratory in the individual staff training folders and are maintained by the laboratory quality assurance officer. All information related to staff qualifications, experience, external training courses, and education are placed into the individual's training file. Verification documentation for laboratory orientation, health and safety, and quality assurance training is also maintained with the training file. Additional training documentation is added to the files as it occurs. This includes data for initial and continuing demonstrations of proficiency, performance evaluations, study data and notes, and attendance lists from individual and group training sessions.	Internal	Scott Bailey / GCAL Shelley Bourgeois / GCAL David Vandenberg / Microbac David Bumgarner / Microbac

QAPP Worksheet 34 - Sampling and Analysis Verification (Step I) Process Table
Page 3 of 6

Verification Input	Description	Internal / External	Responsible for Verification (name, organization)
Laboratory Certifications or Accreditations	Gulf Coast Laboratories, Inc has current ELAP accreditation meeting DoD QSM V4.2 requirements. The laboratory accreditations are included in Attachment E of this QAPP.	Internal/External	Shelley Bourgeois / GCAL David Bumgarner / Microbac
Field Logbooks	The sample number will be traceable to the site, location, and depth (where applicable). The sample identification and description will be recorded by the MC Sampling Lead in the sample collection logbook/logsheets. The PID and water quality parameters pH, conductivity, turbidity, temperature, dissolved oxygen, and oxidation/reduction potential will be recorded for each groundwater well location. The UXOQCS will perform daily reviews of field logbooks/logsheets each day of sampling.	Internal	Braden Livingstone UXOQCS / Shaw
Daily Field Progress Reports	MC Sampling Lead will provide daily reports to the Shaw PM via phone, fax, or e-mail. Further discussion may be found in Section 4.1 in the SEDA RA Work Plan.	Internal	Kevin Gerdes / Shaw
Sample Location Verification	The SUXOS will verify that the Sampling Lead has collected the samples from the proper locations and depths as described in Worksheet 18.	Internal	SUXOS / Shaw
Chain of Custody – Field Level	The MC Sampling Lead will complete the COC form during field sampling in accordance with the sample matrices and analytical tests required as described in Worksheet 19. Prior to placement in the cooler, the SUXOS will review the COC form against the field logbooks/logsheets and Worksheets 18 and 19 to ensure that the samples, sample volumes, and sample nomenclature match and the required analytical tests have been notated. A review of the COC form for completeness will also be conducted.	Internal	Environmental Sampling Lead / Shaw
Chain of Custody – Shaw Project Chemist	Upon completion of the COC form, the MC Sampling Lead will either fax or email the completed COC form to the Shaw Project Chemist. A review of the COC form against Worksheets 18 and 19 will be conducted to ensure that the samples, sample volumes, and sample nomenclature match and the required analytical tests have been notated. A review of the COC form for completeness will also be conducted.	Internal	Eric Malarek / Shaw

QAPP Worksheet 34 - Sampling and Analysis Verification (Step I) Process Table
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Verification Input	Description	Internal / External	Responsible for Verification (name, organization)
Chain of Custody – Analytical Laboratory	All samples to be analyzed by the fixed-base laboratory will be shipped via overnight courier service. Upon receipt, a representative of the laboratory will check the integrity of the custody seals, then locate, sign, and date the COC. The laboratory is responsible for verifying that the COC and containers are in agreement. The COC, a Cooler Receipt Form, and information regarding any discrepancies between the COC and bottle labels will be faxed to the Shaw Project Chemist prior to preparation for analysis. The LIMS will provide evidence of sample custody from receipt by the laboratory until appropriate disposal.	Internal	Brenda Martinez / GCAL Stephanie Mossburg / Microbac
LIMS Login – Analytical Laboratory	A review of the COC form against the laboratory LIMS login and the project analytical requirements as contained in Worksheet 19 will be conducted to ensure that the login is correct and the proper analytical tests have been assigned.	Internal	Brenda Martinez / GCAL Stephanie Mossburg / Microbac
LIMS Login – Shaw Project Chemist	A secondary review of the COC form against the laboratory LIMS login and the project analytical requirement as contained in Worksheet 19 will be conducted to ensure that the login is correct and the proper analytical tests have been assigned.	External	Eric Malarek / Shaw
Sample Receipt Form – Shaw Project Chemist	Gulf Coast Laboratories, Inc will provide within 48 hours of receipt of samples a copy of the sample receipt form. Any discrepancies between the COC and the sample containers will be noted and contained as part of the analytical record.	External	Eric Malarek / Shaw

QAPP Worksheet 34 - Sampling and Analysis Verification (Step I) Process Table
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Verification Input	Description	Internal / External	Responsible for Verification (name, organization)
Laboratory Corrective Action and Report Procedure	Routine corrective action is defined as procedures used to return out of control analytical systems back to control. This level of corrective action applies to all analytical QC parameters and analytical system specification as defined in the laboratory SOPs. Bench analysts have full responsibility and authority for performing routine corrective action. Routine corrective actions are documented as part of the analytical record. Defective processes, holding time violations, systematic errors and quality defects that occur are to be reported by the bench chemist immediately to the section supervisor and a nonconformance record initiated. The section supervisor will notify the designated Laboratory PM who will then notify the Shaw Project Chemist. All notifications must be made in a timely manner. The nonconformance record should become part of the analytical record.	Internal/External	Scott Bailey / GCAL Shelley Bourgeois / GCAL Brenda Martinez / GCAL David Vandenberg / Microbac David Bumgarner / Microbac Stephanie Mossburg / Microbac Eric Malarek / Shaw
Analytical Data Package – Laboratory	All data produced by the laboratory will be required to undergo several levels of review, which will include two levels of management review at the laboratory. The laboratory will review the data packages internally for completeness and verify that all of the required forms and raw data are included for each data package type. Random data packages may be chosen by the Empirical Laboratories QA Officer for additional audits.	Internal	Shelley Bourgeois / GCAL Brenda Martinez / GCAL David Bumgarner / Microbac Stephanie Mossburg / Microbac
Analytical Data Package / Laboratory QC – Shaw Project Chemist	The Shaw Project Chemist will verify that data has been received for all samples that have been sent to the laboratory. An evaluation of these data will be performed to determine whether the laboratory met the QC requirements as stated in the analytical methods and laboratory SOPs. Refer to Worksheets 19 and 28.	External	Eric Malarek / Shaw

QAPP Worksheet 34 - Sampling and Analysis Verification (Step I) Process Table
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Verification Input	Description	Internal / External	Responsible for Verification (name, organization)
Laboratory Electronic Data Deliverables	The laboratory will provide EDDs in Excel and EQUIS formats that have been generated by the laboratory's LIMS system. The Shaw Project Chemist will review these files for correctness and completeness. The Excel EDDs will facilitate the data evaluation and validation process and the EQUIS formats will be used to upload the data into the NYSDEC EQUIS database. Project specific action goals as defined in Worksheet 15 will be added and evaluated. Any QC issues that may impact the data use will be evaluated.	External	Eric Malarek / Shaw

QAPP Worksheet 35 - Sampling and Analysis Validation (Steps IIa and IIb) Process Table
Page 1 of 2

Step IIa / IIb	Validation Input	Description	Responsible for Validation (name, organization)
IIa	Field SOPs	Ensure that all sampling SOPs were followed.	Environmental Sampling Lead, Shaw
IIa	Analytical SOPs	Ensure that all laboratory analytical SOPs were followed.	Scott Bailey / GCAL David Vandenberg / Microbac
IIa	Documentation of Method QC Results	Establish that all method QC was analyzed for and in control as listed in the analytical SOPs. If method QA was not in control, the laboratory will have contacted Shaw of a nonconformance situation prior to report generation for guidance.	Eric Malarek, Shaw
IIa/IIb	Documentation of QAPP QC Sample Results	Establish that all QAPP-required QC samples were collected. Establish that the collected QC samples met the required limits as established in the QAPP using Daily Field Progress Reports.	Environmental Sampling Lead, Shaw Eric Malarek, Shaw
IIa/IIb	Documentation of Analytical Reports for Completeness	Ensure that from the COC generated in the field to the delivery of the analytical data that the appropriate analytical samples have been collected, appropriate site identifications have been used, and the correct analytical methods have been applied. Review the analytical reports to establish that all required forms, case narratives, samples, COC forms, logbooks, and raw data have been included.	Eric Malarek, Shaw
IIb	Project Quantitation Limits	Review laboratory analytical results to ensure they met the project quantitation limits specified in QAPP Worksheet 15.	Eric Malarek, Shaw
IIa/IIb	Data Verification	Data verification will be performed on all samples. Data verification ensures that sample analysis was performed as stated in the QAPP and per the laboratory SOPs.	Eric Malarek, Shaw

QAPP Worksheet 35 - Sampling and Analysis Validation (Steps IIa and IIb) Process Table
Page 2 of 2

Step IIa / IIb	Validation Input	Description	Responsible for Validation (name, organization)
IIa/IIb	Data Validation	The TCLP concrete/dust/chip characterization and TCLP/RCRA IDW disposal parameters will require a data review only. The limited validation effort to assess laboratory performance will include a review of: completeness, chain-of-custody, holding times, QC results reported on summary forms (LCS, Method blanks, MS/MSD, serial dilutions), detection and reporting limits, and other contractual items. A full level data validation will be performed on all soil and groundwater support samples including all MC support samples for explosives, perchlorate, and TAL metals and on the LTM groundwater samples for TAL metals. This includes detailed evaluations of the data such as calibrations, calibration check standards, quantitation verifications, instrument tunes, interference check samples, surrogates, MS/MSD, LCS, method and calibration blanks, holding times and preservation. See Worksheet 37 for further details. Data will be validated in accordance with criteria as specified in Worksheets 12, 15, 19, and 28 which is based upon: • *DoD Quality Systems Manual for Environmental Laboratories, Final Version 4.2, October 25, 2010* (DoD, 2010), • *DoD Perchlorate Handbook August, Rev1, Change 1, 2007* (DoD, 2007), • *USEPA SW-846* and *USEPA Methods for Chemical Analysis of Water and Wastes* methodology. Validation qualifiers will be consistent with the USEPA Region II SOPs (if required). This includes: • *USEPA Region II Evaluation of Metals Data for the Contract Laboratory Program, Revision 13* (SOP HW-2, September 2006). • *USEPA Region II Validation of Data Nitroaromatics and Nitroamines by HPLC, SW-846, Method 8330A, Revision 2* (SOP HW-16, September 2006). The laboratory will provide EDDs in Excel and EQUIS formats that have been generated by the laboratory's LIMS system. The Excel EDDs will facilitate the data evaluation and validation process and the EQUIS format will be used to upload the data into the NYSDEC EQUIS database. The validation report and EDD turnaround time is 30 calendar days from data package receipt.	Eric Malarek, Shaw

QAPP Worksheet 36 - Sampling and Analysis Validation (Steps IIa and IIb) Summary Table

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Step IIa / IIb	Matrix	Analytical Group	Validation Criteria	Data Validator (title and organizational affiliation)
Support Sampling IIa/IIb	Surface Water	TAL ICPMS Metals	The MC support and groundwater sampling data will be validated in accordance with criteria as specified in Worksheets 12, 15, 19, and 28 which is based upon: • *DoD Quality Systems Manual for Environmental Laboratories, Final Version 4.2, October 25, 2010* (DoD, 2010), • *DoD Perchlorate Handbook August, Rev1, Change 1, 2007* (DoD, 2007), • Cited USEPA SW-846 methodology. Validation qualifiers will be consistent with the USEPA Region II SOPs (if required). This includes: • *USEPA Region II Evaluation of Metals Data for the Contract Laboratory Program, Revision 13* (SOP HW-2, September 2006). • *USEPA Region II Validation of Data Nitroaromatics and Nitroamines by HPLC, SW-846, Method 8330A, Revision 2* (SOP HW-16, September 2006). Excel EDDs will facilitate the data evaluation and validation process and the EQUIS format will be used to upload the data into the NYSDEC EQUIS database. The validation report and EDD turnaround time is 30 calendar days from data package receipt.	Eric Malarek, Shaw
		TAL Mercury		
	Soil	TAL ICPMS Metals		
		TAL Mercury		
		Explosives		
		Perchlorate		
		SPLP ICP Metals		
		SPLP Mercury		
Groundwater Sampling IIa/IIb	Groundwater	TAL ICPMS Metals		
		TAL Mercury		
Concrete and Dust/Chip Characterization Sampling IIa/IIb	Concrete and Dust/Chip	TCLP VOCs	The TCLP concrete/dust/chip samples and TCLP/RCRA IDW disposal parameters will require a limited validation review. The limited validation effort to assess laboratory performance will include a review of: completeness, chain-of-custody, holding times, QC results reported on summary forms (LCS, Method blanks, MS/MSD, equipment blank), detection and reporting limits, and other contractual items.	
		TCLP SVOCs		
		TCLP Pesticides		
		TCLP Herbicides		
		TCLP ICPMS Metals		
		TCLP Mercury		
IDW Sampling IIa/IIb	Aqueous and Solid	TCLP VOCs		
		TCLP SVOCs		
		TCLP Pesticides		
		TCLP Herbicides		
		TCLP ICPMS Metals		
		TCLP Mercury		
		Reactivity (CN & S)		
		Ignitability		
		pH		

QAPP Worksheet 37 - Usability Assessment

Summarize the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used:

It is the joint responsibility of the project team listed in this QAPP to ensure that the data collected meet the requirements listed in this QAPP.

Describe the validation process and evaluative procedures used to assess overall measurement error associated with the project:

The following describes the documentation and processes that will be used during the usability assessment and notes how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies. Field data generated by the field personnel is initially reviewed, processed, and evaluated on site by the technical lead, task manager, and/or his/her designee. Copies of the original forms are maintained on site for reference, and the originals are then forwarded to the data coordinator for further review, inclusion into the project database, and final storage in the project central files. The data review process is outlined in Data Management and Evaluation - SEDA Generic Site-Wide SAP (Parsons, July 2006), Section 8.0.

Step 1: Data Deliverables:

Hard copy and electronic analytical data (Excel and EQUIS files) are delivered to the project chemist for initial review, copying, and distribution (e.g., to validator), with the original hard copy going to project central files. The laboratory data will be reported for each analyte for the MDL, LOD, and RL. In addition, any positive value detected between the MDL and the RL must be reported as an estimated "J" concentration. Data validator may also receive a working hardcopy and EDDs for their validation. The laboratory will address via a brief explanation in the Non-Conformance Log any non-conformance that is not within their control. The final laboratory non conformance report shall be provided with the hardcopy data package to the project chemist and data validator to expedite the validation process and the validation qualifier fields populated. The final project deliverables may include electronic file copies of the validation reports for stakeholder use.

Step 2: Data Verification (Limited Validation)

Data verification is defined as "confirmation by examination and provision of objective evidence that specified requirements have been fulfilled." Data validation is defined as "confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use have been fulfilled" (USEPA QA/G-5). All data undergoes a data verification step. The data verification effort to assess laboratory performance will include a review of: completeness, chain-of-custody, holding times, QC results reported on summary forms (LCS, Method blanks, MS/MSD, equipment blank), detection and reporting limits, and other contractual items. Criteria for QC results will be compared work plan requirements as per QAPP Worksheets 12, 15, 19, and 28 based on DOD QSM V4.2 and cited USEPA SW-846 or other methodology (as applicable). Analysis used for disposal criteria comparisons and not used directly in the final risk assessments; will only require a limited validation effort. This includes the TCLP characterization analyses for the concrete/dust/chip and IDW samples.

Step3: Full Data Validation

For SEDA RA, the MC support (TAL metals, explosives, perchlorate, and SPLP metals) and groundwater (TAL metals) sampling data performed by the environmental laboratories will require full validation (see Worksheets 30, 35, and 36). The TCLP concrete/chip and IDW characterization samples will require only require limited validation reviews. The validator will evaluate the laboratory data (by SDG and method), QC results, and laboratory data qualifiers and will apply data validation qualifiers based upon set criteria set forth in this QAPP including the DOD QSM V4.2 and cited method criteria as applicable. These qualifiers may be different from those applied by the laboratory and determine data usability. This includes accuracy (blanks, surrogates, MSs, LCS, etc.), precision (lab duplicates, field duplicates, MSDs, LCS duplicates, SDs, etc.), as well as other method data quality controls such as calibrations, instrument tunes, performance and interference check samples. The Excel EDD files will aid in the validation review process. The project chemist or designee will review each data validation report and associated EDDs. The reviewer may use various checklists during the verification process to document all the verification activities. If used, completed checklists will be available for review upon request. However, these checklists will not be included as part of the data packages. All qualifications will be explained in the data validation reports. All qualified data near the governing criteria will be evaluated against project DQOs for fitness for use.

All applicable analyses should meet the recommended DOD QSM V4.2 as well as the method guidance found in *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846,* Update IV (USEPA, 2007), and its subsequent updates as well as the DoD Perchlorate Handbook. All other requested analyses will conform to their specified method. Validation qualifiers will be consistent with the USEPA Region II SOPs (if required). This includes:

- *USEPA Region II Evaluation of Metals Data for the Contract Laboratory Program, Revision 13* (SOP HW-2, September 2006).
- *USEPA Region II Validation of Data Nitroaromatics and Nitroamines by HPLC, SW-846, Method 8330A, Revision 2* (SOP HW-16, September 2006).

Step4: PARCCS Analysis

The data usability assessment is performed by Shaw for data associated with delineation, risk assessment, or confirmatory sampling. The project chemist and/or the task lead perform the usability assessment on analytical data, as defined by precision, accuracy, representativeness, comparability, completeness, and sensitivity (PARCCS) definitions. A combination of checklists and/or data validation summaries are used to document data validation activities. A quality control summary report or similar document may be used to summarize the DQO for each task, place qualifications on data, note implications or constraints on data use, and identify an overall assessment of data completeness and usability.

Part of the review to determine whether DQOs are met involves evaluating a series of data quality indicators that include measurements of the PARCCS parameters. How each of these measurements is to be performed and assessed is discussed here-in. The target acceptance criteria for the results have been developed for a wide variety of anticipated analyses on soil, surface water, and groundwater matrix samples and are presented in the internal laboratory quality control (QC) validation criteria found in Worksheets 12, 15, 19, and 28. The Project Chemist completes the data review process by reviewing areas in which data non-conformances were identified by the validator. If data are determined to be un-usable (e.g. “R-flagged”), impacts (e.g. critical samples/analytes) to the project are evaluated on a case-by-case basis to determine if re-sampling or re-analysis is warranted through a corrective action report to ensure that only reliable results are used by the project and that enough usable data is available to support the decisions being made. The corrective action report addresses how this problem will be

resolved and corrective actions implemented. A summary of the overall project accuracy, precision, representativeness, completeness, comparability, and sensitivity is discussed in the Final RA Report. This includes a discussion and impacts of the validation qualifications, blank assessments, sampling and analytical completeness, and analytical sensitivity analysis. The data quality indicators include:

Precision

Precision refers to the reproducibility of measurements and is defined as the measurement of mutual agreement among individual measurements of the same property, usually under "prescribed similar conditions." Analytical precision is assessed through the analysis of lab duplicates, field duplicates, MSDs, and lab sample duplicates. Precision is expressed in terms of the RPD between duplicate determinations or in terms of the RSD when three or more determinations are made. Various measures of precision exist, depending on the prescribed similar conditions. Overall sampling and analysis precision are assessed using RPD for duplicate environmental samples. The RPD for MS/MSD sample results are used to assess laboratory spike recovery precision. RPD is defined as the difference between two measurements divided by their mean and expressed as a percent, as shown in Equation (1):

$$RPD\ (\%) = [(D1-D2)/\ A] * 100 \qquad \text{Eq. (1)}$$

where:

D_1 = The result from the original determination

D_2 = The result from a duplicate measurement.

RSD is the standard deviation of a set of values divided by the average value expressed as a percent, as shown in Equation (2):

$$\mathrm{RSD} = \left(\frac{\sigma_{n-1}}{\overline{X}(x_1 \ldots x_n)} \right) \times 100 \qquad \text{Eq. (2)}$$

where:

σ_{n-1} = The sample standard deviation of the sample data

n = The number of determinations

$\overline{X}(x_1 \ldots x_n)$ = The arithmetic mean of the sample data.

Accuracy

Accuracy is a measure of the bias in a system or the degree of agreement of a measurement X (or an average of measurements of the same parameter) against an accepted reference or true value, T. Accuracy is typically expressed as a percent recovery calculated by the ratio of the measurement and accepted true value, as shown in Equation (3):

$$\text{Percent Recovery} = \left(\frac{(X - S)}{T} \right) \times 100 \qquad \text{Eq. (3)}$$

where:

X = The experimentally determined concentration
S = The sample concentration before spiking
T = The "true" concentration.

Analytical accuracy is assessed through the analysis of spikes, such as surrogates, MS/MSD, and LCSs; audit samples and/or standard laboratory reference materials; and calibration check verification samples. With the surrogates and MS/MSDs that are spiked onto the actual sample matrix and analyzed, these accuracy indicators must take into account the nature of the matrix in question and the native concentration of the analyte spiked. Matrix variability or interferences from high concentrations of native compounds may adversely affect spike recovery and yield less than conclusive data. Accuracy checks that focus on analytical method and consist of compounds spiked in a "blank" or non-interfering matrix (e.g., LCSs, standard laboratory reference materials, or calibration verification check samples) address the accuracy of the method and/or instrumentation in detecting the target analyte(s) at a certain quantification level and are not considered to be subject to matrix effects.

Representativeness

Representativeness is a qualitative parameter that expresses the degree to which sample data actually represent the matrix conditions. Requirements and procedures for sample collection and handling are designed to maximize sample representativeness. Representativeness can also be monitored by reviewing field documentation and by performing field QA audits. Other sampling approaches where representativeness is a concern are in building composite samples and in using an unbiased grid sampling system. In compositing, individual subsamples are collected and combined to represent a greater physical area or cover a particular time period. Often, to characterize a large unknown surface area, a grid sampling pattern is established, then samples are collected at randomized node locations where horizontal and vertical traverse lines intersect. Considerations such as number of samples required and their spatial relationship will affect the degree to which the unbiased grid sample results are representative of the surface area. In such cases, the sampling objective must be well defined and the intended purpose for the sample data generated must be reviewed to establish the DQOs for representativeness through statistical analysis. Parameters, such as the number of subsamples composited, the number of samples submitted for analysis, and the sampling interval, can then be specified to increase the confidence interval and improve representativeness when warranted by the performance objective.

Completeness

Data completeness represents the percentage of usable data collected from a sampling/analytical program or measurement system compared to the amount expected to be obtained under optimal or normal conditions. Completeness is calculated for the aggregation of data for each analyte measured for any particular sampling event or other defined set of samples. Completeness is calculated and reported for each method, matrix, and analyte combination. The number of usable results divided by the number of possible individual analyte results and expressed as a percentage determines the completeness of the data set. For completeness requirements, usable results are all results not qualified as rejected in the data review and validation process. The requirement for completeness is 90 percent of all critical field samples requiring chemical or geotechnical analyses. For any instances of samples that could not be analyzed for any reason (holding time violations in which re-sampling and analysis were not possible, samples spilled or broken, etc.), the numerator of this calculation becomes the number of valid results minus the number of possible results not reported. The formula for calculating completeness is shown in Equation (4):

$$\textbf{\textit{Completeness}} = \left(\frac{number\ of\ \ valid\ (i.e., non-Rflagged)\ results}{number\ of\ \ possible\ rsults} \right) \qquad \text{Eq. 4}$$

For statistically based sampling designs, completeness will be dependent upon the number of usable samples that are needed to meet the tolerances for decision errors.

Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. Comparability for sampling and analysis tasks is achieved by:

- Specifying well-recognized techniques and accepted standard methods for sampling and analysis using well-trained sampling and analysis technicians to consistently execute the prescribed methods
- Requiring that all involved sampling and analysis personnel produce adequate documentation to record how the prescribed methods were actually executed, noting non-conformances and corrective measures taken

The specification of standardized laboratory methods helps to ensure that the data generated for an event are comparable to past and future activities. Periodic field and laboratory audits to assess consistency of method implementation for these prescribed procedures are also critical in determining comparability.

Sensitivity

Sensitivity is a qualitative parameter that addresses the ability of the analytical method or instrumentation to differentiate between responses that represent concentrations of analytes. Sensitivity is important, as it is the ability to detect the target analytes at the levels of interest so that project-specific goals are met. The requirements of sensitivity include the establishment of various limits, such as those for calibration (which include MDLs, LODs, and QLs (these values are provided in the tables in Worksheet #15) and those that are sample specific, such as RLs. MDLs, LODs, and QLs are based on interference-free matrices that do not take into account the matrix effects of environmental samples. Therefore, project-specific RLs are evaluated to meet project objectives for analytes of interest during data assessments with the final reported data. Methods were selected based upon the best available technology (BAT) available in the EPA toolbox and are sensitive enough (i.e. PAL>MDL) to see all of the soil criteria and all but arsenic and thallium for the GW criteria. This is a common condition for arsenic and thallium given their low screening criteria even with the BAT method for metals analysis. The metals method includes the more sensitive method 6020A. Any non-detection analytes with PALs > MDLs, or analytes without PALs will be discussed further in the uncertainty section of the report. The following guidelines will be considered during evaluation for usability:

- Review the case narratives pertaining to the data packages and establish that CAs were performed.
- Review all validation qualifier flags based on acceptance criteria.
- Ascertain if the representativeness objective for the project was achieved.
- Consider previous investigations for the specific projects and for pre-existing data gaps.
- Calculate completeness of sample and analytical data collection to check against the objectives of the project.
- Identify data gaps based on completeness and nonconformance events.
- Identify data that do not meet project-specific sensitivity requirements.
- Evaluate if the data gaps prevent from making decisions intended in DQOs.
- Document instances where professional judgment should be used and discuss them with the U.S. Army Chemist.
- Document all evaluations, calculation, rejections, and recommendations and provide rationale for all specific validation actions.

In addition to the PARCCS analysis mentioned, the following items are considered when evaluating data usability when acceptance criteria have been exceeded:

- **Holding Times** – Consider the stability of the different analytes when holding times have not been met. Volatile organics are more susceptible to loss over time than semivolatile organic compounds (SVOC) such as pesticides and dioxins or metals. Except for volatile organics, samples that are reanalyzed a few days past holding time because the QC results were outside acceptance criteria, should not be rejected if they have passing criteria in the reanalysis and have comparable results to the original analyses. If the holding time for volatile organics is exceeded, the data will be rejected and there is no further use of the data.

- **Blanks** – Any analyte detected in the sample (other than the common volatile and semivolatile laboratory contaminants) and also detected in any associated blank, is qualified "U" if the sample concentration is less than five time (5x) the blank concentration. If the concentration of the analyte detected in the sample is greater than five times the concentration in the blank, then no qualification of the sample concentration is required. Special attention will be paid when the result is near the governing criterion. Any common volatile and semivolatile laboratory contaminant detected in the sample that was also detected in any associated blank, is qualified "U" if the sample concentration is less than 10 times (10x) the blank concentration. No qualification will be assessed if the sample concentration is greater than 10x the blank concentration; and as previously stated, special attention will be paid when the result is near the governing criterion. From a data usability standpoint, samples found due to blank contamination will be considered non-detect at the reporting limit or level of contamination (whichever is higher) because of the probability that concentrations are from laboratory or field contamination and not necessarily indicative at the site. This is consistent with USEPA Risk Assessment Guidance for Superfund Volume I Human Health Evaluation Manual (Part A) and previous blank assessments conducted.
- **Sample Preservation** – For all analytes received in a cooler, if a sample requiring to be shipped on ice is received greater than 6 degrees Celsius (°C); professional judgment should be used as to the qualification of results. Sample preservation criteria must be adhered to whenever possible.

Preliminary Data Use (If Required)

To meet the goals of the data user, it may be necessary to make use of preliminary data but not for site closure or action-level compliance. The data must be released by the project chemist or QA officer for use by the project staff. Ideally, the data will have been reviewed against the QC criteria before being released to the project team. The team will be made aware that the data has not been completely validated and that they are using the data at risk. Acceptable uses for preliminary data include step-out discussions, additional sampling requirements, etc. Unacceptable uses of preliminary data include public meetings, risk assessment decisions, No Further Action (NFA) decisions, and for final decision-making purposes. Shaw will review (at a minimum), available case narratives, calibrations, blanks, spikes, and duplicates noting any non-conformance and possible qualifications. After all data evaluations are completed, any limitations on the use of data will be made known to the planning team, and the limitations will be considered during decision making. If necessary, investigation objectives may be revised in anticipation of additional data collection to meet the project quality objectives at the site.

Step 5: Data Users

Identify the personnel responsible for performing the usability assessment:
Members of the project team listed in this QAPP are responsible for the ensuring the usability of the data sets as defined in this QAPP. Following the receipt of all the analytical results, the project team (personnel listed below) will review the data to ensure that the sampling and data meets the DQOs. The following personnel or their designee will perform the usability assessment as it applies to their project discipline and oversight responsibilities:

- TBD, USACE Project Chemist
- Douglas Schicho, Shaw PM
- Eric Malarek, Shaw Project Chemist
- Jeff Tarr, Site Manager
- Kevin Gerdes, Environmental Sampling Lead
- Cindy Hassan, Shaw Human Health Risk Assessor
- Mark Weisberg, Shaw Ecological Risk Assessor
- Shelley Bourgeois, GCAL QA Officer
- David Bumgarner, Microbac QA Officer
- Stephen Absolom, BEC SEDA
- Randy Battaglia, PM USACE NY District
- Tom Battaglia, Tech Lead USACE NY District
- John S. Nohrstedt, PM USAESCH
- Kevin Healy, Tech Lead, USAESCH
- Julio Vazquez, RPM USEPA
- Kuldeep Gupta, NHDES State Regulator

Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies:

The RA Report will summarize the remedial actions, conclusions, and any recommendations. The appendices of the RA Report will include the following supporting documents: analytical data reports, data validation narratives, field documentation, and Daily QC Reports.

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GLOSSARY OF QUALITY ASSURANCE AND RELATED TERMS

Acceptance criteria — Specified limits placed on characteristics of an item, process, or service defined in requirements documents.

Accuracy — The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components that are due to sampling and analytical operations; a data quality indicator. Examples of QC measures for accuracy include proficiency testing samples, matrix spikes, laboratory control samples (LCSs), and equipment blanks.

Action limit/level — The numerical value that causes a decision maker to choose or accept one of the alternative actions. It may be a regulatory threshold standard, such as a maximum contaminant level for drinking water; a risk-based concentration level; a technology limitation; or a reference-based standard.

Activity — An all-inclusive term describing a specific set of operations or related tasks to be performed, either serially or in parallel (e.g., research and development, field sampling, analytical operations, equipment fabrication), that, in total, result in a product or service.

Aliquot — A measured portion of a sample taken for analysis.

Analyte — A property which is to be measured.

Analytical batch — A group of samples, including quality control samples, which are processed together using the same method, the same lots of reagents, and at the same time or in continuous, sequential time periods. Samples in each batch should be of similar composition and share common internal quality control standards.

Assessment — As defined in the UFP-QAPP, the evaluation process used to measure the performance or effectiveness of a system and its elements against specific criteria. Glossary of Quality Assurance and Related Terms Examples include, but are not limited to, audits, proficiency testing, management systems reviews, data quality assessments, peer reviews, inspections, or surveillance.

Audit (quality) — A systematic and independent examination to determine whether QA/QC and technical activities are being conducted as planned and whether these activities will effectively achieve quality objectives.

Bias — The systematic or persistent distortion of a measurement process, which causes errors in one direction (i.e., the expected sample measurement is different from the sample's true value).

Blank — A sample subjected to the usual analytical or measurement process to establish a zero baseline or background value; a sample that is intended to contain none of the analytes of interest. A blank is used to detect contamination during sample handling preparation and/or analysis.

Calibration — A comparison of a measurement standard, instrument, or item with a standard or instrument of higher accuracy to detect and quantify inaccuracies and to report or eliminate those inaccuracies by adjustments.

Calibration standard — A substance or reference material used for calibration. *See also Calibration.*

Certification — The process of testing and evaluation against specifications designed to document, verify, and recognize the competence of a person, organization, or other entity to perform a function or service, usually for a specified time.

Chain of Custody — An unbroken trail of accountability that ensures the physical security of samples, data, and records.

Characteristic — Any property or attribute of a datum, item, process, or service that is distinct, describable, and/or measurable.

Coefficient of variation (CV) — A measure of precision (relative dispersion). It is equal to the standard deviation divided by the arithmetic mean. *See also Relative standard deviation.*

Co-located samples — See Field duplicates, co-located samples.

Comparability — The degree to which different methods or data agree or can be represented as similar. Comparability describes the confidence that two data sets can contribute to a common analysis and interpolation.

Completeness — A measure of the amount of valid data obtained from a measurement system compared with the amount that was expected to be obtained under correct, normal conditions.

Configuration — The functional, physical, and procedural characteristics of an item, experiment, or document.

Conformance — An affirmative indication or judgment that a product or service has met the requirements of the relevant specification, contract, or regulation; also, the state of meeting the requirements.

Contaminants of concern (COC) — The matrix-specific list of chemical compounds and analytes determined to be pertinent to a specific site or project; sometimes used interchangeably with target analytes.

Continuing calibration verification — A check of the initial calibration that is performed during the course of an analytical shift at periodic intervals using a Calibration Check Standard. Continuing calibration verification applies to both external standard and internal standard calibration techniques, as well as to linear and non-linear calibration models. The purpose is to assess the continued capability of the measurement system to generate accurate and precise data over a period of time.

Contractor — Any organization or individual contracting to furnish services or items or to perform work.

Corrective action — Any measures taken to rectify conditions adverse to quality and, where possible, to preclude their recurrence.

Data quality indicators (DQIs) — The quantitative statistics and qualitative descriptors that are used to interpret the degree of acceptability or utility of data to the user. The principal data quality indicators are precision, accuracy/bias, comparability, completeness, representativeness, and sensitivity. Also referred to as data quality attributes.

Data quality objectives (DQOs) — Qualitative and quantitative statements derived from the data quality objectives (DQO) process, as defined by EPA QA/G-4. DQOs can be used as the basis for establishing the quality and quantity of data needed to support decisions.

Data quality objective (DQO) process — A systematic planning tool based on the scientific method that clarifies study objectives, defines the appropriate type, quantity and quality of data and specifies tolerable levels of potential decision errors needed to answer specific environmental questions and to support proper environmental decisions. The DQO process is one type of systematic planning process. *See also Systematic planning process.*

Data reduction — The process of transforming the number of data items by arithmetic or statistical calculations, standard curves, and concentration factors, and collating them into a more useful form. Data reduction is irreversible and generally results in a reduced data set and an associated loss of detail.

Data review — The process of examining and/or evaluating data to varying levels of detail and specificity by a variety of personnel who have different responsibilities within the data management process. It includes verification, validation, and usability assessment.

Data user — Technical and other personnel responsible for engineering, scientific, and legal evaluations that are the basis for site decisions. Data users are responsible for determining data needs required to satisfy project objectives from their perspective (remedy, risk, compliance, etc.).

Decision-maker — Project manager, stakeholder, regulator, etc., who has specific interests in the outcome of site-related activities and will use the collected data to make decisions regarding the ultimate disposition of the site or whether to proceed to the next study phase.

Definitive data — Analytical data of known quality, concentration, and level of uncertainty. The levels of quality and uncertainty of the analytical data are consistent with the requirements for the decision to be made. Suitable for final decision-making. *See also Screening data.*

Design — The specifications, drawings, design criteria, and performance requirement; also, the result of deliberate planning, analysis, mathematical manipulations, and design processes.

Detection limit — A measure of the capability of an analytical method to distinguish samples that do not contain a specific analyte from samples that contain low concentrations of the analyte; the lowest concentration or amount of the target analyte that can be determined to be different from zero by a single measurement at a stated level of probability. Detection limits are analyte- and matrix-specific and may be laboratory-dependent. *See also Method detection limit, Quantitation limit, and Sample quantitation limit.*

Distribution — (1) The appointment of an environmental contaminant at a point over time, over an area, or within a volume; (2) a probability function (density function, mass function, or distribution function) used to describe a set of observations (statistical sample) or a population from which the observations are generated.

Document — Written text such as a report, standard operating procedure, plan. Once written, documents can be revised or amended, unlike records which are not revised once written.

Document control — The policies and procedures used by an organization to ensure that its documents and their revisions are proposed, reviewed, approved for release, inventoried, distributed, archived, stored, and retrieved in accordance with the organization's requirements.

Environmental conditions — The description of a physical matrix (e.g., air, water, soil, sediment) or a biological system expressed in terms of its physical, chemical, radiological, or biological characteristics.

Environmental data — Any parameters or pieces of information collected or produced from measurements, analyses, or models of environmental processes, conditions, and effects of pollutants on human health and the ecology, including results from laboratory analyses or from experimental systems representing such processes and conditions. It also includes information collected directly from measurements, produced from models, and compiled from other sources such as databases or the literature.

Environmental data operations — Any work performed to obtain, use, or report information pertaining to environmental processes and conditions.

Environmental monitoring — The process of measuring or collecting environmental data.

Environmental processes — Any manufactured or natural processes that produce discharges to, or that impact, the ambient environment.

Environmental programs — An all-inclusive term pertaining to any work or activities involving the environment, including but not limited to characterization of environmental processes and conditions; environmental monitoring; environmental research and development; the design, construction, and operation of environmental technologies; and laboratory operations on environmental samples.

Equipment blank — A sample of water free of measurable contaminants poured over or through decontaminated field sampling equipment that is considered ready to collect or process an additional sample. The purpose of this blank is to assess the adequacy of the decontamination process. Also called rinse blank or rinsate blank.

Estimate — A characteristic from the sample from which inferences on parameters can be made.

Field blank — A blank used to provide information about contaminants that may be introduced during sample collection, storage, and transport; also a clean sample exposed to sampling conditions, transported to the laboratory, and treated as an environmental sample.

Field duplicate (replicate) samples — (1) A generic term for two (or more) field samples taken at the same time in the same location. They are intended to represent the same population and are taken through all steps of the analytical procedure in an identical manner and provide precision information for the data collection activity. (2) The UFP-QAPP recognizes two categories of Field Duplicates Samples defined by the collection method, field duplicate, co-located samples and field duplicate, subsamples. *See also Field duplicate, co-located samples and Field duplicate, subsamples.*

Field duplicate, co-located samples — Two or more independent samples collected from side-by-side locations at the same point in time and space so as to be considered identical. These separate samples are said to represent the same population and are carried through all steps of the sampling and analytical procedures in an identical manner. These samples are used to assess precision of the total method, including sampling, analysis, and site heterogeneity. Examples of co-located samples include ambient air monitoring samples, surface water grab samples, and side-by-side sample core soil samples.

Field duplicate (replicate), subsamples — Duplicate (replicate) samples resulting from one sample collection at one sample location. For example, duplicate (replicate) subsamples may be taken from one soil boring or sediment core.

Finding — An assessment conclusion that identifies a condition having a significant effect on an item or activity. An assessment finding may be positive or negative and is normally accompanied by specific examples of the observed condition.

Graded approach — The objective process of establishing the project requirements and level of effort according to the intended use of the results and the degree of confidence needed in the quality of the results.

Guidance — A suggested practice that is not mandatory, intended as an aid or example in complying with a standard or requirement.

Guideline — A suggested practice that is not mandatory in programs intended to comply with a standard.

Hazardous waste — Any waste material that satisfies the definition of hazardous waste given in 40 CFR 261, "Identification and Listing of Hazardous Waste."

Holding time — The period of time a sample may be stored prior to its required analysis.

Inspection — The examination or measurement of an item or activity to verify conformance to specific requirements.

Instrument blank — An aliquot of analyte-free water or solvent processed through the instrumental steps of the measurement process to determine the presence of carryover from the previous analysis. Analysis does not include any sample preparation.

Instrument performance check sample — A sample of known composition analyzed concurrently with environmental samples to verify the performance of one or more components of the analytical measurement process. Those components can include retention time, resolution, recovery, degradation, etc.

Interference — A positive or negative effect on a measurement caused by a analyte other than the one being investigated or other factors.

Internal standard — A standard added to a test portion of a sample in a known amount and carried through the entire determination procedure as a reference for calibrating and controlling the precision and bias of the applied analytical method.

Investigative organization — An entity contracted by the lead organization for one or more phases of a data collection operation.

Laboratory control sample — A sample of known composition prepared using contaminant-free water or in inert solid that is spiked with analytes of interest at the midpoint of the calibration curve or at the level of concern. It is analyzed using the same sample preparation, reagents, and analytical methods employed for regular samples.

Laboratory duplicates/replicates — Two or more representative portions taken from one homogeneous sample by the laboratory and analyzed in the same laboratory. Laboratory duplicate/ replicate samples are quality control samples that are used to assess intralaboratory preparatory and analytical precision.

Laboratory fortified blank — A low-level laboratory control sample (e.g., at the quantitation limit) used to evaluate laboratory preparatory and analytical sensitivity and bias for specific compounds.

Lead organization — An entity responsible for all phases of the data collection operation.

Management — Those individuals directly responsible and accountable for planning, implementing, and assessing work.

Management system — A structured, nontechnical system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for conducting work and producing items and services.

Matrix — The material of which the sample is composed, such as water, soil/sediment, or other environmental medium.

Matrix spike — A sample prepared by adding a known concentration of a target analyte to an aliquot of a specific homogenized environmental sample for which an independent estimate of the target analyte concentration is available. The matrix spike is accompanied by an independent analysis of the unspiked aliquot of the environmental sample. Spiked samples are used to determine the effect of the matrix on a method's recovery efficiency.

Matrix spike duplicate — A homogeneous sample used to determine the precision of the intralaboratory analytical process for specific analytes (organics only) in a sample matrix. The duplicate sample is prepared simultaneously as a split with the matrix spike sample, and each is spiked with identical, known concentrations of targeted analyte(s).

Mean (arithmetic) — The sum of all the values of a set of measurements divided by the number of values in the set; a measure of central tendency.

Measurement performance criteria — Acceptance limits selected for project-specific sampling and analytical systems that will be used to judge whether project quality objectives are met. *See also data quality indicators.*

Method — A body of procedures and techniques for performing an activity (e.g., sampling, chemical analysis, quantification), systematically presented in the order in which they are to be executed.

Method blank — A sample of a matrix similar to the batch of associated samples (when available) in which no target analytes or interferences are present at concentrations that impact the analytical results. It is processed and analyzed simultaneously with samples of similar matrix and under the same conditions as the samples.

Method detection limit — Minimum concentration of a substance that can be reported with 99 percent confidence that the analyte concentration is greater than zero. *See also Detection limit and Quantitation limit.*

Method detection limit studies — A statistical determination that defines the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero.

Must — When used in a sentence, a term denoting a requirement that has to be met.

Nonconformance — A deficiency in a characteristic, documentation, or a procedure that renders the quality of an item or activity unacceptable or indeterminate; nonfulfillment of a specified requirement.

Objective evidence — Any documented statement of fact, other information, or record, either quantitative or qualitative, pertaining to the quality of an item or activity, based on observations, measurements, or tests that can be verified.

Observation — An assessment conclusion that identifies a condition (either positive or negative) that does not represent a significant effect on an item or activity. An observation may identify a condition that has not yet caused a degradation of quality.

Organization — A public or private company, corporation, firm, enterprise, or institution, or part thereof, whether incorporated or not, that has its own functions and administration.

Outlier — A data point that is shown to have a low probability of belonging to a specified data population.

Parameter — A quantity, usually unknown, such as a mean or a standard deviation characterizing a population. *Parameter* is commonly misused for *variable*, *characteristic*, or *property*.

Precision — The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves. Precision is usually expressed as standard deviation, variance, or range, in either absolute or relative terms. Examples of QC measures for precision include field duplicates, laboratory duplicates, analytical replicates, and internal standards.

Procedure — A specified way to perform an activity.

Process — A set of interrelated resources and activities that transforms inputs into outputs. Examples of processes include analysis, design, data collection, operation, fabrication, and calculation.

Proficiency testing (PT) sample — A sample, the composition of which is unknown to the laboratory or analyst, which is provided to that laboratory or analyst to assess capability to produce results within acceptable criteria. PT samples can fall into three categories: (1) prequalification, conducted prior to a laboratory beginning project work, to establish initial proficiency; (2) periodic (e.g., quarterly, monthly, or episodic), to establish ongoing laboratory proficiency; and (3) batch-specific, which is conducted simultaneously with analysis of a sample batch. A PT sample is sometimes called a performance evaluation sample.

Proficiency testing sample, ampulated — A PT sample that is received as a concentrate and must be diluted to volume before being treated as an analytical sample. It can only be single blind.

Proficiency testing sample, full volume — A PT sample that is received by the laboratory ready to be treated as an analytical sample. It does not require dilution and therefore can be single or double blind.

Proficiency testing sample, site-specific — A PT sample created using a well-characterized contaminated matrix and treated as an analytical sample by the laboratory to test its capabilities.

Project — An organized set of activities within a program.

Project quality objectives (PQOs) — Qualitative and quantitative statements derived from a Systematic Planning Process (e.g., EPA QA/G-4 DQO process) that clarify study objectives, define the appropriate type of data, and specify tolerable levels of potential decision errors. PQOs will be used as the basis for establishing the quality and quantity of data needed to support decisions.

Project quantitation limit — The lowest concentration or amount of the target analyte required to be reported from a data collection project.

Preliminary Remediation Goals — Specific project action limits for target analytes .

Quality — The totality of features and characteristics of a product or service that bears on its ability to meet the stated or implied needs and expectations of the user.

Quality assurance — An integrated system of management activities involving planning, implementation, assessment, reporting, and quality improvement to ensure that a process, item, or service is of the type and quality needed and expected by the client.

Quality assurance project plan (QAPP) — A formal document describing in comprehensive detail the necessary quality assurance (QA), quality control (QC), and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria.

Quality control — The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer; operational techniques and activities that are used to fulfill requirements for quality; also the system of activities and checks used to ensure that measurement systems are maintained within prescribed limits, providing protection against “out of control” conditions and ensuring that the results are of acceptable quality.

Quality control sample — One of any number of samples, such as a PT sample, intended to demonstrate that a measurement system or activity is in control.

Quality management — That aspect of the overall management system of the organization that determines and implements the quality policy. Quality management includes strategic planning, allocation of resources, and other systematic activities (e.g., planning, implementation, and assessment) pertaining to the quality system.

Quality Management Plan — A formal document that describes the quality system in terms of the organization's structure, the functional responsibilities of management and staff, the lines of authority, and the required interfaces for those planning, implementing, and assessing all activities conducted.

Quality system — A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required quality assurance (QA) and quality control (QC) activities.

Quantitation limit — The minimum concentration of an analyte or category of analytes in a specific matrix that can be identified and quantified above the method detection limit and within specified limits of precision and bias during routine analytical operating conditions.

Raw data — The documentation generated during sampling and analysis. This documentation includes, but is not limited to, field notes, hard copies of electronic data, magnetic tapes, untabulated sample results, QC sample results, printouts of chromatograms, instrument outputs, and handwritten notes.

Readiness review — A systematic, documented review of the readiness for the start-up or continued use of a facility, process, or activity. Readiness reviews are typically conducted before proceeding beyond project milestones and prior to initiation of a major phase of work.

Reagent blank — An aliquot of water or solvent free of measurable contaminants analyzed with the analytical batch and containing all the reagents in the same volume as used in the processing of the samples. The method blank goes through preparatory steps; the reagent blank does not.

Record (quality) — A document that furnishes objective evidence of the quality of products, services, or activities and that has been verified and authenticated as technically complete and correct. Records may include photographs, drawings, magnetic tape, and other data recording media.

Recovery — A measure of bias. Typically, a known concentration of analyte is spiked into an aliquot of sample. Both the spiked aliquot and an unspiked aliquot of sample are analyzed and the percent recovery is calculated.

Relative percent difference (RPD) — A unit-free measure of precision between duplicate analyses.

Relative standard deviation (RSD) — A unit-free measure of precision or variability. The RSD is also known as the Coefficient of Variation (CV) which is the standard deviation expressed as a percentage of the mean.

Remediation — The process of reducing the concentration of a contaminant (or contaminants) in air, water, or soil matrices to a level that poses an acceptable risk to human health.

Replicate samples — Multiple duplicate samples.

Representativeness — A measure of the degree to which data accurately and precisely represent a characteristic of a population, a parameter variation at a sampling point, a process condition, or an environmental condition.

Reproducibility — The precision, usually expressed as variance, that measures the variability among the results of measurements of the same sample at different laboratories.

Requirement — A formal statement of a need and the expected manner in which it is to be met; documented statements that specify activities that must be done; the mandated activities.

Sample quantitation limit (SQL) — Quantitation limit adjusted for dilutions, for changes in sample volume or size, and extract and digestate volumes, percent solids, and cleanup procedures.

Scientific method — The principles and processes regarded as necessary for scientific investigation, including rules for formulation of a concept or hypothesis, conduct of experiments, and validation of hypotheses by analysis of observations.

Screening data — Analytical data of known quality, concentration, and level of uncertainty. The levels of quality and uncertainty of the analytical data are consistent with the requirements for the decision to be made. Screening data are of sufficient quality to support an intermediate or preliminary decision but must eventually be supported by definitive data before a project is complete.

Secondary Data — Data not originally collected for the purpose for which they are now being used. In addition, the level of QA/QC provided at the time of the original data collection may be unknown.

Self-assessment — The assessments of work conducted by individuals, groups, or organizations directly responsible for overseeing or performing the work.

Sensitivity — The capability of a test method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. Examples of QC measures for determining sensitivity include laboratory-fortified blanks, a method detection limit study, and initial calibration low standards at the quantitation limit.

Service — The result generated by activities at the interface between the supplier and the customer; the supplier's internal activities to meet customer needs. Such activities in environmental programs include design, inspection, laboratory and/or field analysis, repair, and installation.

Shipping container temperature blank — A container of water designed to evaluate whether or not samples were adequately cooled during sample shipment.

Specification — A document stating requirements and referring to or including drawings or other relevant documents. Specifications should indicate the means and criteria for determining conformance.

Spike — A substance that is added to an environmental sample to increase the concentration of target analytes by known amounts. A spike is used to assess measurement accuracy (spike recovery). Spike duplicates are used to assess measurement precision.

Split sample — Two or more representative portions taken from a sample in the field or laboratory, analyzed by at least two different laboratories and/or methods. Prior to splitting, a sample is mixed (except volatiles, oil and grease, or when otherwise directed) to minimize sample heterogeneity. These are quality control samples used to assess precision, variability, and data comparability between different laboratories. (Split samples should be used when accompanied by a PT sample.)

Standard deviation — A measure of the dispersion or imprecision of a sample or population distribution; expressed as the positive square root of the variance, with the same unit of measurement as the mean.

Standard Operating Procedures (SOPs) — A written document that details the method for an operation, analysis, or action, with thoroughly prescribed techniques and steps. SOPs are officially approved as the methods for performing certain routine or repetitive tasks.

Storage blank — A sample composed of water free of measurable contaminants and stored with a sample set in the same kind of sample container. Storage begins upon receipt of sample shipment at the laboratory. The storage blank is analyzed at the end of the sample storage period to assess cross-contamination occurring during sample storage (typically analyzed only for volatile organic compounds).

Supplier — Any individual or organization furnishing items or services or performing work according to a procurement document or a financial assistance agreement. *Supplier* is an all-inclusive term used in place of any of the following: vendor, seller, contractor, subcontractor, fabricator, or consultant.

Surrogate spike or analyte — A pure substance with properties that mimic the analyte of interest (organics only). Surrogates are brominated, fluorinated, or isotopically labeled compounds unlikely to be

found in environmental samples. These analytes are added to samples to evaluate analytical efficiency by measuring recovery.

Systematic planning process — Systematic planning is a process that is based on the scientific method and includes concepts such as objectivity of approach and acceptability of results. Systematic planning is based on a common sense, graded approach to ensure that the level of detail in planning is commensurate with the importance and intended use of the work and the available resources. This framework promotes communication among all organizations and individuals involved in an environmental program. Through a systematic planning process, a team can develop acceptance or performance criteria for the quality of the data collected and for the quality of the decision.

Target analytes — The project-specific list of analytes for which laboratory analysis is required; sometimes used interchangeably with contaminants of concern.

Technical Systems Audit (TSA) — A thorough, systematic, on-site qualitative audit of facilities, equipment, personnel, training, procedures, record-keeping, data validation, data management, and reporting aspects of a system.

Traceability — The ability to trace the history, application, or location of an entity by means of recorded identifications. In a calibration sense, traceability relates measuring equipment to national or international standards, primary standards, basic physical constants or properties, or reference materials. In a data collection sense, it relates calculations and data generated throughout the project back to the requirements for the quality of the project.

Trip blank — A clean sample of water free of measurable contaminants that is taken to the sampling site and transported to the laboratory for analysis without having been exposed to sampling procedures. Trip blanks are analyzed to assess whether contamination was introduced during sample shipment (analyzed for volatile organic compounds only).

Usability assessment — Evaluation of data based upon the results of data validation and verification for the decisions being made. In the usability step, reviewers assess whether the process execution and resulting data meet quality objectives based on criteria established in the QAPP.

Validation — Confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled. Data validation is a sampling and analytical process evaluation that includes evaluating compliance with methods, procedures, or contracts, and comparison with criteria based upon the quality objectives developed in the project QAPP. The purpose of data validation is to assess the performance associated with the sampling and analysis to determine the quality of specified data.

Variance (statistical) — A measure or dispersion of a sample or population distribution.

Verification — Confirmation by examination and provision of objective evidence that the specified requirements (sampling and analytical) have been completed. This is to be a completeness check.

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TABLES

Table 1
Human Health and Ecological Screening Values (Seneca Army Depot)

Analyte	CAS No.	Human Health Soil Screening Values [a]				SPLP Screening Values	Ecological Screening Values for Soil			Human Health Groundwater Screening Values			
		NYS DEC Soil Clean Up Objectives Commercial	NYS DEC Soil Clean Up Objectives Unrestricted	Residential RSL	Industrial RSL	NYS Ground-water Effluent (GA Waters) [b]	EPA Eco-SSLs [c]	EPA Region 4 ESV [d]	Selected ESV for Soil [e]	Ambient Water Quality Criteria [f]	Tapwater RSL [a]	MCL [g]	
TAL Metals SW-846 3010A/3050B/6010C/7470A/7471B		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(ug/L)	(mg/kg)	(mg/kg)	(mg/kg)	(ug/L)	(ug/L)	(ug/L)	
Aluminum	7429-90-5	NA	NA	7700	99000	2000	pH Dependent	50	pH Dependent	NA	1600	50	l
Antimony	7440-36-0	NA	NA	3.1	41	6	0.27	3.5	0.27	3	0.6	6	
Arsenic	7440-38-2	16	13	0.39	1.6	50	18	10	18	25	0.045	10	
Barium	7440-39-3	400	350	1500	19000	2000	330	165	330	1000	290	2000	
Beryllium	7440-41-7	590	7.2	16	200	NA	21	1.1	21	NA	1.6	4	
Cadmium	7440-43-9	9.3	2.5	7	80	10	0.36	1.6	0.36	5	0.69	5	
Calcium	7440-70-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Chromium	7440-47-3	1500	30	12000	150000	NA	26	0.4	26	50	1600	100	
Cobalt	7440-48-4	NA	NA	2.3	30	NA	13	20	13	NA	0.47	NA	
Copper	7440-50-8	270	50	310	4100	400	28	40	28	200	62	1300	
Iron	7439-89-6	NA	NA	5500	72000	600	pH Dependent	200	pH Dependent	300	1100	300	l
Lead [j]	7439-92-1	1000	63	400	800	50	11	50	11	25	NA	15	
Magnesium	7439-95-4	NA	NA	NA	NA	NA	NA	NA	NA	35000	NA	NA	
Manganese	7439-96-5	10000	1600	180	2300	600	220	100	220	300	32	50	l
Mercury [k]	7439-97-6	2.8	0.18	2.3	31	1.4	NA	0.1	0.1	0.7	0.16	2	
Nickel	7440-02-0	310	30	150	2000	200	38	30	38	100	30	NA	
Potassium	7440-09-7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Selenium	7782-49-2	1500	3.9	39	510	20	0.52	0.81	0.52	10	7.8	50	
Silver	7440-22-4	1500	2	39	510	100	4.2	2	4.2	50	7.1	100	l
Sodium	7440-23-5	NA	NA	NA	NA	NA	NA	NA	NA	20000	NA	NA	
Thallium	7440-28-0	NA	NA	0.078	1	NA	NA	1	1.0	NA	0.016	2	
Vanadium	7440-62-2	NA	NA	39	520	NA	7.8	2	7.8	NA	7.8	NA	
Zinc	7440-66-6	10000	109	2300	31000	5000	46	50	46	NA	4700	5000	l

[a] Screening toxicity values are from the NYS SCOs (unrestricted, Table 375-6.8[a], restricted, Table 375-6.8[b]) and USEPA Regional Screening Level (RSL) Table for November 2011. RSL value based on a cancer risk of 1.0E-06 and a hazard quotient of 0.1.

[b] NYS DEC Section 703.6; Table 3 Groundwater Effluent Limitations (2008).

[c] EPA, 2007, Ecological Soil Screening Level guidance. On-line at: http://www.epa.gov/ecotox/ecossl/index.html

[d] Screening value based on: EPA, 2001, *Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment* , Originally published November 1995, Website version last updated November 30, 2001: http://www.epa.gov/region4/waste/ots/ecolbul.html

[e] Priority for Selection of Soil ESVs: 1) EPA Eco-SSL; 2) EPA Region 4 Ecological Screening Values for Soil. Priority for Selection of Surface Water ESVs: 1) NYS WQS; 2) EPA Region 3 ESV; 3) EPA Region 4 ESV.

[f] Technical and Operational Guidance Series (TOGS), http://www.dec.ny.gov/regs/4590.html

[g] MCL values from the USEPA National Primary Drinking Water Standards (January 2011).

[h] NYS DEC Section 703.5; Table 1 Water Quality Standards for Surface Water and Groundwater (2008).

[i] USEPA Region 3 Freshwater Screening Benchmarks, online.

[j] RSL for lead based on the action level of 15 µg/L (EPA, 1996, Drinking Water Regulations and Health Advisories, Office of Water, Washington, DC, October). Not adjusted using divisor of 10.

[k] RSL for mercuric chloride was used.

[l] Value is Secondary MCL.

[m] Value is for dissolved surface water criterion.

µg/L = micrograms per liter = parts per billion

mg/kg = milligrams per kilogram = parts per million

Note: For surface water ESVs that are hardness dependend, hardness of 100 mg/L assumed.

EPA = U.S. Environmental Protection Agency

ESV = Ecological screening value

NA = Not available

Attachment A
Shaw and Laboratory Key Personnel Resumes

(*Reserved for revisions to MRSs included in this work plan*)

Douglas Schicho, PE, PMP, Project Manager has eighteen years experience with Shaw Environmental as an environmental professional. Over the last eighteen years Mr. Schicho has worked at multiple Army, Air Force and Navy facilities encompassing over 300 sites. Mr. Schicho's engineering experience has included due diligence (EBS and ECP), HTRW and MMRP Remedial Investigations/Feasibility Studies (RI/FS), engineering design and remediation activities on DoD sites.

Program Manager, MEC CSE Phase I and Phase II - Program Management responsibilities included coordination with ITSI Program Manager and multiple Shaw project managers. Additional responsibilities included oversight of safety, quality and contractual requirements on five task orders under this contract. Task Orders include CSE Phase II Investigations at Davis Monthan AFB, Barksdale AFB, Langley AFB, McChord AFB and Remedial Investigation at Pole Mountain (FUDS). CSE Phase I investigations were performed at 37 active Air Force Installations. Historical Records Reviews were performed at 137 active Air Force Sites. These investigations identified and characterized over 300 Munitions Response Areas at these Air Force Installations.

Project Manager, CSE Phase II Investigations - Mr. Schicho was the project manager for CSE Phase II assessments at six active Air Force installations in six states under this performance based FFP contract. Installations included Wright-Patterson Air Force Base, Tinker AFB, Air Force Plant 6, Air Force Plant 44, Air Force Plant 42, and Robins Air Force Base. Range types included aerial bombing ranges, EOD ranges, munitions disposal areas, pistol ranges, and skeet ranges.

Project Manager, Environmental Condition of Property Assessments Phase I and Phase II (TO10 and 17) – Environmental Condition of Property Investigations at Fort Monmouth, Fort Gillem and Fort McPherson. The objective of the Phase II ECP was to investigate environmental releases which were identified during the Phase I. At the project sites Doug managed the investigation of potential environmental releases from Underground Storage Tanks, industrial waste sewers, dumping and spills associated with historical Army operations. Investigatory techniques included digital geophysical mapping (DGM), Geoprobe investigation of soil and groundwater, surface water sampling, sediment sampling and the performance of a vapor intrusion investigation of buildings overlying groundwater plumes.

Project Manager, Remedial Investigation, Feasibility Study, Decision Document, and LTM (TO04) – This task order includes thirteen individual projects all involving CERCLA actions at Picatinny Arsenal. Remedial Investigation was completed for the 600 Area Groundwater, a current explosive test range. Proposed Plan and Record of Decision was completed for the Area C/Southern Boundary Groundwater Plume. Mr. Schicho managed and coauthored decision documents for this groundwater operable unit which encompasses the majority of groundwater flow off of Picatinny Arsenal. Through statistical analysis of the groundwater data and oriented rock coring to determine flow direction in a complex fractured rock unit, Shaw was able to achieve regulatory concurrence for a long-term monitoring solution for this operable unit. Feasibility Study, Proposed Plan, and Record of Decision was completed for PICA-111, a propellant manufacturing area. Mr. Schicho was coauthor and manager for the completion of these decision documents for this former propellant production area. Waste handling practices at the former propellant area resulted in contamination of soil with metals, dinitrotoluene, and perchlorate.

Project Manager, Remedial Investigation, Feasibility Study, Decision Document, and O&M of Groundwater Pump and Treat Systems (TO17) – The scope of the Picatinny Arsenal Installation Program includes the CERCLA site closure of over 150 sites at the 6,500-acre facility. As the primary support for the Picatinny Installation Restoration Program (IRP), task order 17 included all facets of the installation restoration program. Tasks included remedial investigation of over 50 sites and groundwater operable units, completing FS, PP, and ROD for over 50 sites.

Doug managed the Building 24 pump and treat system which is a 100 gallon per minute groundwater treatment system installed to form a hydraulic barrier preventing TCE contaminated groundwater from discharging to a surface water body. The groundwater pump and treat was eventually shut down with the installation of a permeable reactive barrier designed under this task order.

Project Engineer, Remedial Investigation and Feasibility Study (TO17) - Responsible for all aspects of the preparation of engineering documents for Picatinny Arsenal. Doug oversaw the work of junior engineers and reported directly to the project manager. Mr. Schicho designed the sampling program for a pyrotechnic range contaminated with MEC, multiple contaminants including polychlorinated

biphenyls (PCBs), metals, pesticides, and chlorinated solvents. Under Doug's management the program was implemented and the resultant data used in developing an EE/CA for the excavation and off-site disposal of contaminated soils from the site. Completed the Remedial Investigation for 17 sites. This investigation included geophysics, soil-gas, well installation, dye trace studies, soil boring, test pits, UXO avoidance surveys, and media sampling. Site hazards required that some activities be performed in Level B.

Project Engineer, Preliminary Assessment and Site Investigation (TO01) - Preliminary Assessment/Site Inspection Phase III Areas, Picatinny Arsenal, NJ. Mr. Schicho acted as a task manager for a team of three in the performance of document review, site inspection, engineering drawing review, and personnel interviews. The assessment was performed at the Phase III area of Picatinny Arsenal. This area included a nitroglycerin, high explosive, and propellant manufacturing area, two munitions dumps, as well as two ordnance-testing areas. In all, over sixty sites were evaluated as part of the arsenal CERCLA program. Doug oversaw the production of the PA/SI sampling plan and site inspection report. Responsibilities included task management, development of sampling plans, and data management.

Winston (Doug) Russell, Health and Safety Manager, has more than 23 years of experience, including experience in the supervision of personnel, health and safety (H&S) programs, quality control (QC), analytical sampling programs, and environmental remediation/construction and restoration projects. He has a degree in electrical engineering, is a qualified U.S. Army Corps of Engineers (USACE) construction QC manager, and maintains Occupational Safety and Health Administration (OSHA) construction industry outreach trainer qualification. For the past 15 years, he has worked as an H&S professional managing construction QC programs on large projects. He has implemented employee exposure monitoring programs, tracked training and medical records, initiated safety councils, and performed hazard communication training and site compliance audits. Currently, he is responsible for H&S program management on several federal programs and projects, has regional H&S responsibility for Shaw's Southeast Federal business line, and manages H&S aspects of Military Munitions Response Programs (MMRP).

Various Department of Defense (DOD) and Department of Energy (DOE) Programs, Health and Safety Coordinator. Prepared H&S plans for site investigations, RIs, and remedial actions involving unexploded ordinance (UXO); chemical warfare materials (CWM); and hazardous, toxic, and radioactive waste (HTRW) sites. Performed site audits and inspections for compliance with H&S plans and OSHA requirements.

Keesler Air Force Base (AFB) Hurricane Recovery, Health and Safety Manager – Biloxi, Mississippi. Developed comprehensive H&S plans for all on-site work and contractors, including initial damage assessments, biological hazard management (mold and asbestos), architectural and mechanical services, building demolitions, surveying, transportation services, and numerous construction activities.

Federal Emergency Management Administration (FEMA) Individual Assistance-Technical Assistance Contract, Health and Safety Manager – Fort McClellan, Alabama. Oversaw H&S during the design and construction of interim housing (420,000 sq ft) for evacuees following Hurricanes Katrina and Rita. Project responsibilities included remediation, construction, and operations and maintenance (O&M) to convert two, three-story dormitory buildings into a 350-room apartment facility to house up to 1,000 evacuees. At the peak of construction, over 500 workers were present on the site, working 18-hour shifts.

Various Federal Clients, Program Health and Safety Manager – Various U.S. locations. Program H&S Manager for the following programs: Savannah Indefinite Delivery Type, USACE-South Atlantic Division (SAD) Total Environmental Restoration Contract (TERC), USACE-Omaha Rapid III and IV and TERC II, Tinker AFB Architecture & Engineering (A&E) II, Air Force Institute for Operational Health, and USACE-Nashville A&E III. USACE-Mobile awarded the SAD TERC program a Million Hour Club award for no lost time injuries on Mobile Task Orders. SAD TERC and Omaha TERC II received Shaw's internal Million Hour Award for no lost workdays.

Redstone Arsenal Groundwater Treatment Plant Construction, Health and Safety Officer and Construction Quality Control Systems Manager (CQCSM) – Huntsville, Alabama. Implemented the formal USACE-Mobile QC process, which included establishing the Definable Features of Work Matrix, Four

Phase Inspection processes, and Submittal Register development/implementation while also managing all H&S personnel. As the CQCSM, he was the point of contact for the USACE on construction safety and quality issues. Also provided safety and QC support for aboveground storage tank remediation, oil water separator remediation, and installation of Land Use Control fencing on munitions and explosives of concern (MEC) and CWM sites. Developed a written nomination for Shaw to participate in the USACE Mobile District Construction Division Celebrate Safety program. Shaw was voted the Excellence in Safety Management award through the Mobile District for 3rd Quarter-FY 00 in the CONUS large category.

Kevin S. Gerdes, Environmental Sampling Lead, has 11 years of experience as an Engineer in multiple aspects of the environmental consulting/remediation industry. Kevin is a mechanical and environmental engineer with a BS and MS in engineering. Projects have included leading sampling teams for site investigation and remedial investigation projects. Proficiency with remedial investigation techniques includes sampling of soil, sediment, surface water, groundwater, soil gas and indoor air. Kevin has conducted design of dual-phase extraction, air sparge, bio-sparge, and soil vapor extraction systems for the remediation of volatile organic compounds; operation and maintenance, and remedial system evaluation; multimedia in-situ and ex-situ technology evaluation and cost estimating for the remediation of VOCs, explosives, metals, PCBs, and PAHs; and asbestos and lead building investigation, project monitoring, and abatement project design. Currently, his work includes the preparation of feasibility studies for the multimedia remediation of various contaminants in support of U.S Department of Defense projects, and Comprehensive Site Evaluation Phase I and II investigations under the Military Munitions Response Program (MMRP).

Project Engineer, Wright Patterson AFB, OH - Kevin was the field team leader for a CSE Phase II investigation being conducted at Wright-Patterson AFB. Responsibilities include preparation and review of work planning documents, Shaw Field Lead for the Phase II investigation at Wright-Patterson AFB (visual surveys, digital geophysical mapping survey, and environmental media sampling), and lead author of the Wright-Patterson AFB CSE Phase II Report.

Project Engineer, 37 Air Force Installations, Nationwide - Kevin supported CSE Phase I investigations conducted at 37 USAF installations across the U.S. Responsibilities include preparation of work plans, review of on-site and off-site historical documentation, visual site inspections, and final report preparation.

Project Engineer, Remedial Investigation and Feasibility Study, Picatinny Arsenal, NJ - Authored Feasibility Studies for multimedia remediation of VOCs, explosives, metals, PCBs, PAHs, and Dioxins. Responsibilities included field sampling, data analysis; technology evaluation for the remediation of soil, sediment, surface water and groundwater; preparation of cost and remedial time frame estimates, and report preparation.

Staff Engineer, Phase I and Phase II ECP, Various Eastern Sites - A Phase I and a Phase II ECP Assessment were conducted for Fort Monmouth in support of the 2005 Base Realignment and Closure program. Based on the results of the Phase I, a Phase II ECP was conducted including geophysical surveys, multi-media sampling, direct push groundwater and soil sampling, installation of monitoring wells, and indoor air and soil gas sampling in support of vapor intrusion evaluation.

Field Operations Leader, In-Situ Bioremediation of Energetic Compounds in Groundwater - Mr. Gerdes served as Field Operations Leader for the implementation of a demonstration project implementing in-situ bioremediation of energetic compounds in groundwater. The efficacy of cheese whey addition via "active-passive" groundwater recirculation was evaluated at a former explosives loading and packing facility.

Gretchen Tabano, P.E., Project Engineer, holds a Bachelor's Degree in Engineer Science (Mechanics/Environmental). Ms. Tabano has over 15 years as a MEC Specialist, Project Engineer, and Task Manager involved in MMRP and HTRW investigations and cleanup. She has completed preliminary assessments, Site Inspections (SIs), RIs, FSs, and EE/CAs involving the removal and/or avoidance of ordnance as part of the process; the excavation and disposal of lead-contaminated range soils, pits of unknown chemical/biological wastes, and landfills, including UXO wastes; and RI/FS for VOC, total petroleum hydrocarbon (TPH), and explosive contamination in soil and groundwater and pits of UXO/CWM. Ms. Tabano is also very knowledgeable in BRAC site investigations and remediation.

MEC Characterization, Camp Hale, Vail, CO. MEC Expert responsible for performing SI at this FUDS property. Work includes characterizing the installation from a MEC perspective; evaluating actual or potential release(s) of related hazardous substance(s), pollutant(s), or contaminant(s) to migration/exposure pathways (groundwater, soil, and air) from munitions response site (MRS); and evaluating associated targets of concern for the presence of MEC. Utilized real-time data collection techniques, Triad approach, and systematic planning techniques with USACE, regulators, U.S. Forest Service, and the public to facilitate remedial decision-making at the MRS. Performed Munitions Response Site Prioritization Protocol (MSRPP) scoring for about 20 MRSs. Able to close several MRSs to the satisfaction of the stakeholders.

Comprehensive Site Assessments, Multiple U.S. Air Force Installations, Multiple CONUS Locations. MEC Expert and Task Manager for CSE II (comparable to CERCLA SI) at 12 Air Force installations (New Boston and Clear AFS and Vandenberg, Buckley, Nellis, Hill, Arnold, Barksdale, Davis-Monthan, Langley, and McChord AFBs). This work was performed to characterize the installations from a MEC perspective; evaluate actual or potential release(s) of related hazardous substance(s), pollutant(s), or contaminant(s) to migration/exposure pathways (groundwater, soil, and air) from MRSs; and evaluate associated targets of concern for the presence of MEC. Utilized real-time data collection techniques, Triad approach, and systematic planning techniques with installation representatives, regulators, USACE, and the public to facilitate remedial decision-making at the MRS. Performed MSRPP scoring for over 100 MRSs. Incorporated Wide Area Assessment data as well as land and water-based data collection techniques to characterize MRSs. Closed several MRSs to the satisfaction of the stakeholders.

Multiple RI/FSs, Aberdeen Proving Ground, Aberdeen, MD. MEC Specialist and Task Manager for RI/FS activities, which included historical records searches, site reconnaissance, and the concurrent development of conceptual site models for three sites (a former UXO burial pit and salvage yard, a former chemical munitions filling plant, and a railroad maintenance shop). Managed multiple RI/FS activities for MEC/munitions constituents (MC) and other contamination, including primarily lead in soil and solvents in groundwater. Managed the preparation of sampling and analysis plans and RI/FS reports under CERCLA guidelines as well as the execution of field sampling programs. Managed development and maintenance of a chemical database for collection of analytical information for all three sites. Following the RI/FS reports, managed preparation of the Proposed Plan and DDs that have been approved by the USEPA and MDE.

MEC and HTRW Remedial Investigations, Ft. Ritchie, Cascade, MD. MEC Expert and Task Manager for project involving MEC and HTRW remedial investigations using historical data analyses, field reconnaissance, surveys, and site inspections at a closed, 600-acre military installation, nearly half of which was formerly used for artillery practice. Responsible for MEC removal activities that led to final transfer of the property. Worked on plans and reports under CERCLA guidelines, including sampling and analysis plans and final site reports. Developed cost estimates, prepared work scopes, allocated resources, and managed project personnel. Partnered with the Army, MDE, and USEPA Region 3. Used data gathered through analyses of historical documents, field reconnaissance, surveys, and site inspections. Coordinated UXO and MEC removal and avoidance activities. Helped manage the project's MEC/MC and other chemical data. Also helped manage development of a GIS to make the data more useful to the Army.

Multiple Site Investigations, Ft. McClellan, Anniston, AL. As the MEC Expert and Task Manager, developed work plans, reports, and DDs for multiple SIs at FUDS small arms ranges under purview of USEPA Region 4 and State of Alabama regulators. Managed concurrent investigations of nine ranges using X-ray florescence, robotic total station surveying, and GIS-based software to pre-characterize the sites before collecting samples for laboratory analyses and risk assessment, which resulted in a cost savings of $250,000.

Cindy Hassan, Human Health Risk Assessor, holds a Bachelor's Degree in Medical Technology and a Master's Degree in Epidemiology. Ms. Hassan has over 20 years in environmental science with expertise in risk assessment, National Environmental Policy Act (NEPA) documentation, toxicology, and hazardous materials training. She provides technical support and management on both government and commercial projects involving federal USEPA, regional USEPA, and state risk assessment guidance, as well as processes from other agencies, such as the DOD.

CERCLA/RCRA Environmental Services, Vint Hill Farms Station, Warrenton, VA. Human Health Risk Assessor responsible for conducting human health risk assessment for RI at Area Requiring Environmental Evaluation (AREE) 34. The assessment's focus was VOCs in groundwater; the primary chemicals of concern were tetrachloroethylene, trichloroethylene, and degradation byproducts. The risk assessment was conducted in accordance with guidance from both USEPA Region 3 and VDEQ. Ms. Hassan also prepared technical assessments for the Five-Year Reviews of AREE 1 and AREE 32. By presenting sound technical evidence and providing complete documentation, Ms. Hassan was instrumental in the USEPA Region 3 and VDEQ acceptance of an industrial future risk scenario for subsurface soil. Shaw's regulatory support reduced the installation's remedial costs by nearly $1M.

CERCLA/RCRA Environmental Services, Radford Army Ammunition Plant, Radford, VA. As the Human Health Risk Assessor, participated in the facility-wide study of background concentrations in soil, working with the USACE, USEPA Region 3, and VDEQ to reach consensus on the statistical approach to the study. Performed risk assessments for RCRA Facility Investigations (RFIs) at nine sites and developed cleanup levels at sites that require RCRA Corrective Measures Studies (CMSs). Worked with USEPA Region 3 risk assessor to resolve risk assessment issues throughout the project. The installation's background study achieved high praise from both USEPA Region 3 and VDEQ.

Multiple Operable Units, Letterkenny Army Depot, Chambersburg, PA. Human Health Risk Assessor responsible for reviewing previous human health risk assessments (HHRAs) performed for SE Operable Unit (OU) 5, Area A (Waste Disposal Trenches) and Area B (Clay-Lined Oil Burning Pit) as well as SW OU 9, Area J (Landfill J). Potential risks at both OUs had been found to be acceptable under industrial land use assumptions. Furthermore, the risk assessments had been approved by USEPA Region 3 and Pennsylvania DEQ. Subsequently, the Army became interested in whether these sites could be closed with NFA. Ms. Hassan negotiated NFA at Solid Waste Management Unit (SWMU) 58 (Rubble Pile) and a second Installation Restoration Program (IRP) site. In a facility-wide background study to determine the naturally-occurring inorganic background concentrations, Ms. Hassan recommended the use of explosives as a marker which significantly reduced the area that required remediation, creating a 35% cost savings for the client.

CERCLA Remedial Investigations, Ft. Detrick, Frederick, MD. Lead Human Health Risk Assessor responsible for preparing HHRAs for five sites at this installation as part of a CERCLA RI. Sites were previously used for former munitions loading and storage, test grids for biological simulants, firing range, burn area for explosives, and skeet shooting range. The HHRAs focused on the most conservative land use scenario and evaluated adult and child residents for potential exposure to soil. In addition, the RI included screening level ecological risk assessments for each site. MDE approved the results of the HHRA, and the Army's recommended NFA for the soil at all five sites.

Operable Unit 4 Remedial Investigation, Ft. Ritchie, Cascade, MD. Lead Human Health Risk Assessor responsible for preparing HHRA for OU 4 at this BRAC installation. HHRA activities included evaluation of exposures to soil, groundwater, surface water, and sediment. The HHRA addressed residual risks to chlorinated solvents (tetrachloroethylene, trichloroethylene, and degradation byproducts) after in situ treatment of groundwater with sodium permanganate. Prepared a sensitivity analysis of key inputs to the Johnson & Ettinger vapor intrusion model to satisfy concerns of the MDE regarding uncertainties. Results of this analysis justified the Army's use of engineering controls, deed restrictions, and LTM at the site as part of the redevelopment plan.

Mark Weisberg, Ecological Risk Assessor, holds a Bachelor's Degree in Biology and Environmental Studies and Master's Degrees in Oceanography and Limnology as well as Water Resources Management. Mr. Weisberg is a Certified Hazardous Materials Manager, and has more than 20 years of experience in ecology, environmental assessment, and project management. Mr. Weisberg is responsible for supervising and conducting risk assessments for RI/FSs at uncontrolled hazardous waste sites, RFIs at controlled sites, and other DOD sites. His areas of expertise include ecological and human health risk assessment; toxicology; statistical analysis; water quality; site assessment; and federal, state, and local permit preparation. His work on major projects includes environmental exposure and risk analysis, environmental permitting, and water resources management.

CERCLA Risk Assessments, Picatinny Arsenal, NJ. Lead Risk Assessor responsible for human health risk assessments following RAGS-D format for over 50 CERCLA sites since 2001. This information has been used in preparing site-specific FSs or DDs related to site closure. The data provided in these documents allowed Shaw to develop a decision matrix that provided the ability for human health risks and ecological bioaccumulation issues to be appropriately weighed and a risk management decision made. Use of these risk calculations saved the Army an estimated $80,000 compared to the performance of new risk assessments.

Multiple Ecological Risk Assessments, Radford Army Ammunition Plant, Radford, VA. Lead Ecological Risk Assessor responsible for completing numerous screening level ecological risk assessments since 2002. This information has been used in preparing site-specific CMSs related to site closure. A letter of commendation from this client stated the Shaw team established a 'can do' attitude that restored confidence in the installation and USACE to the point where there are no longer questions regarding whether the work will be done on time, within budget, or be of high quality.

Multiple Ecological Risk Assessments, Letterkenny Army Depot, Chambersburg, PA. Lead Ecological Risk Assessor responsible for senior reviews and technical consulting on several sites, including SE OU 5 Areas A and B. With his knowledge of unique regional attributes, Mr. Weisberg completed the project in a timely manner, giving attention to details that may have been overlooked had someone with less relevant experience completed the job. For example, his contributions have helped Shaw identify over $2M in cost saving initiatives to date.

CERCLA Five-Year Review, Vint Hill Farms Station, Warrenton, VA. As the Lead Ecological Biologist and Risk Assessor, reviewed remedial alternatives of the selected remedy to determine if it was still protective of the environment for the CERCLA Five-Year Review. Task included examining current land use and habitat, wildlife exposure assumptions and intake parameters, chemical toxicity reference values, ecological screening benchmarks, and other critical parameters used in the quantitative ecological risk assessments. Based on this detailed review, the selected remedies for AREEs 1 and 32 were determined to continue to be protective of the environment.

Multiple Risk Assessments, Ft. Ritchie, Cascade, MD. Lead Ecological Risk Assessor for various assessment activities. Responsible for performing risk assessment evaluations, including an alternate concentration limit evaluation for OU 4.

Eric Malarek, Project Chemist, holds a Bachelor's Degree in Chemistry and a Master's Degree in Business Administration. Mr. Malarek has 25 years hands-on experience overseeing and providing broad range of environmental project consulting, quality assurance (QA) oversight and training, data validation, data management, field sampling, laboratory and field auditing, and technical support. His project experience includes site/remedial investigations, removal actions, FSs, corrective actions, and LTM programs at large federal sites. He is extremely knowledgeable in data validation and relevant laboratory operations, procedures, regulatory requirements, quality assurance/quality control (QA/QC) protocols, scheduling, data packages, and other critical factors for ensuring project success.

Multiple MEC and HTRW Investigations, Ft. Ritchie, Cascade, MD. Chemist for this $15.9M project where Shaw conducted MEC and HTRW remedial investigations, including field sampling and analyses, historical data analyses, field reconnaissance, surveys, and site inspections. Mr. Malarek was active in: preparing and reviewing the project statement of work and Quality Assurance Project Plan (QAPP) addendum checklist; selecting the laboratory; coordinating with the USACE chemist and project manager; and performing data management and data validation. Site activities included sampling and analysis for site-specific contaminants and waste characterization parameters related to ongoing removal actions at OU 15 (polychlorinated biphenyls [PCBs] and metals), OU 2 (metals), OU 4 (VOCs), and several UST tanks (TPH). Waste characterization parameters included Toxicity Characteristic Leachate Procedure analysis where applicable. Data validation was performed for 100% of the data in accordance with USEPA Region 3 guidance.

Remedial Investigation at Landfill G, Letterkenny Army Depot, Chambersburg, PA. Chemist for RI at Landfill G. Mr. Malarek was active in: preparing and reviewing the project statement of work and QAPP addendum checklist; selecting the laboratory; coordinating with the USACE chemist and project manager; and performing data management and data validation. LTM of groundwater elevations at newly installed off-post piezometers was performed, and monthly groundwater samples were collected for VOCs. Evaluated analytical data resulting from field sampling activities; RI for VOCs, explosives, semivolatile organic compounds (SVOCs), and metals; removal action for metals and PCBs; and LTM monitoring for VOCs. The QAPP addendum provided site-specific QA/QC requirements for ensuring the integrity of activities associated with the data quality objectives. Data validation was performed for 100% of the data in accordance with USEPA Region 3 guidance.

Multiple Remediation Projects, Radford Army Ammunition Plant, Radford, VA. Chemist for multiple environmental support projects performed under various contracts worth a combined $11.8M. A majority of this work has been environmental investigations in support of the RCRA Permit. Mr. Malarek participated in: preparing and reviewing the project statement of work and quality assurance addenda; coordinating with the USACE chemist and project manager; and performing data management and data validation. Site activities included sampling and analysis for approximately 143 soil and 38 aqueous samples for an ongoing remedial action at various SWMUs. The soil and sediment analysis included VOCs, SVOCs, polynuclear aromatic hydrocarbons (PAHs), pesticides and PCBs, herbicides, explosives, metals, and dioxins and furans. The groundwater analysis included VOCs, SVOCs, PAHs, pesticides and PCBs, herbicides, explosives, metals, dioxins and furans, perchlorate, chloride, sulfate, nitrate, nitrite, ethane, ethene, methane, sulfide, alkalinity, total organic carbon, and pH. The addenda provide site-specific QA/QC requirements for ensuring the integrity of activities associated with the data quality objectives. Data validation was performed for 100% of the data in accordance with USEPA Region 3 guidance.

CERCLA/RCRA Environmental Services, Vint Hill Farms Station, Warrenton, VA. Chemist for CERCLA/RCRA environmental services project for such activities as investigations, remedial actions, and LTM. Mr. Malarek was active in preparing and reviewing the QAPP and in performing data validation and management. Site activities include sampling and analysis for samples covering VOCs at AREE 34 as well as dioxins/furans and metals at AREE 1 for ongoing investigation activities. Data validation was performed for 100% of the data in accordance with USEPA Region 3 guidance.

Colonie Site Remediation, Colonie FUSRAP Site, Colonie, NY. Chemist for $65M, 8-year environmental remediation. Mr. Malarek was active in preparing and reviewing the project work plan, QAPP, and sampling and analysis plan as well as in performing data validation for groundwater LTM for metals, VOCs, and radiological isotopes. Data validation was performed for 100% of the data in accordance with USEPA Region 2 guidance.

Scott Bailey, Laboratory Director, *Gulf Coast Analytical Laboratories, Inc*. (GCAL) holds a B.S. degree in Environmental Health. Scott Bailey has 28 years of related experience. He is responsible for coordinating the overall activities of the analytical laboratories on a daily basis and providing long-term direction. Responsibilities include monitoring the scheduling of analytical testing and releasing testing data and results. He has served as Technical Advisor for GCAL for 3 years and assisted laboratory management with training needs, method development, and data validation. Prior to Technical Advisor, Mr. Bailey served as Operations Manager for GCAL for 12 years and was responsible for coordinating the overall activities of the analytical laboratories on a daily basis and providing long-term direction. Responsibilities included monitoring the scheduling of analytical testing and releasing of testing data and results.

Prior to GCAL, Mr. Bailey served as Organics Manager for ITS – Environmental Laboratories for 2 years and was responsible for the management of the GC, GCMS, and the extraction departments of the laboratory. Duties also included supervision of the report generation department. He was Division Manager for National Environmental Testing for 1 year and directed the functional areas of marketing, finance, chemistry, and administration for the lab facility. Additional duties included contract administration, scheduling, and client consultation. He also served as Operation Manager for Environmental Testing & Certification Corporation for 3 years and directed the functional areas of marketing, finance, chemistry, and administration for the lab facility. Additional duties included contract administration, scheduling, and client consultation. Prior to this, he was an analyst for ETC.

Brenda Martinez, Client Services Manager, *Gulf Coast Analytical Laboratories, Inc.* holds a B.S. in Bioenvironmental Science and a M.S. in Environmental Management. Ms. Martinez is responsible for performing Project Management. Her duties include acting as the main point of contact for the client in the laboratory and to provide technical information to clients and keep them informed of project progress. Her duties also include coordinating and scheduling projects with various departments within the laboratory according to the customers analytical and turnaround requirements as well as to review chains of custody, login reports and final reports.

Her past experience prior to GCAL was as Vice-President of Client Relations and her responsibilities included acting as the main point of contact for the client in the laboratory, reviewing method requests and coordinating project setup in the lab. She also wrote final reports and reviewed laboratory data for accuracy and quality assurance. She also served as the internal auditor for the laboratory and maintained client database. Before her VP role, she served as Laboratory Manager where she was responsible for setting up and overseeing all laboratory projects. Her focus included concentration on bench scale remediation studies and product biodegradability assessments including the maintenance and operation of the analytical equipment as well as writing and reviewing laboratory Standard Operating Procedures. She supervised up to 4 laboratory technicians.

Shelley Bourgeois, Quality Assurance Manager, *Gulf Coast Analytical Laboratories, Inc.* holds a B.S. degree in Biology. Ms. Bourgeois current responsibilities include the implementing and monitoring the laboratory Quality Assurance Program, conducting internal audits, investigating problem areas, establish data quality criteria, verifying corrective actions are getting taken when necessary, directing participation in state and federal accreditation programs, monitoring training records, and monitoring proficiency test studies. Additional duties include administering the ethics training/data integrity program and providing reports concerning QA matters to management. Her past experience was as Project Chemist, responsible for contracting analytical laboratory services and for QA/QC verification of data. Performed data validations and ensured data validation issues were addressed in the day-to-day operations of the investigation. Prior she was Inorganics Manager for GCAL and responsible for the management and supervision of the Metals Laboratory. Her duties included the management and training of personnel, scheduling of, sample workloads, supervision of metals sample preparation, analysis of samples by various analytical instrumentation, coordination of laboratory QA/QC projects, and maintenance of procedures to QA/QC guidelines. In addition, responsibilities include comprehensive data review and validation for the laboratory as well as the coordination of higher level QA data packages. Prior to this position, she was Metals Analyst for GCAL and responsible for analysis of samples by

various instruments including GFAA, Flame AA, ICPMS and the mercury analyzer. Additional responsibilities included data reduction and posting in the LIMS.

Stephanie Mossburg, Microbac Laboratories, Inc. Team Chemist/Data Specialist/Project Manager Ms. Mossburg has been with Microbac since 1991. She holds an AS in Chemistry and a BS in Biochemistry. After spending eight years in the laboratory, Stephanie was promoted to a Project Chemist, concentrating on data validation of AFCEE projects. Since the inception of the laboratory's Sales/Service Teams, she has provided technical support and project management, performing pre-award technical review, LIMS customization/project setup and 100% final review of EDD's and hardcopy data packages for completeness and accuracy. She focuses primarily on government programs including DODQSM, AFCEE, Army Corps of Engineers, and Navy projects; however, her assigned clientele also involves her in commercial laboratory projects.

Her regulatory program experience covers DOD, DOE, AFCEE, RCRA, NPDES, and Superfund Voluntary Action Programs. Her instrument experience covers Gas Chromatograph Mass Spectrometer (GC/MS), HP Mass Spec & Tekmar 3000 systems, Tekmar 2000 purge and trap systems, Hewlett-Packard 5890 Series GCs, equipped with PID, FID and ELCD detectors, and Archon auto samplers.

David E. Vandenberg, Managing Director Microbac Laboratories, Inc. Mr. Vandenberg has 26 years experience in the Environmental, and Health and Safety Fields. As Vice President of Microbac's Analytical Management Division, he is responsible for business development and expansion; profit/loss analysis and implementation; general administrative and management duties; operation of Analytical Operations; and, supervision of approximately 75 fulltime employees. Mr. Vandenberg is familiar with the needs and concerns necessary to successfully implement environmental sampling and analytical programs within laboratory operations. He is an expert in design and project management in the areas of Analytical Support, RI/FS, Asbestos (AHERA), Industrial Hygiene, and Site Remediation techniques. In addition, Mr. Vandenberg is competent in regulatory compliance and permitting, and is familiar with RCRA, SARA, NPDES, and CERCLA programs. He is also knowledgeable in the application of SW-846, CLP, and standard methods. His education includes a B.S in Chemistry/Business,

Mr. Vandenberg has worked within a variety of different industries, and has had extensive experience providing services to industrial clients. In particular, he is familiar with potential matrix problems, specifically related to coal gasification projects. He has worked on sampling design and analytical design at two coal gasification units: one for DOE in Morgantown, West Virginia and another at General Electric plant in Schenectady, New York. Additionally, under Mr. Vandenberg's direction, the staff at the Marietta location developed, at the request of a client, a low-level polynuclear aromatic hydrocarbon (PAH) GC/MS, method (PPT). Microbac realizes the ubiquitous nature of PAH's in the coal gasification process. Microbac also recognizes phenolics, cyanide, and arsenic as potential problem areas and is familiar with these parameters. On site screening techniques for phenolics utilized in process waters have also been developed by Microbac staff.

David L. Bumgarner, Technical Director/Quality Assurance Officer, Microbac Laboratories, Inc. Mr. Bumgarner has a diversified technical background in the environmental/analytical field with practical experience in air pollution monitoring, potable and non-potable water analyses, analytical quality control, production of quality control standards, and environmental laboratory management. Mr. Bumgarner's air pollution work includes the calibration and auditing of ambient air monitors and gas chromatographic analysis of organic vapors in industrial stack gases. While employed by the West Virginia Department of Health, he was responsible for implementation of analytical methods for organic compounds in drinking water as required by SDWA. Mr. Bumgarner has over fifteen years of experience in the management of environmental laboratories supervising EPA methods for wet chemistry, AA, ICP, GC, GC/MS, and waste characterization. He served as Microbac's corporate QA/QC manager for two years, writing SOP's for all laboratories and for groundwater sampling. He was also directly involved in the evaluation, selection, and implementation of a LIMS for the analytical laboratory. He provides analytical consultation, specifically the preparation and review of Sampling and Analysis Plans (SAP) and development of Quality Assurance Project Plans (QAPP) for RCRA Facility Investigations (RFI) in EPA Regions 3 and 5. His education includes BA Chemistry and MS Chemistry. His project experience includes program and lab management on various sites and locations.

Attachment B
Subcontractor Laboratory Quality System Manual
(Provided on CD)

GULF COAST ANALYTICAL LABORATORIES, INC

QUALITY ASSURANCE PROGRAM PLAN

FOR

GCAL Inc.
7979 GSRI Avenue
Baton Rouge, Louisiana 70820
225-769-4900

Revision 30
September 29, 2011

Approval Signatures:

9/29/2011
Randy Whittington – Chief Executive Officer Date

9/29/2011
Scott Bailey – Laboratory Director Date

9/29/2011
Allison Naquin – Technical Services Director Date

9/29/2011
KarenVarnado – Quality Assurance Manager Date

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1 QUALITY ASSURANCE POLICY STATEMENT

Quality Assurance consists of a planned system of activities necessary to provide confidence in the results of laboratory analytical determinations. The principal objective of Gulf Coast Analytical Laboratories, Inc. (GCAL) is the production of high quality analytical data through the use of measurements that are accurate and reliable for the intended purpose. We are dedicated to providing analytical data and services that conform to all of the requirements specified and expected by our clients. This Quality Assurance Program Plan (QAPP) details facilities, personnel and equipment necessary for accomplishing this objective along with general procedures and practices that will be followed to maintain adherence to the objective. All policies and procedures have been structured in accordance with The NELAC Institute (TNI) Standards, the Department of Defense (DOD) Environmental Laboratory Accreditation Program requirements, and in accordance with applicable state and federal regulations, approved reference methods, and guidance documents. GCAL's management staff is dedicated to maintaining compliance with state and federal regulations, TNI Standards and the DOD requirements.

There is a commitment and dedication by all laboratory staff to produce data of known and documented quality. This commitment and dedication to quality is fully supported from the bench level to upper management in order to meet the objectives of our laboratory and best serve our clients.

GCAL's approach to Quality Assurance starts with the Chief Executive Officer (CEO) who delineates policy and sets goals in conjunction with senior management personnel. Management staff and laboratory personnel implement policies. All departments are involved in the process by providing assessment of operating procedures along with recommendations for improvements or corrections. The QAPP and the appropriate Standard Operating Procedures are distributed to all laboratory personnel as controlled documents according to SOP QA-001 (Document Control). All personnel are required to read and comply with this program.

The Quality Assurance Manager (QA Manager, QAM) oversees prevention, assessment, and correction procedures for the analytical laboratory and various associated departments within the organization. These three functions; prevention, assessment, and correction, comprise the foundation of the laboratory's approach to Quality. Through this foundation, GCAL's management staff is committed to continually improve the quality system.

Prevention covers positive actions taken before or during analyses to insure that the analytical systems are functioning properly. Prevention includes such things as instrument calibration and maintenance, frequent standardization, personnel training and quality control planning.

Assessment is a component of quality control that includes monitoring of performance to determine precision and accuracy. Examples include duplicate and spike analyses, check samples, peer review of calculations and validation of methodology.

Correction is action taken to determine the causes of quality non-conformances and to restore proper functioning of the analytical system. This includes trouble shooting to correct instrument malfunctions, or retraining of personnel.

All quality assurance activity requires constant monitoring and documentation to provide evidence of consistent, valid analytical data. GCAL keeps records of such activities in order to have available for its clients documented assurance that the data they receive quantitatively reflect the parameters requested.

The policies and practices of quality assurance/quality control presented in this plan are set forth as minimums. Additional quality assurance/quality control measures are defined by a specific project plan.

In the case of discrepancies between this document and SOPs, the SOP shall take precedence. A list of supporting SOPs including technical procedures is located in Appendix F of this document.

_____

Randy Whittington, CEO

2 ETHICS POLICY

GCAL utilizes a clearly stated ethics policy in the form of the following Ethics and Data Integrity Statement. This agreement is discussed with all new employees during orientation and is then signed and retained with the employee's training file. Violation of the agreement is basis for termination of employment. Employees receive training in data integrity and their ethical responsibilities annually. Each employee must sign GCAL's Ethics and Data Agreement annually. The signed document will be kept in the employee training records.

GCAL's management takes seriously any allegations of improper, unethical or illegal activities. All allegations shall be investigated, fully documented and treated as confidential. The identity of the employee reporting the possible ethics violation shall be maintained as confidential. GCAL's management shall not retaliate against any employee raising ethical questions.

GULF COAST ANALYTICAL LABORATORIES, INC.

ETHICS AND DATA INTEGRITY AGREEMENT

I, _____, state that I understand the high standards of integrity required of me with regard to the duties I perform and the data I report in connection with my employment at GCAL. Our core values are honesty, success, service and integrity. I understand that it is critical for our long-term success that each and every employee aligns with all company core values.

I agree that in the performance of my duties for GCAL and its clients, I shall conform to the following ethics standards and will report immediately to the Quality Assurance Manager and the appropriate supervisor any information concerning misrepresentation of analytical data that includes, but is not limited to:

1) Altering an instrument computer or clock for any inappropriate purpose;

2) Altering the contents of logbooks and/or data sheets to misrepresent data;

3) Misrepresenting an analyst's identity;

4) Changing raw data documents with correction fluid or obliteration;

5) Preparation and submittal of fraudulent data packages;

6) Inappropriate calibration techniques such as peak shaving, setting fraudulent integrator parameters, or use of computer macros that alter QC results.

7) Changing reported results without proper documentation and approval;

8) Altering injection volumes for calibration and misrepresenting the true values;

9) Failure to comply with standard operating procedures or methods without proper documentation and approval;

10) Any attempt to misrepresent data or events as they actually occur in the course of data production, review or reporting;

11) Disposing of or deleting electronic data files or hardcopies of raw data;

12) Failure to analyze all QC and PT samples in the same manner as client samples. This includes glassware selection, all prep steps, any clean up steps, reagent addition, and analysis, unless specified to be different by the SOP or reference method;

13) Engaging in any practice that ultimately misrepresents data or narratives in any way.

I will not knowingly participate in any such activity and will not tolerate unethical practices by others. I understand that confidentiality will be strictly enforced by GCAL when dealing with these matters. As a further extension of my commitment to this program, I am responsible for seeking approval to report data resulting from techniques or procedures that deviate from standard operating procedures, methods, or industry standard practices. Any such reporting of data will include a laboratory narrative that must be approved by the appropriate supervisor and the QAManager.

If I am unsure of how to properly handle data generated by me, I am responsible for seeking advice and approval from the Quality Assurance Manager and the appropriate supervisor. I agree to inform the Q A Manager and the appropriate supervisor of any accidental reporting of non-authentic data by others or myself within 24 hours of discovery.

I understand that if I knowingly participate in any prohibited activity, I will be subject to disciplinary action that may include immediate termination by GCAL. I also understand that I face individual suspension and debarment from all Federal programs should I be convicted of such practices. I understand that suspension and debarment from all Federal programs affects my ability to work in the environmental field, as well as, any other profession where government funding or loans may be involved. I understand the most serious consequence of unethical conduct can be imprisonment if convicted.

I understand that it is not the company’s intent to punish anyone for an accidental mistake or oversight. Employees will not face disciplinary actions for an accidental mistake or oversight. Repeated careless or neglectful behavior will be subject to corrective action. Covering up an accidental mistake or oversight is not acceptable behavior and will result in termination. Mistakes or oversights are immediately reported to the appropriate supervisor and/or QAM.

My signature affirms my understanding of the consequences of violating GCAL's ETHICS AND DATA INTEGRITY AGREEMENT and my commitment to its intent. My signature further affirms that I have received formal training on this topic.

_____
Printed Name

_____
Signature Date

3 Administrative Organization

GCAL is organized along clear lines of authority to provide our clients with service that is efficient and reliable. The organizational structure of the laboratory is shown in Appendix A.

It is the policy of the laboratory that each management and operational level has a designated deputy or deputies to maintain continuity of service and other functions whenever key staff is absent. The deputies are responsible for the completion of duties during the staff member's absence. For the purposes of certification, the Technical Services Director has the responsibilities of the Technical Director as defined by TNI. In the event that the Technical Services Director is not able to perform his/her duties for more than 35 consecutive calendar days, GCAL will notify the accrediting authorities in writing and will identify the temporary Technical Services Director. Temporary deputies are defined in the chart below.

Position	**Deputy**
Chief Executive Officer (CEO)	Technical Services Director
Laboratory Director	Technical Services Director
Technical Services Director	Laboratory Director or Quality Assurance Manager
Quality Assurance Manager	Technical Services Director
Department Manager	Department Supervisor
Department Supervisor	Group Leader
IT Manager	Laboratory Director and/or CEO

3.1 Roles, Responsibilities, and Qualifications

The following lists the general roles and responsibilities in each level of the laboratory. Resumes of key personnel are attached in Appendix B. Management ensures that each employee is independent from commercial, financial, or other pressures that might adversely affect the quality of test and reporting of results.

All employees are responsible for complying with GCAL's quality system. It is the responsibility of every employee to perform the duties outlined in this Quality Assurance Manual or as assigned by management.

The CEO, Technical Services Director, Laboratory Director, Quality Assurance Manager, Department Managers or any Supervisor may halt work and withhold reports when non-conforming work is identified. In addition, management may halt work if an employee is observed not following laboratory procedures or if the employee is observed performing questionable acts while analyzing samples. Work will not be resumed until such time as the CEO, Technical Services Director, Laboratory Director and/or Quality Assurance Manager has deemed the process to be compliant with GCAL's policies and procedures.

3.1.1 The Chief Executive Officer (CEO) bears the primary responsibility for data quality at GCAL and directs laboratory policies. The CEO:

- is responsible for the laboratory and its employees.
- directs the functional areas of marketing and finance.
- makes financial decisions for the laboratory.
- sets goals and objectives for the laboratory.
- supervises the Chief Financial Officer, IT Director, Technical Services Director, Laboratory Director and the Safety/Regulatory Compliance Officer.
- as a member of management participates in strategic planning to develop short-term and long-term goals for the laboratory.

3.1.2 The Laboratory Director (Lab Directory) is responsibility for data quality at the laboratory. The Lab Director must have a degree in chemical, environmental, biological sciences, physical science or engineering with at least 24 college credit hours in chemistry and at least 5 years of experience in environmental testing. The Lab Director is responsible for the supervision of laboratory operations and reporting results. The Lab Director:

- reports to the CEO.
- reviews, approves and implements the Quality Assurance Project Plan, all policies and standard operating procedures in the laboratory.
- sets goals and objectives for the laboratory and employees.
- makes personnel and financial decisions.
- assures the laboratory has sufficient resources for the timely generation of data.
- provides day-to-day supervision, conducts performance appraisals, and delegates work assignments to personnel.
- monitors standards of performance in quality control and quality assurance.
- monitors the validity of the analyses performed and data generated in the laboratory to assure data are of known and documented quality.
- directs the development, validation, and implementation of new test methods as necessary.
- is responsible for maintaining the work environment, which encourages open, constructive problem solving and continuous improvement.
- as a member of management participates in strategic planning to develop short-term and long-term goals for the laboratory.

3.1.3 The Technical Services Director is responsible for coordinating the activities of the Quality Assurance Department, the Sample Administration Department, Client Services Department, and administrative support personnel. The Technical Service Director must have a degree in chemical, environmental, biological sciences, physical science or engineering with at least 24 college credit hours in chemistry and at least 5 years of experience in environmental testing. The Technical Services Director:

- reports to the CEO.
- reviews and approves the Quality Assurance Project Plan and applicable standard operating procedures for the laboratory.
- defines, communicates and enforces quality standards.
- provides day-to-day supervision, conducts performance appraisals, and delegates work assignments to personnel.
- is responsible for ensuring that all quality related requirements are understood and implemented by the laboratory.
- is responsible for effectively communicating with clients all quality related requirements.
- tracks and identifies new opportunities to improve GCAL's methods and employee training.
- reviews and approves all technical proposals.
- as a member of management participates in strategic planning to develop short-term and long-term goals for the technical services department and the laboratory.

3.1.4 The Information Technology Director manages the implementation and development of information technology tools. The IT Director is responsible for the automated data collection systems used by the laboratory. The IT Director:

- reports to the CEO.
- works with management and employees to assess and respond to GCAL's IT needs.
- provides day-to-day supervision, conducts performance appraisals, and delegates work assignments to IT personnel.
- is responsible for maintaining the integrity and continual operations of GCAL's network and LIMS.
- is responsible for developing and ensuring that all system backups are performed as scheduled.
- is responsible for developing, reviewing and certifying all back-up and disaster recovery procedures.
- maintains security and privacy of LIMS and computer systems.
- oversees the development, design and implementation of new applications and changes to the existing computer systems and software packages.

- interacts with clients to determine IT requirements such as electronic data deliverables.
- as a member of management participates in strategic planning to develop short-term and long-term goals for the IT department and the laboratory.

3.1.5 IT Assistant:

- reports to the IT Director
- assist in maintaining the LIMS system.
- assist in performing system backups.
- assist in maintaining the integrity and continual operations of GCAL's network and LIMS.
- performs other duties as assigned by the IT Director.
- performs other duties as assigned.

3.1.6 The Report Validation Manager:

- reports to the Laboratory Director.
- provides day-to-day supervision, conducts performance appraisals, and delegates work assignments to personnel.
- is responsible for report validation and review.
- is responsible for review of Quality Assurance Project Plans for incoming projects and notifies the laboratory of project specific requirements.
- assists the lab in method development and implementation.
- is responsible for reviewing final reports. Any discrepancies found in the data are reported to the appropriate Department Supervisor for review and correction if necessary.
- is responsible for signing final reports.
- supervises the receptionist, report validation, data production, and report generation groups.
- Performs other duties as assigned.

3.1.7 The Quality Assurance Manager is responsible for implementing, maintaining and improving the quality system throughout the laboratory. The Quality Department operates independent of the production pressures of the laboratory. The QA Manager must have a degree in chemical, environmental, biological sciences, physical science or engineering with at least 24 college credit hours in chemistry and at least 2 years of experience in environmental testing. If the QA Manager is absent then the Technical Services Director is the deputy. The QA Manager:

- reports to the Technical Services Director.
- supervises the Quality Assurance Technician.
- operates independently from the laboratory operations.
- is responsible for maintaining the laboratory's certification status.
- serves as the focal point for the quality system and is responsible for oversight and/or review of quality system.
- is responsible for the preparation and maintenance of the GCAL's Quality Assurance Program Plan.
- acts as the liaison between the laboratory and external parties on matters relating to GCAL's quality system and/or external assessments and audits.
- is the contact for performance testing studies and project-specific quality control issues.
- coordinates the analysis of proficiency test samples and maintains records of the results.
- monitors analysts' training records and verifies that training records are adequate and current.
- approves and confirms the implementation of corrective actions.
- is responsible for the approval and distribution of controlled documents.
- has the authority to intercede in all areas where quality related problems exist. No work will be released until the related quality deficiency has been corrected and approval has been given to proceed forward.
- must have training in QA/QC and a general knowledge of the tests included in GCAL's scope of accreditation.
- is responsible for implementing, maintaining, and improving the quality system;
- ensures that all personnel understand their contributions to the quality system.
- ensures communication takes place at all levels within the laboratory regarding the effectiveness of the quality system.
- evaluates the effectiveness of training.
- Conducts internal audits annually and provides documentation of these audits to management.
- meets with laboratory staff to disclose issues of non-compliance identified during internal audits to develop corrective action strategies.
- uses internal audits, third party assessments, control charts, proficiency testing results, data analysis, corrective and preventive actions, customer feedback, and management reviews in an efforts to monitor trends and continually improve the quality system.
- performs other duties as assigned.

3.1.8 Quality Assurance Technician:

- reports to the Quality Assurance Manager.

- tracks and assists in developing laboratory logbooks including assembling, retrieving and archiving.
- tracks and verifies internal calibration programs.
- assist with revising SOPs as assigned and enters the SOPs into GCAL's intranet.
- obtains purchase orders for and schedules calibration services.
- assist with employee training and assists in maintaining the employee training records.
- assist in preparing for and assist during internal audits, external audits and assessments.
- assist with GCAL's proficiency testing program.
- assist the Quality Assurance Manager in implementing the quality system and in ensuring that the quality system is followed at all times.
- assist in obtaining and updating documents for training and/or experience in QA/QC procedures and is knowledgeable in the quality system as defined by State Regulations and TNI standards.
- completes applications for renewal of accreditation.
- performs other duties as assigned.

3.1.9 Department Managers:

- report to the Laboratory Director.
- are responsible for the overall flow of work and data through their department.
- provide day-to-day supervision, conduct performance appraisals, and delegate work assignments to personnel in the laboratory.
- are responsible for the maintenance of accurate SOP's with input from the QA/QC Department.
- are responsible for training laboratory personnel.
- are responsible for reviewing and validating data released from the department.
- supervise the quality control activities performed as part of routine analytical operations
- perform other duties as assigned.

3.1.10 Department Supervisors:

- report to the Department Manager.
- are responsible for the overall flow of work and data through their section/area.
- provide day-to-day supervision, conduct performance appraisals, and delegate work assignments to personnel in the laboratory.
- are responsible for the maintenance of accurate SOP's with input from the QA/QC Department.

- are responsible for all activities within their section/area, ensuring that all instrumentation and equipment meet performance criteria and calibration requirements.
- are responsible for training laboratory personnel.
- are responsible for validating data released from their section/area of the laboratory.
- inform the Department Manager or Laboratory Director of project status and any laboratory capacity issues.
- must have experience in the methods performed in their section/area and experience in data review and validation.
- perform other duties as assigned.

3.1.11 Lab Analysts/chemists:

- report to the Department Supervisor.
- are responsible for the generation of data by analyzing samples in accordance with GCAL's approved and implemented standard operating procedures in a manner that meets regulatory and reference method requirements.
- are responsible for recording all observations during analysis and for ensuring that all documentation related to the analysis is accurate and complete.
- are required to notify the Department Supervisor, Department Manager, Lab Director or Quality Assurance Manager of any quality issues immediately upon discovery.
- have the authority to accept or reject data based on compliance with QC acceptance criteria.
- are responsible for the initial data review.
- are required to be familiar with reference methods cited in GCAL approved SOPs.
- are required to read the Quality Assurance Program Plan.
- are required to be familiar with state and federal regulation that apply to analytical testing procedures.
- perform other duties as assigned.

3.1.12 Project Managers/Client Services:

- report to the Laboratory Technical Director.
- are responsible for scheduling client projects.
- communicate to laboratory personnel any project-specific requirements.
- review log-in summaries.
- notify the client of sample receipt and/or analytical problems.
- monitor the progress of analytical work and provides data to the client in a timely manner.

- documents client inquiries.
- perform other duties as assigned.

3.1.13 Group Leaders:

- report to the Department Supervisor.
- are the temporary deputies in the event the Department Supervisor is absent.
- guide the scheduling of sample analysis.
- ensure there is sufficient staff available.
- perform other duties as directed by the Department Supervisor or member of management.

3.1.14 Safety/Compliance Officer

- reports to the CEO
- provides safety training for GCAL's employees.
- is responsible for checking and maintaining safety equipment.
- has knowledge of waste disposal regulations.
- Coordinates waste disposal activities including documenting waste disposal.
- performs safety audits and reports findings to management.
- performs other duties as assigned.

3.1.15 Couriers

- Report to the Technical Services Director.
- Responsible for pickup and delivery of client samples to the laboratory.
- Responsible for sample collection on an as needed basis.
- Perform other duties as assigned.

3.2 Personnel Training

It is the policy of GCAL to hire employees with an educational background and/or experience in an analytical field. On-the-job training takes place for all new employees based on needs identified by the job description and tasks required by the position. New employees are hired for a probationary period of three months. At the end of three months the employee's records are reviewed and evaluated for performance and productivity and a decision is made whether to continue employment.

It is the responsibility of every employee to perform their job duties as outlined in this QAPP and in accordance with GCAL's SOPs. All quality system documents are communicated to the appropriated personnel. Documents that are included in the quality system are available to all employees on GCAL's Intranet site and/or hardcopy.

3.2.1 GCAL's training program begins with an orientation designed to familiarize the new employee with safety and chemical hygiene issues, the importance of QA/QC in an analytical laboratory, general laboratory procedures, and GCAL's policies. All employees undergo training in ethical and legal responsibilities including the potential penalties for improper, unethical, or illegal actions. Each employee must read and sign GCAL's Ethics and Data Integrity Agreement. Employees are required to read the laboratory QAPP at the time of hire and any time the QAPP is revised. All technical personnel undergo a training process involving lecture tapes that cover basic laboratory tasks. A written test follows each tape. Employees who perform or review manual integrations as part of their job duties receive training on GCAL's manual integration policy. Employees performing manual integrations must sign GCAL's Manual Integration Policy Statement.

3.2.2 New employees are under the direct supervision of experienced analysts and/or the department supervisors who are responsible for instructing the Trainee on the analytical procedures including the applicable QA/QC. Training includes reviewing Standard Operating Procedure (SOP) appropriate to the Trainee's job duties, appropriate reference methods, and hands-on training with instruments and/or equipment. Reference methods are available to laboratory personnel either in hardcopy or electronically. Copies of the EPA Test Methods for Evaluating Solid and Chemical Waste (SW846), Chemical Analysis for Water and Wastes, Standard Methods For The Examination of Water and Wastewater, and ASTM methods are available. The analyst in training must perform an acceptable initial demonstration of capability (IDOC) before being allowed to analyze samples without direct supervision. The IDOC consists of successfully analyzing four consecutive laboratory control samples (LCS) that have been prepared at a specified concentration using a certified stock standard. The 4 aliquots shall be analyzed either concurrently or over a period of days if necessary. The IDOC will be deemed acceptable if the precision and accuracy meet the requirements established by GCAL.

3.2.3 Analyst are required to complete a continuing demonstration of capabilities (DOC) whenever there is a significant change to the instrument or test method or at minimum annually unless otherwise required by the reference method. The DOC shall include one of the following: acceptable performance of a Proficiency Test sample; performance of 4 consecutive LCS samples that meet the laboratory's requirements for precision and accuracy. Refer to SOP QA-014 for addition information on demonstrations of capabilities.

3.2.4 GCAL recognizes developmental training as a means to increase the effectiveness of the employee and the organization. Therefore, GCAL utilizes other training methods along with on-the-job training. Examples include seminars, specialized training by instrument manufacturers, and internal training courses. GCAL encourages employees to take college courses appropriate to the work performed by the laboratory.

3.2.5 On-going proficiency is documented using the Demonstration of Certification Statement form and must be signed by the Analyst, Technical Services Director and the Quality Assurance Manager. The signed Certification Statement and supporting data are kept in the employee's training records.

3.2.6 Additional training will be required for an employee whose performance does not meet standard requirements.

3.2.7 Periodic performance reviews are given to all personnel. The purpose of these reviews is to give recognition for good work when desired, outline personnel and departmental objectives, suggestions for improvement and clarification of responsibilities.

3.3 Training Records

The QA/QC Department maintains training records for each employee. The records include the demonstration of capability, training course certificates, in-house or external training seminar documentation, and ethics agreement and manual integration agreements if required.

4 QUALITY ASSURANCE/QUALITY CONTROL

4.1 Quality Assurance Responsibilities

Quality Assurance (QA) is defined as an integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets the defined standards of quality with a stated level of confidence. (NELAC 2003) QA is an integral part of GCAL's quality system. The direct and ultimate responsibility for assuring data quality at GCAL rests with the CEO. The CEO develops policies and general quality assurance strategies in collaboration with the management staff and department supervisors.

GCAL has clearly defined staff (QA) responsibilities. The first level of QA lies with the laboratory analyst, who is responsible for performing the work properly, documenting it, and obtaining peer review to assure that the data meets scientific standards. To accomplish this, the analyst must have a clear understanding of the analytical techniques and procedures used and the factors that affect the quality of the results. Analysts' capabilities are verified prior to conducting analyses and reviewed periodically thereafter.

Analysts must have a working knowledge of the QA policies, including data quality objectives for laboratory control standards, duplicates and spikes; an understanding of detection limits and standard calibration requirements; and knowledge of preventive maintenance techniques. All staff is required to review and follow all applicable SOPs and the Quality Assurance Program Plan.

The second level of quality assurance lies with the management staff and department supervisors. Management is responsible for the proper training of analysts and stressing the importance of accuracy and reliability of results. Management is responsible for the quality of all analytical data produced. This responsibility includes routine review and approval or disapproval of all data and inspection of the QC records associated with the data. If the data are not adequately substantiated, corrective action is taken.

The QA manager is responsible for the the QA/QC program. This includes administration of the program as outlined in this document, maintenance of QA records including this QAPP, and preparation of reports to management covering QA activities. The QA Manager or designee performs annual audits of QA procedures and employees, establishes and maintains accreditation, and coordinates all proficiency testing. The QA Manager oversees the corrective action program.

4.2 Proficiency Testing (PT studies)

GCAL participates in a minimum of two TNI and State approved proficiency test studies each year and performs corrective action PT studies as necessary. The QA/QC Department orders the required PT studies at approximately six-month intervals from a TNI and/or state approved Proficiency Test Provider. When PT samples are received, the QA Technician or designee will log the PT samples into the LIMS. The PT study is assigned a work order number. PT samples are handled as client samples throughout the analytical process. PT samples will be handled as real environmental samples utilizing the same analyst, procedure, and equipment as would be used for client samples. PT samples will not be analyzed in multiple replicates or dilutions unless specified by GCAL's analytical SOP. The QA/QC department and department supervisor will be notified immediately of any problems encountered with the PT sample.

The QA/QC Department is responsible for the reviewing and reporting PT results to the PT provider. PT results and associated batch QC are reviewed in the same manner as a client's sample result. The review includes sample prep for appropriate dilution, reported concentration, consistency across methods, logical results, and transcription errors. Batch QC failures will necessitate re-analysis of the PT sample, or comments in the case narrative. If GCAL must withdraw from a PT study, the primary accrediting authority and PT provider will be informed in writing prior to the close of the study. PT results are reported to the PT provider by electronic submission.

The QA Manager shall review scored results for performance and accuracy. Results scored "Not Acceptable" shall be thoroughly investigated to determine the cause of the failure, corrective action performed and a supplemental PT sample analyzed to re-establish successful performance. Documentation of scored PT results, raw data, and corrective action shall be kept on file. GCAL will notify LDEQ, ACLASS and all other accrediting authorities of any "Not Acceptable" PT results, the cause of the PT failure, corrective actions implemented, and the results of the supplemental PT used to re-establish successful performance.

It is inappropriate for any employee to share results or to attempt to obtain results from any other laboratory participating in the PT or from the PT provider. GCAL will not knowingly accept PT samples or portions of PT samples from other laboratories.

GCAL utilizes the first WP Study of the year allowed by EPA to meet DMRQA requirements for clients that use GCAL for analysis of samples regulated by a discharge permit. Samples are analyzed, reviewed, and the applicable results are reported to the client.

It is the responsibility of the QA Manager to maintain compliance with TNI Standards, Louisiana Administrative Code and DOD regulations regarding PT analysis and reporting. Compliance includes passing two of the three most recent studies and performing PT studies for every matrix/method/analyte offered by approved PT providers. The QA/QC department shall suspend any matrix/method/analyte combination that fails two of the three most recent PT

studies until the laboratory meets the requirements of initial acceptability. Refer to SOP QA-015 for more details.

4.3 Accreditation

GCAL is accredited by The NELAC Institute (TNI), Certificate number 01955. The primary accrediting authority is the Louisiana Environmental Laboratory Accreditation Program (LELAP) administered through Louisiana Department of Environmental Quality. A full list of accreditations is maintained in the QA department and listed in Appendix E.

Compliance with and maintenance of laboratory accreditation is the responsibility of the QA Manager. Scopes of accreditation and certificates shall be kept on file in the QA department and scanned to the appropriate electronic file on the server. All correspondence with accrediting authorities will be kept on file in the QA Department.

Maintenance of accreditation is based on compliance with State regulations and the appropriate TNI Standard. When implemented the TNI Standards approved September 8, 2009 will be used for accreditation. It is the responsibility of the QA manager to be familiar with and implement the required changes when new regulations are promulgated or new standards approved.

4.4 Quality Control

Quality control is defined as the overall system of technical activities whose purpose is to measure and control the quality of a product or service so that it meets the needs of users. (NELAC 2003) This section describes the types of quality control samples used in the laboratory and how they are used to determine precision and accuracy. When the analysis of a sample set is completed, the results will be reviewed and evaluated to assess the validity of the data set. All QC samples are processed and analyzed using the same conditions as the samples.

4.4.1 A blank is a sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results. (NELAC 2003) A reagent and/or method blank is prepared and analyzed with each set of samples. Field blanks (if provided by the client) are analyzed to determine possible contamination during sample collection. Trip blanks are applicable to volatile organics analysis (VOA) where volatile contaminants may be introduced during shipment to the laboratory. Storage blanks are placed in refrigerators used for volatile sample storage at the laboratory and analyzed every two weeks.

The reagent and/or method blank results are evaluated for contamination. If high blank values are observed, laboratory glassware and reagents will be checked for

contamination. Analysis will be halted until the source of contamination has been determined and corrective action taken. The concentration of an analyte in a reagent blank must be less than ½ the reporting limit or less than 5% of the analyte detected in the associated samples. Field blank results are evaluated similar to the reagent and/or method blanks. If high field blank values are encountered, the value will be narrated in the final report to the client. If the reagent and/or method blanks and the field blank exhibit significant contamination, the source of contamination may be within the laboratory. In the case of VOA's, ambient air in the laboratory and reagents shall be checked as possible sources of contamination. If method blanks are not acceptable, the associated samples must be re-prepped and analyzed. For storage blank criteria, refer to SOP GEN-010.

4.4.2 A Laboratory Control Sample (LCS) made from a matrix known to be free of the analytes of interest and spiked with a known and verified concentration of target compounds. The LCS is prepared and analyzed with each batch of twenty or fewer samples. The full list of target compounds or a representative list of target compounds for the method may be spiked into the LCS. If a representative list is used, the laboratory will insure that all target analytes are included in the spike mixture over a two year period. Some projects, such as DOD, require that all target analytes are spiked. Project specific information is documented by the project manager in the project profile in the LIMS. Analysts are responsible for reviewing project profiles for client requirements. Analyte free reagent water is used as the matrix for the LCS associated with water samples. A purified solid matrix such as Ottawa sand, Teflon beads, or sodium sulfate is used to prepare the LCS for soil or solid samples. For those tests where it is difficult to obtain a suitable solid matrix for spiking, analyte free reagent water is taken through the preparation and analysis procedure. A certified reference material may be used as an LCS. The analyte concentration range must be within the calibration range of the method. Because some analytes may interfere with an accurate assessment if spiked simultaneously, the spike chosen will represent the elution patterns of the target analytes. The results of check standards analyses are compared with the true values and the percent recovery of the check standard are calculated. An LCS that is determined to be within acceptance criteria establishes that the analytical system is in control and validates system performance for the associated batch of samples. If the LCS has been spiked with a large number of analytes it becomes likely that a few analytes will be outside the control limits. This may not indicated that the analytical system is out-of-control and corrective action may not be necessary. A marginal exceedance (ME) is defined as beyond the LCS criteria (3 standard deviations) and less than 4 standard deviations when allowed by the project. The number of MEs allowed is as follows:

- > 90 analytes in LCS, 5 analytes allowed in the ME of the LCS control limits.
- 71-90 analytes in LCS, 4 analytes allowed in the ME of the LCS control limits.

- 51-70 analytes in LCS, 3 analytes allowed in the ME of the LCS control limits.
- 31-50 analytes in LCS, 2 analytes allowed in the ME of the LCS control limits.
- 11-30 analytes in LCS, 1 analyte allowed in the ME of the LCS control limits.
- < 11 analytes in LCS, no analytes allowed in the ME of the LCS control limits.
-

4.4.3 Marginal exceedances must be random. The same analyte repeatedly exceeding the LCS control limits indicates a systematic problem and requires investigation. The source of the error must be located and corrective action taken. If correction is required, the check standard is reanalyzed to demonstrate that the corrective action has been successful. Acceptable accuracy (control limits) is a requirement of the method or determined by the laboratory through the use of control charts.

4.4.4 A matrix spike is a sample to which known concentrations of target analytes have been added before sample manipulation is performed. Matrix spikes are included in each batch of twenty or fewer samples for those tests where spiking is applicable. The matrix spike is also referred to as the MS. The analytes to be spiked are specified in the reference method, SOP, client request or by regulation. Because some analytes may interfere with an accurate assessment if spiked simultaneously, the spike chosen will represent the elution patterns of the target analytes. The observed recovery of the spike versus the theoretical spike recovery is used to calculate accuracy as defined by percent recovery. If the accuracy value is outside the control limits for the given parameter, the LCS is reviewed to verify that the analytical system is in control. If the accuracy value is outside the control limit, the sample set (parent sample, MS/MSD, or duplicate) is reanalyzed for the parameter in question, unless insufficient sample volume is available or the samples are past holding time. Generally, matrix spike control limits are set as the LCS control limits. The same spike list and concentration as required for the LCS will be used for the MS.

4.4.5 A duplicate for each matrix type is included in each batch of twenty or fewer samples. Routinely, the laboratory includes a replicate sample (a sample the laboratory divides into two aliquots sometimes referred to as a duplicate sample) in inorganic test batches and a matrix spike duplicate (a duplicate of the matrix spike) in organic test batches. The type of duplicate to include in a batch is based on specific project requirements and method requirements. A Laboratory Control Sample Duplicate (LCSD) is included with each LCS per batch of samples. The MS/MSD pair is analyzed with each batch of samples if sufficient sample is available. Duplicate sample analysis for the sample set is used to determine the precision of the analytical method for the sample matrix. The duplicate results are used to calculate the precision as defined by the relative percent difference (RPD). If the RPD is above the control limit, the sample set shall be re-analyzed for the parameter in question or the failure is documented in the case narrative. In

inorganic analysis, RPD's are not considered applicable if the concentration in the sample/duplicate is less than 5X's the reporting limit.

4.4.6 If required by the method, each sample is spiked with the method specified surrogate(s) prior to extraction and analysis. The results of the surrogate(s) are compared with the true values spiked into the sample. The percent recoveries of the surrogates are calculated and reported with the sample results. If recoveries are outside the control limits, corrective action is required or a comment in the case narrative is required. Surrogates are reported as diluted out, in an analysis requiring extraction, if a dilution greater or equal to 10X is performed on the sample. Surrogates are used to monitor instrument performance, extraction performance, and matrix affects in each sample analyzed. Required corrective actions for surrogate failures can be found in the analytical SOPs.

4.4.7 Internal standards are added if required by the method. Internal standards are used to correct for minor variations in retention times and/or response. In most cases internal standards are defined in the method. If not defined an internal standard that is similar in response but not present in the sample such as deuterated or less common isotopes shall be used. Internal standard performance is monitored as part of the method performance for response and, if applicable, retention time.

4.4.8 An initial calibration verification (ICV) is analyzed following the initial calibration and before any samples are analyzed. The ICV is a certified standard from a different manufacturer than the standard used for the initial calibration. If a second source standard is not available then GCAL will use a certified standard from the same vendor but with an independent lot number.

4.5 Statistical Control

As part of the analytical quality control program, the precision and accuracy for each analytical method is established by the use of control charts. The charts are used to assess the method performance over a period of time. A minimum of twenty points are used to establish a control chart. Control limits of ± three standard deviations are utilized. Marginal exceedences will be charted using ± four standard deviations if marginal failures are allowed by the project. Refer to Section 4.4.2 for additional information on MEs.

4.5.1 Control charts are used to predict trends (positive or negative) in the analytical processes and to determine when an analysis is out of control. Examples of situations that show up in control charts are:

- Shift in mean - is usually caused by incorrectly prepared standards or reagents, contamination of sample, problems in instrument calibration, or analyst error.
- Trend of mean downward - is usually caused by deterioration of standards or reagents.

- Trend of mean upward - is usually caused by concentration of standard due to solvent evaporation or deterioration of reagents.
- Increase in variability - is usually caused by poor technique by the analyst or deviation from procedure.

4.5.2 Precision is defined as the degree to which a set of observations or measurements of the same property, obtained under similar conditions conform themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms. (NELAC 2003) Precision is the measure of how closely multiple analyses of a particular sample agree with each other. To determine the precision of the method and/or laboratory analyst, a routine program of duplicate analyses is performed. The results of the duplicate analyses are used to calculate the relative percent difference (RPD), which is the governing quality control parameter for precision. The relative percent difference (RPD) for duplicate analyses is defined as 100 times the difference (range) of each replicate set, divided by the average value (mean) of the duplicate set.

4.5.3 Accuracy is defined as the degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator. (QAMS) Accuracy is the measure of the closeness of an observed value to the "true" value (theoretical or reference value or population mean). The accuracy of an analytical method and/or the laboratory analyst is based on the analysis of laboratory control standards. LCS results are used to calculate the quality control parameter for accuracy evaluation, the percent recovery (%R). The %R is defined as 100 times the observed concentration divided by the true concentration of the spike.

4.5.4 Uncertainty can be calculated using the Quality Control based Nested approach as described in SOP QA-013. Uncertainty will only be calculated if requested by the client. The approach uses batch QC over a period of time. This approach can also incorporate sample uncertainty if field QC is available. A minimum of twenty measurements is required.

4.6 Audits and Assessments

Internal audits are scheduled and documented by the QA Department. A member of the QA Department or designee performs the internal audits. All technologies and Departments must be reviewed at least annually. Audits are documented through the use of a method specific checklists and a written report maintained in the QA Department. Internal audits are used to determine if lab activities meet the requirements of GCAL's quality system, state regulations and TNI standards.

4.6.1 Internal audits are performed ensure that all aspects of the QA program are compliant with state regulations and TNI standards. The QA Manager reviews all information pertaining to the quality system and notes any areas of non-compliance. In addition, observations may be documented in the report. Observations are issues that while compliant with state regulation, TNI standards and GCAL's quality system has the potential to develop into non-compliance in the future. Areas were the analyst's performance exceeds expectation will be noted in the report. The report is prepared based on the audit findings and is distributed to management in a timely manner. The report findings are discussed with the appropriate laboratory personnel and department supervisor so that a concerted effort can be made to correct any non-conformances as well as to provide positive feedback. At a minimum, the QAM or designee will review the following elements of the program annually:

- Sample handling, including custody and storage procedures
- Sample analysis
- SOPs and associated reference methods
- Bench sheets required for the analytical procedure
- Traceability of stock and working standards and reagents.
- Records such as certificates of analysis for reagents and standards, certificates for support equipment, maintenance records, etc.
- Preventive maintenance
- Proficiency Testing
- Training Records
- Project Management
- Report Generation.

4.6.2 SOPs are reviewed annually or during the internal audit process. SOPs are reviewed against the reference method to ensure that the procedure is technically accurate. The analyst performing the analytical procedure is observed and interviewed to determine compliance with GCAL's SOP. Analytical records are reviewed to ensure traceability of the standards and reagents as well as to verify that all analytical observations are being recorded at the time of analysis and that equipment is in working order. Analysts' training records are reviewed to verify that they are accurate and current. Area of non-compliance and observations are reported to management.

4.6.3 Monthly audits are performed to check support system compliance. A member of QA staff performs the audit and a report is issued to the CEO, Laboratory Director, and Technical Services Director. Follow-up and corrective action is performed as necessary. At a minim, the following areas will be reviewed monthly:

- Calibration of support equipment log books.

- Temperature checks for ovens, incubators, refrigerators, and freezers.
- Logbook documentation and review, and use of strikeout corrections.
- Expiration of standards used.
- Sample chain of custody and tracking of samples.
- Re-Extractions.
- Certificate of analysis.
- Equipment maintenance.
- Tag-out policy.
- Storage blank analysis.
- Safety equipment maintenance.
- Standards and Reagents Labeling

4.6.4 When the findings or non-compliances identified during an internal audit cast doubt on the validity or accuracy of a test result, GCAL will initiate the corrective action process and begin an investigation to determine the cause. During the investigation analytical results will be reviewed to determine the effect if any on the data.

4.6.5 Client and regulatory assessments are scheduled through the QAManager. It is GCAL's policy to have all information pertaining to the client or to our scope of accreditation readily available for review by the assessor or assessment team. Client confidentiality will be maintained throughout the assessment process. The QA Manager coordinates and monitors all on-site assessments, reviews all findings, issues a corrective action plan within 30 days after receipt of the assessment report, and follows-up to ensure agreed changes are implemented. All documentation pertaining to an assessment will be kept on file in the QA department.

4.6.6 A management review will be conducted annually. The management staff will review the laboratory quality system and environmental testing activities to ensure suitability, effectiveness, and identify areas of improvement. This is a system wide assessment. The QAManager will write a report summarizing the findings and any new policy decisions. The review will include at a minimum the following:

- Matters arising from the previous review
- Suitability of policies and procedures
- Reports from managerial and supervisory personnel
- Outcome of recent internal audits
- Corrective and preventive actions
- Assessments by external bodies
- Results of inter-laboratory comparisons or proficiency tests
- Changes in volume and type of work
- Client feedback and complaints
- Adequacy of staff, equipment and facilities.
- Personnel including issues and training for new and existing employees

- Quality control activities
- Goals for upcoming year and status of goals from the previous management review

4.7 Nonconformance and Corrective Actions

A non-conformance is any indication or judgment that a product or service has not met the requirements of the relevant specification, contract, or regulation. It is the state of failing to meet the requirements. Corrective action is the action taken to eliminate the causes of an existing non-conformance, to prevent recurrence. Non-conformance identification and corrective action are an integral part of GCAL's plan for quality assurance in sample analysis. Every attempt is made by laboratory staff to comply with any requirements set forth in methods, standard operating procedures, GCAL's Quality Assurance Program Plan, and client or program specific requirements. When non-conformances occur and are not correctable immediately at the bench, the occurrence is documented in the case narrative of the final report and the client is notified of the non-conformance. When errors, deficiencies or out-of-control situations develop, corrective action is initiated. The following non-conformance identification and corrective action programs are used in the laboratory and are described below.

4.7.1 Laboratory non-conformances and corrective actions are documented on a Non-Conformance/Corrective Action Form (NCCAF). NCCAF's are tracked in a controlled logbook and maintained by the QA department. Any GCAL employee that identifies a non-conformance has the authority to initiate corrective action. The corrective action process is initiated by notifying the QA manager, supervisor, or a member of management or the process can be stated by filling out the non-conformance section of a NCCAF and submitting it to the QA manager. Once initiated, it is the responsibility of the QAM to see that a root cause analysis is performed, a resolution is identified and any follow up action determined necessary is completed. If corrective action is determined to be unsuccessful, the process is repeated. When identified non-conformances result in a change to reported data, a corrected report is prepared, the client is notified of the change, and the corrected report is submitted to the client. The corrected report file copy is then attached to the top of the original report file copy.

4.7.2 Sample integrity problems determined at login are documented on a Login Discrepancy Form. The form is completed at the time the discrepancy is noted during the login process and forwarded to the assigned project manager. The assigned project manager will contact the client for instructions on how to proceed with the sample. These instructions are documented on the form. If the client's instructions are to proceed with analysis, the project manage will notify login personnel and the samples will be released for analysis. If the client's instructions state that re-sampling will occur then original samples will be sent for disposal or returned to the client if requested. The Login Discrepancy Form is kept in the report file copy.

4.7.3 On-the-spot or immediate corrective action refers to corrective actions that are taken at the time the non-conformance is identified and usually applies to spontaneous problems, such as an instrument malfunction. This type of corrective action is handled by the analyst at the bench. Any staff member who detects/suspects non-conformance to previously established criteria or procedure in equipment, instruments, data, methods, etc. shall immediately notify the appropriate department supervisor and/or Laboratory Director. In many cases, the staff member will be able to correct the problem. Acceptable on-the-spot corrective actions are defined in SOPs and documented in the appropriate logbooks. Examples include re-analysis of a failing LCS, re-extraction, etc. Trends in re-extracts are monitored. When a trend is identified it will trigger a root cause investigation and corrective action.

4.7.4 Prep non-conformances are documented on a Re-extract Form and are logged and tracked in a controlled logbook maintained in the QA department. Reasons for prep batch re-extraction can include method blank failures, LCS failures, and surrogate failures. Trends in re-extractions are monitored by the QA department. When a trend is identified it will trigger a root cause investigation and corrective action.

4.7.5 If the result of a corrective action or audit cast doubt on the validity of a sample result, the client must be notified within 3 business days. Client notification and further instructions must be documented.

4.8 Customer Inquiries and Complaints

4.8.1 Customer inquiries are received by project managers. If the inquiry requires follow-up action, the project manager fills out a Client Inquiry Form and logs the inquiry into the Client Inquiry Logbook. The inquiry is then sent to the supervisor of the lab or to a member of management for investigation. Following the investigation, a response is recorded on the Client Inquiry Form and the client is notified of the outcome of the investigation. This investigation can include a complete review of the raw data and re-analysis of the sample if applicable. If the inquiry uncovers a lab error and involves further corrective action, the project manager then completes a NCCAF and logs the corrective action into the Corrective Action Logbook. At this point, the corrective action is turned over to the QA department for follow-up and review. If required, the final report is re-issued with the appropriate corrections. The report is marked as resubmitted and the reason for the resubmittal is documented in the case narrative.

4.8.2 The employee that receives a customer complaint forwards the details of the complaint to the QA manager. The details of the complaint must include at a minimum the client/customer, date of complaint, and a description of the issue. The responsible party is identified. The compliant details and the associated corrective

action form are sent to the appropriate employee for resolution. Complaints are handled as corrective actions in accordance with SOP GEN-018.

4.9 Service to Clients

GCAL will seek feedback, both positive and negative, from customers in an effort to identify areas where improvement is needed. The customer satisfaction questionaire will be hosted on the GCAL internet site. This feedback will be used to improve our quality system, testing activities, and service to our clientele.

4.10 Management and Control of Change Process

Changes to the Quality system, either temporary or permanent are documented. Controlled documents such as QAPP and SOPs will be reviewed annually and revised when necessary. This will be documented through the use of a revision number, approval date on each document as referenced in QA-001. Approval signatures for SOPs are located in the heading. The QAPP approval signatures are located on the front page of the document. The SOP will include a document review and revision history. Notification of Updated SOP form will be used to document that employees are aware that an SOP has been updated and by signing the form agree to follow the revised/updated SOP. Changes to the LIMS will be documented using the LIMS Change form. Any requested change to the LIMS must have approval from the appropriate supervisor, manager and management. Changes to the LIMS will be made in a test environment and must be completely functional (de-bugged) before the change can be implemented. Employees will be notified of changes to the LIMS and trained on said changes.

5 DATA DOCUMENTATION, VALIDATION, AND REPORTING

Data validation is performed to check data integrity and to verify that the data is correct and of an acceptable quality. Data integrity involves reviewing all documentation for errors and mistakes. It includes review for correct documentation of sample ID's, verification that holding times were met, transcription errors, correct calculations, complete records, and for acceptable chain of custody documentation. A review of the data is performed to verify the results and to assure that all QC is within acceptable criteria. The data is reviewed according to the method specified criteria and according to the client specific project requirements. The reviewer will identify unacceptable data and initiate the appropriate corrective actions. The documentation of data shall be performed in a manner that allows for the historical reconstruction of results by internal or third party validators.

5.1 Recording data

All raw data is recorded in bound log books and/or by instrument printout. This includes calibration, LCS, matrix spikes, duplicates, reagent blanks, calculations, dilutions and any notations concerning a given analysis. If data are recorded by hand, it must be done in ink. It is inappropriate to have pencils, erasers, or correction fluid at the bench for any reason.
Data are kept either as hardcopy, electronically, or both. All instruments with audit trail capabilities will have the audit trail function turned on. Computers used in data capture and instruments capable of password protection will be password protected. Log books used in the laboratory for data capture will be controlled. QA department is responsible for creating and archiving log books. If changes or corrections are necessary to either hard copy or electronic data, it must be performed in a way that maintains the original observation and the integrity of the data. Changes made to hard copy data will require the analyst to use a single line strike though, initial and date, and the reason for the correction if other than transcription error. If the record does not allow space to clearly show the change, write it in the comments section of the log book or at the bottom of the page. If electronic files must be changed, the file must be renamed so that the original data is not lost. Reasons for doing so must be written in the comments and/or fully documented using a correction form. At no time shall data be obliterated for any reasons.

Electronic data is backed up and protected by the IT Department. All schedules and procedures are fully documented in IT SOPs.

5.2 Data Reduction

Data reduction includes all activities that convert instrument/computer responses into reportable results. This involves all calculations and compound identification. Final results are obtained by direct reading from the instrument or calculations based on instrument readings, output, or responses. Manual data reduction is performed by calculating results with the appropriate formula. Manually entered information is reviewed for accuracy on the hard copy. Computer data reduction requires that the analyst verify information used in final calculations is entered accurately. The analyst must also review the raw data for properly identified components, possible interferences, confirmation requirements, and acceptable readings for integrations.

5.3 Data Review

5.3.1 All data undergoes an extensive review process. The analyst performs the first level data review and validation. Data is uploaded or manually entered into the LIMS. The first level reviewer will verify that:

- the calibration meets SOP and or project criteria and frequency, and the calibration supports the required detection limit.
- all reagents and standards used are within expiration date.

- the method blank meets acceptance criteria.
- the appropriate QC has been performed and meets acceptance criteria.
- dilutions were performed as necessary, and the reason documented.
- there isn't anything unusual about the sample that is affecting the data. This includes submitted duplicates that are obviously different, presence of interference, analysis past hold time, etc.
- all documentation is complete and accurate.

Refer to SOP QA-002 for more details on analyst review.

It is the analyst's responsibility to document any problems and communicate these to the supervisor, department manager or Lab Director. If an immediate solution is not found, such as one re-analysis of QC that passes criteria, the problem(s) must be communicated to the Laboratory Director, Technical Director, and/or QA Manager. An Analyst is not authorized to continue with an analysis if the calibration or QC results do not meet the acceptance criteria established by the SOP or project. Notify the supervisor, department manager or Lab Manager immediately and start the corrective action process. Samples shall be held until further documented instructions are received.

5.3.2 Second Level data review and validation is performed by the department manager or their designee. Data is validated in the LIMS. The second level reviewer will verify:

- that the data meets SOP and/or project requirements, including acceptance criteria, frequency of calibrations, frequency of QC samples, and detection limits.
- the data for the analytical group is logical. For example nitrite is not greater than nitrate + nitrite.
- that all calibration or QC failures are clearly described in the batch exception reports. This includes descriptions of allowed failures such as the number of marginal exceedences allowed for the LCS.
- that dilutions are described in the batch exceptions report.
- that times and dates are logical and correct.
- that documentation is accurate and complete so that the data can be reconstructed based on the information provided.
- that the appropriate standards and reagents were used for their intended purpose.
- all storage and preservation requirements were met or non-compliances fully described.
- that data is consistent with historical results when available.
- that results are within permit requirements when known.
- that calculations are correct.
- that manual integrations are appropriate and documented.

Refer to SOP QA-002 for more details on second level supervisor review.

5.4 Data Validation

After the complete package is assembled, the report validation manager or designee will review the data. The level three reviewer will verify:

- that the correct package has been prepared.
- that the package is complete and includes all requested analysis, forms, reports, chain of custody, and raw data as appropriate.
- that project specific data quality objectives and/or GCAL's requirements have been achieved.
- that exceptions and any information that can impact the data are clearly identified in the case narrative.
- that data is flagged appropriately and that the data flags are clearly defined.
- that raw data and data reports are consistent.
- that all samples associated with the have been analyzed and that the sample IDs are correct.
- that reporting limits are supported by the calibration.
- that dilution schemes are justified and correct.
- that all calculations are correct.

If problems or questions are identified during the third level review, a corrective action form must be completed. The corrective action form and the report are sent back to the appropriate supervisor(s) or manager for review and correction. Once the department manager or supervisor has completed this review and correction, the report is returned to the validator. All steps are documented using the corrective action form. Once complete the corrective action form is returned to QA/QC department. The corrective action is reviewed and approved by the QAM.

5.5 Data Reporting

Hardcopy and electronic reports are the products of the GCAL. It is therefore imperative that the report accurately and completely reflects the results determined by the lab. Any modifications or departures from GCAL's SOPs will be clearly communicated in the report through the use of data qualifiers and the case narrative.

When all requested analysis have been reviewed and validated by the supervisor(s) a preliminary report may be sent via e-mail if requested by the client. The preliminary report is subject to change if the third level review of the data indicates a problem. The client will be notified of any changes in the preliminary report as soon as changes are identified and the report corrected. The final report will then be printed. GCAL has the capabilities to produce several levels of reports and electronic data deliverables. These include a LIMS report with batch QC, a CLP like forms package, a full CLP like deliverable package, and various other formats. The client specifies the level of reporting when the samples are submitted.

After the reports have been authorized and signed by the Report Validation Manager or designee the reports are sent to the project manager for release to the client. The QA Manager or designee must review a minimum of 10% of all federal program reports, including DOD/AFCEE packages. The QA review is performed following the release of the final report outside of the day-to-day process. The project manager is responsible for checking that the report level is correct and that the report has been signed. After final approval of the reported data, various electronic data deliverable can be produced to submit data electronically. Refer to SOPs LAD-003 and QA-003 for more details on assembling final reports, reviewing final reports, and QA review.

5.5.1 All test reports include the following:

- A cover page that includes a title, "Analytical Results", name, address, and telephone number of the laboratory, work order number which uniquely identifies the report, and the name and address of the client, contact, and project name, and NELAP certificate number,
- GCAL contact person for questions,
- Sequentially numbered pages with the total number of pages written in the Laboratory Endorsement page, or numbered as # of # (for example 1 of 50),
- Signature of Data Validation Manager or designee,
- Statement that the report relates only to the samples reported,
- Statement that the report shall be reproduced only in full and with the written permission of GCAL,
- Case narrative indicating any anomalies, method or QC failures during sample analysis,
- A report sample summary including the sample ID, lab ID, matrix, and collection and receipt date/time.
- The test results that include prep and analytical methods, prep and analysis date and time, prep and analysis batch, weight or volume of sample prepped/analyzed, units, indication of dry weight correction where applicable, results, reporting limits, and data qualifiers,
- QC summary with qualifiers as appropriate, and
- Chain of custody, log-in check sheets, and log-in discrepancy form where applicable.

5.5.2 Additional information shall be provided to clients when requested through reports. This information includes:

- Copies of raw data and logbook entries for submitted analysis,
- Instrument calibration summary and raw data,
- Method detection limits,
- Summaries for surrogate recoveries, internal standards, instrument tune, and method blank summary,

- Manual Integration Summary
- Additional information as requested.
- Identification of sub-contracted work.

5.6 Sub-contracting

Laboratories that GCAL sub-contract to will be reviewed with an emphasis on their overall quality control practices and compliance to GCAL's quality assurance requirements. GCAL bears the responsibility for all sub-contracted work performed by a sub-contractor we select. Any laboratory used for subcontracting must be certified or accredited if required for the project and documentation of such must be kept on file. The QA/QC Department or project manager will submit a request to the lab to provide verification of certification or will notify the appropriate accrediting authority to verify certification. Project requirements must be communicated to the sub-contracted lab in a timely manner. When data is received it is reviewed by report validation. GCAL will facilitate any client comments or complaints regarding sub-contracted data. The sub-contract laboratory must have successfully completed an assessment by the applicable DOD Environmental Laboratory Accreditation Program (ELAP) component (AFCEE, Army Corp, etc.) for use in all DOD work. The sales representative and project manager verifies compliance with the DOD QSM or other project criteria before the start of the project. Records of compliance must be supplied by the sub-contracted lab and kept on file. If testing is sub-contracted to another laboratory, the client will be notified in writing.

5.7 Data Storage

The laboratory will retain all records related to sample analysis including raw data, calculations, derived data, calibrations and copies of test reports. These records are archived in accordance with regulatory requirements for a minimum of ten years or as required by specific client contracts. In the event the laboratory goes out of business, clients will be notified at least 60 days (time permitting) prior to closure of the laboratory and will receive final reports for all submitted samples. The client notification will request instructions on the retention or distribution of laboratory records and will provide contact information to be used after the laboratory closes. Software/hardware required to access electronic data will be maintained.

A copy of client reports is stored either electronically or a hard copy is stored in a room requiring key-card access. All reports must be signed out using the archived reports logbook. Client reports and chain of custodies are scanned for electronic storage. All archived logbooks, corrective actions, PT results, training records, and other QA/QC reports are stored in a secured storage area. Written and printed data records (bench sheets, logbooks, electronic printouts, etc.) are scanned before being boxed and placed in storage. Electronic data is stored on a dedicated server. This server is backed-up daily. Approximately 1 year of electronic data is accessible at workstations. Data removed from the servers and stored on tapes can be reloaded by submitting

a request to IT. The safety/compliance officer keeps safety and disposal records. The Comptroller is responsible for keeping personnel information in controlled files.

Archived data is stored on-site until capacity is met. The oldest archived data is then moved to a secure storage facility. The storage and on-site facility are monitored and protected from fire and theft. Electronic data storage is free from magnetic sources. It is the goal of GCAL to have redundant copies (hard and electronic) to prevent loss of records due to records being misplaced, environmental deterioration or catastrophe.

6 FACILITY DESCRIPTION AND EQUIPMENT

6.1 Laboratory Facilities

GCAL is a full service environmental laboratory. The laboratory was established in 1979 with a staff of two and has grown to its present size of over 70 employees operating in a modern laboratory space of 20,000 square feet.

The laboratory's working areas are subdivided into areas for instrumental analysis, wet chemistry and sample preparation. These areas are designed to allow for a safe and comfortable working environment with special attention having been given to ventilation, airflow patterns and environmental controls. Administrative and Marketing areas are located for optimization of supervision and to allow for efficient handling of paperwork and results. The laboratory is protected by a video monitoring system and fire monitoring system. A floor plan of the facility is included in Appendix D.

6.2 Procurement and Inventory Control

Chemical reagents, solvents, gases, glassware and general chromatographic supplies are ordered as needed to maintain sufficient quantities on hand for use. Purchase orders are maintained as an inventory control of materials ordered by the laboratory. All orders are processed through central receiving and routed to the appropriate departments. Routine supplies are maintained on site in an inventory control stock room.

The purchase of analytical instrumentation is based on anticipated sample volume and the need to maintain superior quality data. Specifications are carefully examined to be sure new instrumentation meets current and anticipated needs. Warranty and service contract information is gathered at the time bids are reviewed and this information is considered in making the final selection. An extensive performance check-out before the instrument is accepted is mandatory. New equipment must undergo a rigorous method validation before being put into production. Operators of new instruments are sent to training courses if necessary.

Inventory records are maintained for all major capital equipment. Major suppliers of consumable items are:

Allometrics	Templet & Templet	Dionex
Fisher Scientific Company	Supelco	CPI
Environmental Express	Perkin-Elmer	Shimadzu

6.3 Capital Equipment

Laboratory equipment and instrumentation are maintained in compliance with instrumentation manuals. All equipment is kept in working condition to allow for conformity to each approved method. The key instrumentation such as Gas Chromatography, Gas Chromatographs/Mass Spectrometers, ICP, ICP-MS and Atomic Absorption Spectrometers has maintenance contracts with their respective suppliers. A list of instrumentation and equipment is maintained by the QA/QC Department and is included in Appendix C.

6.4 Equipment Operation and Calibration

Equipment is defined as any non-disposable mechanical and/or electronic device used in the generation or measurement of data.

6.4.1 The calibration of instruments and support equipment is required to ensure that the analytical system is operating correctly and functioning within acceptable precision, accuracy and sensitivity limits. Calibration is defined as the systematic determination of the relationship of the response of the measurement system to a known standard. The calibrations or calibration checks are performed with reference standards traceable to primary standards (e.g. NIST or other certified standards). If traceable chemical standards are not available, standards are prepared according to the laboratory quality control procedures or the project's requirements. The calibration requirements for each type of equipment or instrument are defined in the standard operating procedures. Additionally, specific requirements are defined in a project plan. Table 6-1 summarizes the calibration requirements of the lab.

6.4.2 It is the responsibility of the analyst to verify that the instrument configuration and operating conditions used satisfy the analytical requirements and to maintain quality control data confirming instrument performance and analytical results. The inability to achieve calibration is an indication that the equipment needs maintenance. It is not acceptable for an analyst to repeat analysis of calibration or QC standards beyond what is allowed by the SOP until “acceptable” results are achieved.

6.4.3 If equipment outside the permanent control of the laboratory is used, it must meet the same criteria. The laboratory shall ensure that the function and calibration status of the equipment is checked and shown to be satisfactory before it is put into

service. The equipment must meet all requirements of LADEQ regulations/TNI standards.

6.5 Equipment Maintenance

Maintenance is defined as cleaning and/or replacing equipment components to assure that the equipment has been properly and periodically serviced and is in satisfactory condition. The equipment manual is a good guideline to determine preventive and routine maintenance schedules. These manuals also assist in identification of commonly needed replacement parts so that an inventory of these parts can be properly maintained.

6.5.1 A maintenance log is issued for each piece of equipment. It shall be maintained by the analyst to describe problems, the maintenance performed on the instrument and outcome. This includes routine service checks by laboratory personnel (unless described in the SOP) as well as factory service calls. This log also provides a written source for future use in preventive maintenance. The equipment maintenance logs are reviewed monthly by a member of QA department.

6.5.2 In order to prevent system down time, minimize corrective maintenance cost and to help insure data validity, GCAL uses a system of preventive maintenance. All routine maintenance is performed as recommended by the manufacturer. Maintenance contracts are purchased as appropriate. This insures preventive maintenance visits by factory authorized service representatives and immediate service for corrective actions if required.

6.5.3 When a piece of equipment is deemed defective, it is taken out of service and identified with an "OUT OF SERVICE" label that includes the date the equipment was taken out of service. For support equipment such as balances, ovens, coolers, and pipettes, the QA/QC Department is notified so that repair can be scheduled. Analysts perform routine and preventive maintenance for instruments and document the maintenance in the appropriate equipment log book. If outside service is necessary, the Department Supervisor schedules the service with approval from the Laboratory Director. Satisfactory instrument performance must be verified prior to returning to service any repaired equipment.

6.5.4 Table 6-1 is a list of support equipment calibration frequencies. In addition to the stated frequencies, calibrations are performed prior to first use and upon evidence of deterioration. Class “A” glassware is only verified upon evidence of deterioration. Calibration acceptance is based on 10 replicates. Refer to SOP GEN-010 for more details.

Table 6-1 Equipment Calibration

Equipment	Calibration*	Frequency
Analytical Instrument	Traceable standard	Each day of use or as required by instrument manual
Oven and Refrigerator	Calibrated thermometer	Each day of use
Thermometers	NIST Thermometer	Annually (Mercury), Quarterly (Digital)
NIST Thermometer	Certified off-site	As required by certificate
Balance	Certified weights	Each day of use, certified semi-annually
Weights	Certified off-site	As required by certificate
Adjustable pipettes	Weight	Each day of use
Non standard lab ware	Weight	By lot
Non-class A volumetric	Weight	Quarterly
Agitators (TCLP, SPLP)	Stop watch	Monthly

* Acceptance criteria are included in log books used to document verification or maybe found on the certificate affiliated with the thermometer, weights or stop watch.

6.6 Reagents

6.6.1 All solvents used for preparation of standards must be of acceptable purity to not interfere or invalidate the test. Purity of reagents must meet the reference method requirements and must not invalidate the test as shown by the acceptability of method blanks.

6.6.2 Reagents must be stored as specified by the manufacturer, and must be disposed of after the expiration date. If no expiration date is supplied, label acids and bases for five years from receipt, and other reagents as one year from receipt.

6.6.3 Neat chemicals must be stored as specified by the manufacturer, and must be disposed of after the expiration date. If no expiration date is supplied, label the neat chemicals for 10 years from receipt.

6.6.4 All reagents must be in labeled bottles with the date of receipt and date opened marked in permanent marker.

6.6.5 Reagent water is available throughout the lab. GCAL uses de-ionized water supplied by Siemens. In addition for ICP-MS analysis the DI water is treated using

a Millipore Synergy UV system to further enhance water quality. GCAL has 4 supply systems that provide water throughout the facility. The water resistivity is monitored daily at three of the supply systems. The fourth system is for the dishwasher and is monitored by the light system provided by Siemens. Each of the remaining three supply systems have various stations assigned to them. Resistivity is checked at one of the stations for each of the systems daily. Should the resistivity fail at any one of the stations for a supply system the entire system will be taken out- of- service. Siemens supplied lights are monitored each morning and Siemens will be notified when service is necessary.

6.7 Standards

Preparation of standards for calibration or QC must be made from materials of known purity, (98% or better preferred) or from purchased concentrates certified by NIST, EPA, or other acceptable agencies.

6.7.1 An expiration date of one year from the date received will be assigned to all stock standards without a manufacturer's specified expiration date. Upon receipt into the laboratory, a unique identification number (ID) is assigned to the standard. The following information is recorded standard container: laboratory assigned ID, standard name, concentration, initials of the analyst opening the standard, date opened, and expiration date. All other information regarding the standard including lot number, the analyte purity, expiration date, concentration, must be entered in the standards log maintained by the QA department.

6.7.2 Preparation of intermediate or working standard solutions is necessary for many tests. These working standards include calibration standards, spiking solutions, surrogate solutions, internal standard solutions, etc., and must be stored as suggested by the manufacturer when not in use. Working standards for the analysis of volatile organic constituents must be prepared every two weeks or more often if required by the method or if performance is compromised. Working standards for the analysis of semi-volatile organic constituents and pesticides are prepared as needed and expire 6 months from the date prepared or no later than the expiration date on the stock standard whichever is sooner.. Working standards for trace metal analysis are prepared at least monthly and have a concentration of 1 mg/L and less. Calibration standards for mercury are digested as needed and calibration standards for graphite furnace are prepared daily. Working standards expiration dates cannot be longer than the expiration date of the parent standard or reagents used. Standard expiration may be extended by approval of the QA Manager in an emergency. Acceptable performance must be demonstrated and documentation kept on file. Prepared working standards are verified by comparison to response from the previous calibration as described in SOP GEN-006.

6.7.3 The identification of each standard prepared must be unique and all documents

related to sample analysis in which the standard was used must contain this unique identification. The documentation shall be such that traceability ofall of standards and reagents used is maintained and can be related to raw data from sample analysis..

6.7.4 Freezers and refrigerators are designated for storage of standards. Samples are not stored with standards. Refrigerators or freezers used for storage of standards or samples are monitored for temperature compliance seven days a week. Refrigerators are maintained at $<6^{o}C$ and $>0^{o}C$. Freezers are maintained between $-10^{o}C$ and $-20^{o}C$.

7 ANALYTICAL METHODS

GCAL utilizes methods of analysis that provide evidence of analyte identification, separation from interfering substances, limits of measurement appropriate to that of analyte concentration and reasonable measures of precision and accuracy of the data obtained. Depending upon the analysis requested and the sample matrix, the methods used are official, standard or reference, screening, or modified. Analyses will be performed in accordance with the methods cited herein unless specific project requirements or needs dictate adoption of an alternate method or modification of the cited methods. Modification of a method due to sample matrix shall be discussed with and authorized by the client.

If analysis is performed in an alternate manner, the method shall be documented. Documentation is dependent upon the specific instrumentation and data collection and reduction methods used within the lab. Methods used directly from official or standard procedures are referenced as such. Routinely used procedures are available in each department and are also available electronically. Official protocols are used when required or requested.

7.1 Method Validation

Before the performance of methods for reporting to client, each method must be validated. This shall include achieving acceptable calibration and a demonstration of capability. Any work that is performed for government or regulatory purposes shall also have an acceptable limit of detection (LOD) or method detection limit (MDL) study before samples are reported.

7.1.1 Every instrument used to determine results for client samples or QC shall be appropriately calibrated daily before each use. Calibration shall include an initial calibration and continuing calibration as defined in the reference method and described in the SOP. Acceptable performance as defined in the reference method/SOP shall be shown before proceeding with sample analysis. Initial calibrations are verified using an independent standard. Additionally the following shall apply to all calibrations performed:

- Raw data shall be retained to allow reconstruction of the calibration and process to reduce instrument response to concentration. Records shall also include the analyst, date performed, and instrument.
- Samples and QC shall be quantitated using the initial calibration unless the cited method uses alternative procedures.
- The calibration range shall define the working range of the instrument with the exception of metals analysis. For all other analysis the low level standard defines the lowest reporting limit (PQL or LOQ) that is reported to a client. For metals a zero and one point calibration is used. High and low-level checks shall also be included as required by the project or method.
- Sample results exceeding the concentration range (or linear range for metals analysis) shall be diluted.
- The analyst is allowed to drop points out of a calibration curve at the high and/or low ends of the calibration curve if the minimum number of points and the project required detection limits are maintained. Points shall not be removed from the middle of a calibration unless there is a documented reason. The analyst is allowed to re-analyze and replace the suspect point within the same analytical batch or remove the point for all analytes with approval from the QA Manager, Technical Services Director or Laboratory Director.

7.1.2 Before the implementation of a test method or analyte to a test method, a satisfactory demonstration of method capability is required. This shall include the analysis of four LCS samples with acceptable accuracy and precision. Accuracy and precision is generally defined in the test method. Thereafter, each analyst shall perform a demonstration of capability as part of their initial training and annually. This demonstration shall include acceptable performance in one of the following:

- Acceptable performance of a blind sample;
- A demonstration of method capability; or
- Performance of four consecutive LCS samples with acceptable precision and accuracy.
- If the first three cannot be performed, analysis of samples with results statistically indistinguishable from a trained analyst.

All demonstrations shall be documented on the certification statement form and maintained in the analyst's training filed by the QA/QC Department.

7.1.3 A low-level check standard shall be performed at 1-2X the reporting limits. The recovery of this check standard must meet method defined LCS criteria, or lab derived limits if not defined by the method. Alternatively an LOD check shall be performed meeting the criteria of SOP QA-009.

7.1.4 Method detection limit studies shall be performed using 40CFR Part 136 Appendix B. All MDL/LOD are verified using NELAC limit of detection requirements. See SOP QA-009 for a full description of MDL/LOD requirements.

7.1.5 Precision and accuracy of measurement shall be monitored as an ongoing method validation measure. Control charts shall be generated at least annually and control limits updated and compared to method or laboratory historical limits. A copy of the control chart shall be kept on file in the QA/QC Department.

7.2 Methods Outside of Scope of Accreditation

Occasionally a client will request analysis for informational or non-regulatory purposes. Work outside of the scope of accreditation does not require validation in the same manner as other analysis. Method development will be discussed with the client to meet the client's needs. A letter stating the intent of the work shall be obtained from the client and kept on file.

Reports issued outside of the scope of accreditation shall be identified. This identification shall include either the removal of the LELAP certification number, or, in the case of a mixed report, those methods outside of the scope of accreditation shall be clearly stated in the case narrative.

7.3 Review of New Work

For the laboratory to perform additional work within its scope or to expand its scope of testing a thorough review must be undertaken. Laboratory management considers available resources and current and pending workload prior to accepting new work.

It is the responsibility of the Laboratory Director, with input from the Technical Services Director, and department supervisors to assess the ability of the laboratory to accept new work.

Before new work is accepted the QAManager must assess the accreditation needs and obtain all necessary certifications.

7.4 Analytical Methods

The analysis performed at GCAL is listed in the following Tables.

Organic Tests Performed		
Analyte (Parameter)	**Method**	**Reference**
Aromatic Volatile Organics	8021B 602	2 6
Explosives	8330A	2
Organochlorine Pesticides	608 8081B	6 2
PCBs	8082A	2
TPHG	8015C	2
TPHD	8015C	2
GRO	8015C	2
DRO	8015C	2
ORO	8015C	2
Petroleum Range Organics	Fl-Pro	10
Total Petroleum Hydrocarbons	TX1005/TX1006	13,14
EPH	Massachusetts	15
VPH	Massachusetts	16
Organophosphorus Pesticides	8141A	2
Chlorinated Herbicides	8151A	2
Dissolved Gases	RSK175	9
GC/MS Semivolatile Organics	625 8270C, 8270D	6 2
GC/MS Volatile Organics	624 8260B	6 2
GC/MS SIM Semivolatile	625 8270C, 8270D	6 2
HPLC PAH's	8310	2
Solvents	8015D	2
Alcohols	8015D	2
Methanol	94.03/99.01,HAPC 8015D	11 2
Extractions and Preparations		
TCLP	1311	2
SPLP	1312	2
Separatory Funnel	3510C	2
Liquid/Liquid	3520C	2
Ultrasonic	3550C	2
Waste Dilution	3580A	2

Organic Tests Performed		
Analyte (Parameter)	**Method**	**Reference**
Soxhlet	3540C	2
Purge and Trap	5030B, 5030C	2
Closed System Purge and Trap	5035A	2

INORGANIC TEST PERFORMED		
Analyte (Parameter)	**Method**	**Reference**
Metals		
Aluminum		
ICP	200.7	7
	6010B, 6010C	2
ICP-MS	200.8	7
	6020A	2
Antimony		
ICP	200.7	7
	6010B, 6010C	2
ICP-MS	200.8	7
	6020A	2
Arsenic		
GFAA	7010	2
	200.7	7
ICP	6010B, 6010C	2
	200.8	7
ICP-MS	6020A	2
Barium	200.7	7
ICP	6010B, 6010C	2
ICP-MS	200.8	7
	6020A	2
Beryllium	200.7	7
-ICP	6010B, 6010C	2
Boron	200.7	7
-ICP	6010B, 6010C	2
Cadmium	200.7	7
-ICP	6010B, 6010C	2
Calcium	200.7	7
-ICP	6010B, 6010C	2
Chromium	200.7	7
-ICP	6010B, 6010C	2
Chromium VI	7196A	2
-Colorimetric	3500Cr D	3
Cobalt	200.7	7

INORGANIC TEST PERFORMED		
Analyte (Parameter)	**Method**	**Reference**
-ICP	6010B, 6010C	2
Copper -ICP	200.7 6010B, 6010C	7 2
Iron -ICP	200.7 6010B, 6010C	7 2
Lead -ICP	200.7 6010B, 6010C	7 2
Magnesium -ICP	200.7 6010B, 6010C	7 2
Manganese -ICP	200.7 6010B, 6010C	7 2
Mercury CVAA	245.1/245.2 7471B 7470A	1 2 2
Molybdenum -ICP	200.7 6010B, 6010C	7 2
Nickel -ICP	200.7 6010B, 6010C	7 2
Potassium -ICP	200.7 6010B, 6010C	7 2
Selenium -GFAA -ICP	 7010 200.7 6010B, 6010C	 2 7 2
Silver -ICP	200.7 6010B, 6010C	7 2
Sodium -ICP	200.7 6010B, 6010C	7 2
Strontium -ICP	200.7 6010B, 6010C	7 2
Thallium -GFAA -ICP	 7010 200.7 6010B, 6010C	 2 7 2
Tin -ICP	200.7 6010B, 6010C	7 2
Titanium -ICP	200.7 6010B, 6010C	7 2
Vanadium	200.7	7

INORGANIC TEST PERFORMED		
Analyte (Parameter)	**Method**	**Reference**
-ICP	6010B, 6010C	2
Zinc -ICP	200.7 6010B, 6010C	7 2
Zirconium -ICP	200.7 6010B, 6010C	7 2
Metal Preparation Methods		
Acid Digestion Aqueous and ICP	200.7 3010A	7 2
Acid Digestion Aqueous GFAA	200.9 3020A	1 2
Acid Digestion Solids	3050B	2
Microwave Assisted Acid Digestion Solid and Organic	3051A 3052	2
TCLP	1311	2
SPLP	1312	2
Wet Chemistry		
Acidity	2310B	3
Alkalinity	2320B	3
Ash	D482	4
BOD/BODC	5210B	3
Bromide	300.0 9056A	1 2
BTU-Heat of Combustion	D240-92	4
Cation Exchange Capacity	LADNR 29B	17
COD	HACH 8000/8328	5
Corrosivity	1110A 9040B/4500 H B 9045C	2 2 2
Chloride	SM 4500Cl E 300.0 9056A 9251	3 2 2 2
Residual Chlorine	4500-Cl G	3
Fecal Coliform	9222D	3
Color	2120 C	3
Conductivity	2510B 9050A	3 2
Corrosivity Toward Steel	1110A	2
Cyanide -Free -Total	 335.4 335.4/ 9012A	 1 1 2

INORGANIC TEST PERFORMED		
Analyte (Parameter)	**Method**	**Reference**
-Amenable to Chlorination	335.4/ 9012A	1 2
Density	2520C	3
Fluoride	4500F-D/300.0 9056A	3,1 2
Hardness Calculation	2340B	3
Ignitibility	1010A 1030	2 2
% Moisture	SW846 Dry Weight/2540B	2
Nitrogen -Ammonia -Kjeldahl -Nitrate -Nitrite -Total Nitrate Nitrite	 4500NH_3BE 4500NH_3BF 4500NH_3BE 4500NH_3BF 300.0 9056A 353.2 300.0 9056A 353.2	 3 3 3 3 1 2 1 1 2 1
Oil and Grease	1664A 9071B	8 2
Oxygen, Dissolved	4500 O G 4500O-C	3 3
Paint Filters Liquid Test	9095A	2
Phenolics	420.1/420.4 9066	1 2
pH	4500-H^+B 9040B 9045C	3 2 2
Phosphorus -Orthophosphate -Total Phosphorus	 4500PE 365.1	 3 1
Reactivity -Cyanide -Sulfide	 7.3.3.2 7.3.4.2	 2 2
Silica, Dissolved	4500Si-D	3
Solids -Total Dissolved -Total Suspended -Total Solids	 2540C 2540D 2540B	 3 3 3

INORGANIC TEST PERFORMED		
Analyte (Parameter)	**Method**	**Reference**
-Total Volatile Solids	2540E	3
-Volatile Suspended Solids	2540E	3
-Setteable	2540F	3
Specific Gravity	2710F	3
Sulfate	300.0	1
	9038	2
	9056	2
Sulfide	4500S^2D	3
	9034	2
Sulfite	4500 SO_3^{2-}B	3
Surfactants		
-Ionic (MBAS)	5540C	3
-Non-Ionic (CTAS)	5540D	3
Total Organic Carbon (TOC)	5310B	3
	9060	2
Total Organic Halides (TOX)	9020B	2
Turbidity	180.1	1
	2130B	3
Viscosity	D445	4
Perchlorate	314.0	12
Sample Preparation Procedures		
Alkaline Digestion Cr^{6+}	3060A	2
Bomb Prep Method for Solid Wastes	5050	2
Distillation Sulfides	9030B	2
SPLP	1312	2

METHOD REFERENCES

1) EPA 600 4-79-020, Methods For Chemical Analysis of Water and Wastes, 1983, second printing. Methods for the Determination of Inorganic Substances in Environmental Samples (EPA/600/R-93/100)

2) EPA SW-846, Test Methods for Evaluation Solid Waste, 3rd Edition, Update I dated 7/92, Update II dated 9/94, Update IIA dated 8/93, Update IIB dated 1/95, Update III dated 12/96, Update IV dated 1/08.

3) APHA/AWWA/WPCF, Standard Methods for the Examination of Water and Wastewater, 18th Edition, 1992, Online Edition.

4) ASTM, American Society for Testing & Materials.

5) Hach Company, EPA Approved Procedures for Water and Wastewater, 1986.

6) 40 CFR Part 136 Appendix A, Test Procedures for Analysis of Organic Pollutants

7) Method 200.7, Determination of Metals and Trace Elements in Water and Wastes By Inductively Coupled Plasma-Atomic Emission Spectrometry, Revision 4.4, EMMC Version, May 1994.

8) EPA-821-R-98-002, USEPA Office of Water Analytical Methods; Method 1664, Revision A: N-Hexane Extractable Material (HEM; Oil and Grease) and Silica Gel Treated N-Hexane Extractable Material (SGT-HEM; Non-polar Material) by Extraction and Gravimetry, February 1999.

9) EPA Standard Operating Procedure

10) Florida Department of Environmental Protection, Method For Determination of Petroleum Range Organics, FL-PRO, Revision 1, November 1995.

11) NCASI Method DI/MEOH-94.03, Methanol in Process Liquids by GC/FID, May 2000 and NCASI Method DI/HAPS-99.01, Selected Haps in Condensates by GC/FID, February 2000.

12) NERL, Office of Research and Development, EPA; Method 314.0, Determination of Perchlorate in Drinking Water Using Ion Chromatography, Revision 1.0, November 1999.

13) TNRCC; Method 1005, Total Petroleum Hydrocarbons, Revision 03, June1, 2001.

14) TNRCC, Method 1006, Characterization of Nc_6 to Nc_{35} Petroleum Hydrocarbons in Environmental Samples, Draft

15) Massachusetts Department of Environmental Protection, Method for the Determination of Extractable Hydrocarbons (EPH), Revision1

16) Massachusetts Department of Environmental Protection, Method for the Determination of Volatile Hydrocarbons (VPH)

17) LA DNR 29B, Procedures for Analysis of Exploration and Production Waste.

8 SAMPLE CUSTODY AND INTEGRITY

GCAL utilizes a Laboratory Information Management System (LIMS) that was specifically developed for the needs of environmental laboratories. Horizon©, developed by Chemware, Inc., tracks samples and data throughout the laboratory. Results are available from the LIMS in a variety of hard copy formats. Furthermore, web access can be provided to clients who wish to

view their data. A password security system prevents clients from viewing any data other than their own.

The following is an example of some of the information that is entered into the system:

1. Sample number (unique to this sample)
2. Job number (unique to this job or set of samples)
3. Date received
4. Time received
5. Date analytical results due
6. Sample description
7. Customer's name
8. Customer's address
9. Group number
10. Storage location
11. Notation of any special handling instructions or priority assignments
12. Billing information - purchase orders
13. Analyses requested

GCAL understands that sample integrity is a vital part of Quality Assurance. Samples submitted to the laboratory shall be logged in immediately, or other action taken to preserve integrity of the sample until it can be logged into the system. Any sample that is suspected of being contaminated, improperly stored or preserved, or improperly prepared, shall be reported to the client immediately. Storage blanks located in the volatiles refrigerators are analyzed every two weeks. Records of these analyses are maintained in the GC and GC/MS Volatiles laboratories. No sample is analyzed if there is a question concerning its integrity.

After the sample analyses are complete and the final report is issued to the client, samples are held for 60 days from receipt before disposal. Samples are held longer per the customer request. GCAL does not accept evidentiary samples.

8.1 Sample Acceptance Policy

Delivery of samples to GCAL shall constitute acceptance by Client of these Terms and Conditions. Until GCAL accepts delivery of samples by notation on a chain of custody document or otherwise in writing, GCAL is not responsible for loss of or damage to samples. GCAL, at its sole discretion, reserves the right to refuse or revoke Acknowledgment of Receipt for any sample due to insufficient sample volume, improper sample container, or risk of handling for any health, safety, environmental, or other reason. GCAL does not accept samples that contain asbestos, biohazards, or radiological materials. Regardless of prior acceptance, GCAL may return samples at its sole discretion if it is determined that the samples may pose a risk in handling, transport or processing, for any health, safety, environmental or other reason. GCAL also reserves the right to return excessive sample volume to the Client, at the Client's expense.

Samples not consumed in testing will normally be retained for a maximum of sixty (60) days before disposal. Samples will be returned to the Client when requested in writing or when they would pose a disposal problem as a hazardous waste as determined by GCAL, at its sole discretion. The cost of returning samples will be invoiced to the Client. GCAL, in its sole discretion, may also agree in writing to retain samples at a monthly storage charge, agreed upon and payable in advance.

If the Client is ordering the work on behalf of another, the Client represents and warrants that the Client is the duly authorized agent for the purpose of ordering and directing said work unless otherwise stated in writing, and accepted by GCAL.

Sample acceptance policy is sent out with bottle orders in an effort to make sample collection personnel aware of GCAL's policy prior to sampling. Sample acceptance policy is also available electronically upon request.

8.2 Chain of Custody

A complete chain of custody is maintained by GCAL. Each sample when submitted to our laboratory is accompanied by a Chain of Custody form. These forms contain pertinent information about the sample including specific analytical requests, sampling notes, sample condition, customer name and address.

Additionally, information concerning the site name, field identification marks, date and time of collection, sampler signature, and preservation data is recorded.

Samples are labelled, preserved if necessary and stored appropriately (i.e. refrigerator, freezer or shelf). Samples to be analyzed for volatile organic compounds are stored in refrigerators located in the volatiles analytical laboratories.

8.3 Internal Chain of Custody

Samples labels include a bar code. All samples must be scanned each time custody of the container changes. This information is stored in the LIMS, and includes a complete record of the sample custody from receipt to disposal. Information includes the location of the sample, the date and time of each custody transfer, unique initials of each person assuming custody, and a reason for the transfer.

8.4 Custody Transfer

If a sample requires additional work to be performed by a qualified outside laboratory, a GCAL chain of custody form is completed and submitted with a representative portion of the sample. A copy of this form is maintained on file. The sub-contracted laboratory must sign and date the COC upon receipt and return it, along with any unused sample, once analysis has been completed.

8.5 Sample Kits

Customers will request a sampling kit (bottles, vials, etc.) with which to collect samples. Sample kits are prepared according SOP SAD-003. Chain of Custody (COC) forms are sent with the kit to insure proper sample custody. The COC form is completed at the time of sample collection and is returned with the samples. A record of sample kits prepared for clients is maintained by Login personnel.

8.6 Shipping Requirements

The Department of Transportation (DOT) regulations shall be used for packaging and shipment. Shipping containers shall be secured using impact strapping material. Copies of the signed Chain of Custody (COC) forms must be delivered with the containers. Any samples being split with another party must be properly labeled, contain a COC, and be packed and shipped according to DOT regulations.

A laboratory file is maintained listing sample kits prepared for clients. It contains the client name, address, form of delivery, preservative (if requested), sample bottle distribution, and analyses to be performed. Additionally, the date the kit is requested, sent and expected arrival date is included, along with any pertinent miscellaneous information.

9 STANDARD OPERATING PROCEDURES

GCAL employs standard procedures for all work performed. These standard procedures insure that work is completed in a professional and timely manner and that all contractual obligations are met.

Standard safety procedures are also part of GCAL Standard Operating Procedures. Confidentiality and security agreements on all work performed are strictly enforced.

Analytical SOPs must incorporate or reference the following topics:

- Identification of test method
- Applicable matrix or matrices
- Detection limit
- Scope of application
- Summary of test method
- Definitions
- Interferences
- Safety
- Equipment and supplies
- Reagents and standards
- Sample collection, preservation, storage, and handling
- Quality control
- Calibration
- Procedure
- Calculations
- Method performance
- Pollution prevention
- Data assessment and acceptance criteria
- Corrective action for out-of-control data
- Handling out-of-control data
- Waste management and
- References
- Tables, Diagrams, Flowcharts, and Validation Data

SOPs are reviewed annually and are the basis for internal method audits. If no changes are made to an SOP during review, an SOP review form is completed and appended to the last page of the original SOP kept on file. Refer to SOP QA-001 for document control procedures.

10 Sample Handling Guidelines

The following tables are guidelines to be used for sample container, quantity or volume,

preservation and holding times. Specific information with regards to the Parameters listed in the table can be found in 40CFR Part 136 Tables IA, IB, IC, ID & IE and Table II., SW846 Table 4-1 and Table 3-1, SW846 Method 1311 Section 8.5,

Inorganic and Conventional Parameters

Parameters	Container	Recommended Weight (g) or Volume (mL) #	Preservative *	Holding Time **
Acidity	P,G	100	$<6^0C$	14 days
Alkalinity	P,G	100	$<6^0C$	14 days
Ammonia-N	P,G	500	$<6^0C$, H_2SO_4 to pH <2	28 days
Biochemical Oxygen Demand (BOD)	P,G	1000	$<6^0C$	48 hours
Bromide	P,G	200	None	28 days
Chemical Oxygen Demand (COD)	P,G	100	$<6^0C$ H_2SO_4 to pH <2	28 days
Chloride	P,G	200	None	28 days
Chlorine, Residual	P,G	200	None	Immediately
Coliform, Fecal	P,G (sterile)	100	$<6^0C$, $Na_2S_2O_3$	6 hours
Color	P,G	100	$<6^0C$	48 hours
Cyanide	P,G	1000	$<6^0C$, ascorbic acid, NaOH to pH > 12	14 days
Ferrous Iron	P,G	100	2mHCl/100mL	Immediately
Flashpoint	P,G	100	None	Not specified
Fluoride	P	500	None	28 days
Hardness	P,G	100	HNO_3 to pH < 2	6 months
Nitrogen, Kjeldahl (TKN)	P,G	500	$<6^0C$, H_2SO_4 to pH < 2	28 day
Nitrate-N	P,G	100	$<6^0C$	48 hours
Nitrite-N	P,G	100	$<6^0C$	48 hours
Nitrate-Nitrite as N	P,G	200	$<6^0C$, H_2SO_4 to pH < 2	28 days
Oil and Grease	G	1000	$<6^0C$, H_2SO_4 or HCI to pH < 2	28 days
Phenols	P,G	1000	$<6^0C$, H_2SO_4 to pH < 2	28 days
Phosphorus, Total	P,G	200	$<6^0C$ H_2SO_4 to pH < 2	28 days
Phosphorus, Ortho	P,G	200	$<6^0C$	48 hours
pH	P,G	100	None	Immediately
Radiochemistry Alpha, Beta,	P,G P,G	2000 100	HNO_3 to pH < 2 None	6 months 6 months

Parameters	Container	Recommended Weight (g) or Volume (mL) #	Preservative *	Holding Time **
Radium Tritium Radon, I-131	P,G	1000	HNO_3 to pH < 2	14 days
Reactivity	G	100g	$<6^0C$	Not Specified
Silica	P, PFTE, Quartz	100	$<6^0C$	28 days
Solids, Dissolved (TDS)	P,G	100	$<6^0C$	7 days
Solids, Suspended (TSS)	P,G	500	$<6^0C$	7 days
Solids, Volatile (TVS)	P,G	100	$<6^0C$	7 days
Solids, Total (TS)	P,G	100	$<6^0C$	7 days
Specific Conductance	P,G	100	$<6^0C$	28 days
Specific Gravity	P,G	100	$<6^0C$	28 days
Sulfate	P,G	200	$<6^0C$	28 days
Sulfide	P,G	500	$<6^0C$, Zn acetate, NaOH to pH > 9	7 days
Sulfite	P,G	200	None	Immediately
Surfactants (MBAS)	P,G	250	$<6^0C$	48 hours
Total Organic Carbon (TOC)	P,G	100	$<6^0C$, HCI to pH < 2	28 days
Total Organic Halogens (TOX)	G-TLC (amber)	100	$<6^0C$, H_2SO_4 to pH <2	28 days
Total Petroleum Hydrocarbon (TPH)	G-TLC	1000	$<6^0C$, H_2SO_4 or HCI to pH < 2	28 days
Turbidity	P,G	100	$<6^0C$	48 hours
Viscosity	P,G	500	None	Not Specified

Solid and waste samples: Quantity 1-100g as specified by the method,

* Preservative $<6^0C$.

** Holding time for solids and samples is not defined

NOTE: Organic Nitrogen = TKN – Ammonia-N

Metals

Parameters	Container	RecommendedWeight or Volume	Preservative	Holding Time
Aqueous				
Total	P,G	500 mL	HNO_3 to pH < 2	6 months
Dissolved	P,G	500 mL	Filter on site HNO_3 to pH < 2	6 months
Solid				
Total	P,G	100 g	$<6^0C$	6 months
Hexavalent Chromium:				
Aqueous	P,G	500 mL	$<6^0C$	24 hours
Solid	P,G	100g	$<6^0C$	30/7 days
Mercury:				
Aqueous				
Total	P,G	500 mL	HNO_3 to pH < 2	28 days
Dissolved	P,G	500 mL	Filter on site HNO_3 to pH < 2	28 days
Solid				
Total	P,G	100 g	$<6^0C$	28 days

NOTE: CrIII=Total Cr-Hexavalent Cr

Organic Parameters

Volatile Organics

Sample Matrix	Container	Minimum Quantity	Preservative	Holding Time
Concentrated Waste Samples	G-TLC or G-TLS	2 x 40 mL vials, 2-oz wide mouth	$<6^0C$	14 days
Aqueous Samples	G-TLS	2 x 40 mL vials	$<6^0C$, HCI to pH < 2, add $Na_2S_2O_3$ if residual chlorine present	14 days, 7 days if not acid preserved
Solid Samples	G-TLS or G-TLC	2-oz wide mouth and/or 3 Encores	$<6^0C$	14 days*

* Solid samples collected in EnCore™ samplers must be transferred to a soil sample vial within 48 hours of collection.

Semivolatile Organics, Pesticides/PCBs, Herbicides, PAH's And Petroleum Hydrocarbons

Sample Matrix	Container	Minimum Quantity	Preservative	Holding Time***
Concentrated Waste Sample	G-TLC (Amber)	1 Liter	None	14 days to extraction, 40 days after extraction
Aqueous Samples	G-TLC (Amber)	2 - 1 Liter	$<6^0$C	7 days to extraction, 40 days after extraction
Solid Samples	G-TLC	8 oz.	$<6^0$C	14 days to extraction, 40 days after extraction
Dioxins and Furans**	G-TLC(Amber)	2 - 1 Liter	$<6^0$C	30 days to extraction, 45 days after extraction

**Concentrated wastes and soil samples are collected in 2 oz. to 1 Liter amber glass jars with TLC as specified in the method.
***Samples for TX1005/1006, Petroleum Hydrocarbons analysis must be extracted within 14 days of collection and must be analyzed within 14 days after extraction

TCLP and SPLP Parameters

Parameters	Holding Time from Collection to TCLP Extraction (days)	Holding Time from TCLP Extraction to Preparative Extraction (days)	Holding Time from TCLP/Preparative Extraction to Analysis (days)	Total Time
Volatiles	14	NA	14	28
Semivolatiles	14	7	40	61
Mercury	28	NA	28	56
Metals	180	NA	180	360

Acronym Used in the Tables: (Teflon is a registered trademark of E.I. DuPont)
CLP: EPA Contract Laboratory Program
G-TLC: Glass with Teflon®-lined cap
NA: Not Applicable
G: Glass
G-TLS: Glass with Teflon®-lined septum
P: Polyethylene

10.1 Waste Collection and Storage

Samples are stored in the appropriate cooler for 60 days after receipt. After 60 days, samples are scanned out for disposal on the LIMS. The samples are then stored in the waste staging area until disposal into appropriate drums. Hazardous samples are returned to the client whenever possible to be disposed of with larger quantities of the sample material. Laboratory waste is segregated by laboratory personnel into waste streams, which have been established by the Safety and Regulatory Compliance Officer. The waste streams are determined by analysis of the waste and through process knowledge. All laboratory wastes are disposed of in the proper container. No waste is placed in regular trash containers or poured down the drain. Waste is stored in drums in satellite accumulation areas and then in the central accumulation facility. Waste disposal service is provided by approved vendors who will incinerate, landfill, treat, or reclaim the waste based on the characteristics.

10.2 Pollution Prevention

Environmental concerns, risks to employees, the public, and high disposal costs have increased the need and effort of the laboratory to minimize or prevent waste generation. The quantity of chemicals and standards purchased is based on expected usage during its shelf life and the disposal cost of the unused material. The volume of standards and reagents prepared in the laboratory reflect stability and anticipated usage. If possible, methods requiring the use of hazardous chemicals or that produce hazardous waste are replaced with an alternative method. Sample containers are selected based on the minimum volume that is necessary to perform a test, thereby reducing sample waste. Sample sizes are reduced in some cases, therefore reducing the quantities of extraction solvents and reagents.

11 SAFETY PROCEDURES

GCAL has a comprehensive safety program outlined for all employees. A safety manual is distributed to each employee followed by a training seminar to familiarize the employee with the safety procedures at GCAL.

11.1 Basic Safety Rules

1. All injuries are reported to a supervisor or member of management immediately.
2. All hazards are reported to a supervisor or member of management immediately.
3. Running and horseplay are not permitted in the laboratory.
4. Smoking is not permitted in the laboratory. Smoking is allowed in the designated area.
5. Laboratory glassware is not to be used for eating or drinking.
6. Laboratory reagents such as sucrose or sodium chloride shall not be used for food.

7. Eating on the premises is confined to designated areas. Eating is not allowed in the laboratory.
8. Proper personal protective equipment is always utilized. Safety glasses are to be worn in designated areas.
9. Contacts are not to be worn in designated laboratory areas.

11.2 Arrangement of Furniture and Equipment

Furniture is arranged for maximum use of available space while providing working conditions that are efficient and safe.

Aisles are kept at least 4 feet wide to provide for safe passage of personnel and equipment, and are kept free of obstructions.

Stepladders or footstools are supplied for reaching high objects and are kept out of the way when not in use.

Eyewash stations, safety showers and fire extinguishers are located centrally and care is taken to avoid blocking access to them.

11.3 Hoods and Ventilation

Adequate hood facilities are installed and used where toxic or flammable materials are used. Hoods with a sash provide physical protection from splash and greater control of fumes. Hood velocities are checked quarterly. Hoods are kept clean. Hoods are not to be used for storage.

11.4 Spills

Spilled materials are cleaned up promptly. All spills shall be handled as if corrosive or dangerous unless definitely known to be harmless. Spill Kits are located throughout the laboratory.

Corrosive or toxic materials are not placed in waste cans in the laboratory. When in doubt a supervisor is consulted.

Broken glass is swept up immediately and discarded so as to avoid any injury or cuts.

11.5 Emergency Equipment

Fire extinguishers are centrally located throughout the laboratory. The paths to these are kept free and clear at all times.

An extinguisher that has been used shall not be returned to its holder until it has been recharged and checked.

Any fire that appears to be too large to extinguish immediately is reported to the fire department at once. All fires, regardless of size are to be reported to a supervisor. Causes shall be determined and necessary steps to prevent a similar accident shall be taken.

Eyewashes are located in the laboratories for irrigation of the eyes if corrosive liquids or any other materials are splashed into the eyes.. Tubing attached to faucets in the sink shall also be used to wash the eyes if necessary.

Safety showers are centrally located throughout the laboratory and are used whenever corrosive materials are spilled on an analysts' skin or clothing.

All safety equipment is periodically checked to be sure everything is in working order and is easily accessible.

General first aid kits are located throughout the laboratory. These kits contain first aid products for the treatment of minor cuts and bruises, burns or abrasions, and personal discomfort.

11.6 Protective Equipment

Lab coats and aprons are supplied for all employees of GCAL. Protective clothing is available to prevent damage to clothing and persons.

Shoes must be worn at all times and must be closed-toe; high heels or sandals are not acceptable in lab areas.

Eye Protection is mandatory for all personnel working in the laboratory. Safety glasses or goggles shall be worn by analysts to protect the full eye area in designated areas. Placards identifying area that require the use of safety glasses are located throughout the laboratory. Guest visiting the laboratory will be required to wear safety glasses in specified areas.

Various types of gloves are provided for employees: Insulated gloves are provided for use when handling hot or cold items; Heavy rubber gloves are to be used when handling corrosive liquids

or unknown substances; Lightweight disposable gloves are provided for use with toxic or irritating substances.

Air purifying respirators are available for use when working with organic vapors and/or acid fumes for qualified trained analysts. These respirators shall be worn whenever contact with irritating concentrations of these fumes is encountered.

11.7 Storage of Laboratory Materials

All chemicals, reagents and glassware are stored in such a manner that they are easily located and do not present a danger. Heavy items are kept near the floor.

Flammable solvents are stored in special cabinets or in solvent bunkers. Only quantities required for immediate use are stored in analytical areas.

Reagents are grouped to prevent danger from hazardous combinations. Acids and bases are stored separately. Oxidizing chemicals are stored away from acids and bases.

Compressed gases are stored away from heat and open flames. Compressed gas cylinders are secured to the wall or cabinet with chains or belts to prevent rolling or toppling. A special cart is used to transport replacement cylinders and empties.

11.8 Chemical And Sample Handling

If there are questions about proper chemical handling the MSDS (Material Safety Data Sheet) is used as reference.

- Samples are always treated as if they were hazardous chemicals.
- Rubber pipette bulbs are used for drawing samples or chemicals into pipettes.
- Procedures that produce flames or toxic vapors are performed under a hood.
- Chemicals are returned to their proper storage area after use.
- All prepared solutions are labeled with the name of the solution, ID number for the solution, concentration, lot number if applicable, date prepared, analyst preparing the solution, and expiration date.
- Acids are always poured into water when diluting.
- Large amounts of alkali are never added to water at one time.
- Glass-stopper containers are not used for storing alkaline solutions.
- Labels for Acid and Caustic solutions must include the concentrations and the lab assigned expiration date.

12 CONFIDENTIALITY

GCAL understands that it must retain in confidence all information obtained through the analysis of samples or the information disclosed to GCAL in order to adequately perform and interpret analytical data.

GCAL will maintain the secrecy and confidentiality of any proprietary information it receives or generates.

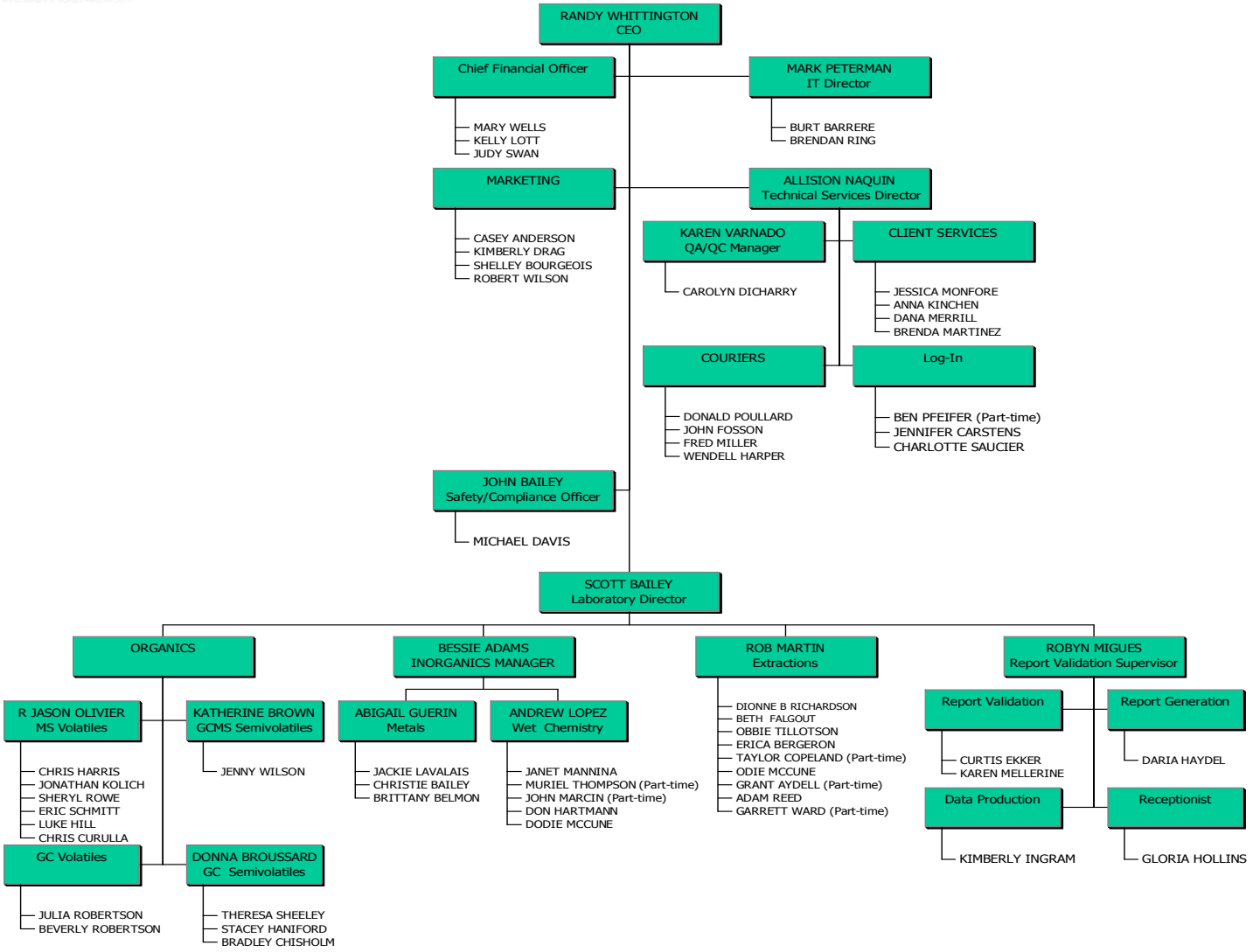
GCAL will not submit final analytical reports to anyone other than the contractor requesting the analytical services or consultation services. .

Entities that would like copies of reports released to other parties must provide GCAL with explicit written authorization. Reports will not be release to anyone other than the contractor without GCAL having first received authorization.

Appendix A

GCAL
GULF COAST ANALYTICAL LABORATORIES, INC

ORGANIZATIONAL CHART



9/28/2011

Appendix B

RANDY K. WHITTINGTON

Current Position:

CEO, Gulf Coast Analytical Laboratories, Baton Rouge, LA, October 2009 - present

Responsible for financial and marketing functions. Responsible for long range planning and structuring of future business operations..

Previous Experience:

Technical Services Manager, Gulf Coast Analytical Laboratories, Baton Rouge, LA, January 1997 – April 2007

Responsible for the management and supervision of Sample Management, Project Management, and Report Generation. Duties include implementing systems for increased productivity in all three sections. Also coordinates communication among these departments and other areas of the laboratory and marketing.

Technical Services Manager, ITS-Environmental Laboratories, Baton Rouge, LA, October 1996 - January 1997

Responsible for the management and supervision of Sample Management, Client Services, and Report Generation. Duties include implementing systems for increased productivity in all three sections. Also coordinates communication among these departments and other areas of the laboratory and marketing.

Project Manager and Data Validation Manager, Terra Consulting Group, Baton Rouge, LA, 1993 - 1996

Performed organic data validation for CLP and RCRA data packages for pesticides, PCBs, volatile and semi-volatile analytical fractions. Responsible for the design and implementation of the analytical aspects needed to generate legally defensible data for a Remedial Feasibility Investigation (RFI) at various large chemical plants. Ensured data validation issues were addressed in the day-to-day operations of the investigation.

Gas Chromatography Supervisor, West-Paine Laboratories, Baton Rouge, LA, 1991-1993

Directly responsible for the supervision of the organics laboratory in Randy

environmental and hazardous waste matrices following current SW-846, 500 and 600 series methodologies. Responsibilities include coordinating and managing of QA/QC for all Gas Chromatography data from sample log-in, extraction, analysis, review and preparation of computerized reports.

Gas Chromatography Laboratory Manager, ETC/Toxicon, Baton Rouge, LA, 1987-1991

Supervised the Gas Chromatography laboratory in the analysis of Organochlorine and Organophosphorus Pesticides, PCBs, Herbicides, PNAs, VOA and Semi-VOAs; supervised all aspects of the GC laboratory including analysis, data interpretation, report preparation, instrument maintenance, method development, and problem solving. In 1990 temporarily relocated to Edison, New Jersey to restructure the Gas Chromatography division while also implementing USEPA CLP and Finnigan QA Formaster; maintained efficiency of twenty-two various Gas Chromatographs.

Education: BS, Environmental Engineering , Columbia Southern University

Inchcape Managerial Training Skills Workshop - 1993

Finnigan QA Formaster Training

Restek Chromatography Class

Bank One Managing and Financing Independent Business - 16 Hours - October 1998

SCOTT A. BAILEY

Current Position:

Laboratory Director, Gulf Coast Analytical Laboratories, Baton Rouge, LA January 2011 - Present

Responsible for coordinating the overall activities of the analytical laboratories on a daily basis and providing long-term direction. Responsibilities include monitoring the scheduling of analytical testing and releasing testing data and results.

Previous Experience:

Technical Advisor, Gulf Coast Analytical Laboratories, Baton Rouge, LA June 2007 – December 2010

Assisted laboratory management with training needs, method development, and data validation.

Operations Manager, Gulf Coast Analytical Laboratories, Baton Rouge, LA January 1997 – May 2007

Responsible for coordinating the overall activities of the analytical laboratories on a daily basis and providing long-term direction. Responsibilities include monitoring the scheduling of analytical testing and releasing testing data and results.

Operations Manager, ITS-Environmental Laboratories, Baton Rouge, LA September 1995 - January 1997

Responsible for coordinating the overall activities of the analytical laboratories on a daily basis and providing long-term direction. Responsibilities include monitoring the scheduling of analytical testing and releasing testing data and results.

Organics Manager, ITS – Environmental Laboratories, Baton Rouge, LA, October1993 - September 1995

Responsible for the management of the GC, GCMS, and the extraction departments of the laboratory. Duties also included supervision of the report generation department.

Division Manager, National Environmental Testing, Baton Rouge, LA
March 1992 - October 1993

Directed the functional areas of marketing, finance, chemistry, and administration for the Baton Rouge facility. Additional duties included contract administration, scheduling, and client consultation.

Operation Manager, Environmental Testing & Certification Corporation, Baton Rouge, LA , December 1989 - January 1992

Directed the functional areas of marketing, finance, chemistry, and administration for the Baton Rouge facility. Additional duties included contract administration, scheduling, and client consultation.

Analyst, ETC, Baton Rouge, LA, December 1983 - December 1989

Education:

BS, Environmental Health, Louisiana State University, Baton Rouge, LA, December 1991

ITS Managerial Training Skills Workshop, 1994

ITS - Environmental Laboratories, Baton Rouge, Manager and Supervisor Training Retreat - June 1996

UCLA ITS Executive Development Program - August 1996

ALLISON M. NAQUIN, Ph.D.

Current Position: **Technical Services Director, GCAL Inc, Baton Rouge, LA Jan 2011**
Responsible for managing all technical aspects of the laboratory facility. Responsible for ensuring the laboratory produces quality data, while generating and implementing strategies to improve service levels, quality and efficiency throughout the organization.

Previous Experience:

Laboratory Manager, GCAL Inc, Baton Rouge, LA, Jan 2010 – Jan 2011
Responsible for coordinating the overall activities of the analytical laboratories on a daily basis and providing long-term direction. Responsibilities include monitoring the scheduling of analytical testing and releasing testing data and results. Continue General Manager duties as described below.

General Manager, QA/QC Manager, GCAL, Inc., Baton Rouge, LA, August 2007 – Jan 2011
Responsible for all operations within the facility including laboratory and administrative policies and procedures.

QA/QC Manager, GCAL Inc., Baton Rouge, LA, April 2005 – August 2007

Responsible for implementing and monitoring the laboratory Quality Assurance Program Plan, conducting internal audits, investigating problem areas, control-chart generation, establishing data-quality criteria, verifying corrective actions are being taken when necessary, directing participation in accreditation programs, and monitoring performance evaluation studies. Additional duties include administering the ethics training/data integrity program and providing reports concerning QA matters to management.

Laboratory Auditor, GCAL Inc., Baton Rouge, LA, February 2005 – April 2005

Support QA/QC functions and perform internal audits. Responsibilities include performing internal audits of lab and writing audit reports. Assist in writing standard operating procedures.

Environmental Scientist Supervisor, Louisiana DEQ, Baton Rouge, LA, December 2004 – February 2005

Served as the Technical Advisor for the laboratory to the Assistant Secretary of the Office of Environmental Assessment. Responsibilities include draft/review and approval of Quality System documents; advise laboratory on technical and quality issues to obtain NELAP accreditation, and audit laboratory activities to NELAC standards. Continue assistance to Lab Accreditation Program.

Environmental Scientist III, Louisiana DEQ, Lab Accreditation Program, Baton Rouge, LA, April 2002 – December 2004

Assess commercial environmental and industrial laboratories to NELAC/ISO standards, and assess quality documents. Responsibilities also include serving as organic specialist to accreditation group, review data packages, assist in training seminars to environmental community, and assists Executive Staff with technical issues.

Environmental Scientist I-II, Louisiana DEQ, Laboratory Services Division, Baton Rouge, LA, February 2001 – April 2002

Responsibilities include analysis of volatile samples by GC/MS, interpretation and reporting data, preparation of data packages, and draft standard operating procedures. Cross-trained on semi-volatile analysis by GC/MS.

Research Assistant, Louisiana State University, Chemistry Department Baton Rouge, LA, August 1998 – December 2000

Responsibilities include directing daily activities of research lab, conduct environmental research, maintain and repair laboratory equipment, and mentor undergraduate students. Also, prepared and delivered seminars on personnel research and related literature, and was liaison between LSU and Southern University for research project.

Teaching Assistant, Louisiana State University, Chemistry Department Baton Rouge, LA, January 1995 – August 1998

Responsibilities include instructor for general chemistry laboratory, tutor undergraduate students, and provides class reviews and exam proctoring for professors.

Independent Contractor, Baton Rouge, LA, September 1998 – November 1998

Performed metals digestion and ICP/MS analysis of environmental samples from an EPA clean-up site. Issued reports to Dr. James Wharton of LSU Chemistry Department.

Adjunct Chemistry Instructor, Louisiana State University, Chemistry Department, Baton Rouge, LA, August 1994 – December 1994

Responsibilities include instructor for general chemistry laboratory, provides instruction in class materials, and administers and grades class-work and exams.

Education

Doctor of Philosophy, Chemistry, Louisiana State University, Baton Rouge, LA, May 2001

BS Chemistry, Louisiana State University, Baton Rouge, LA August 1994

Accreditation Process, Laboratory Ethics, How to Write Quality Documents Training Course, Analytical Excellence, April 2004

Assessments for ISO/IEC 17025 & NELAC (ASI Course 300), Advanced Systems, Inc., July 2003

Data Assessment Training, Analytical Excellence, Inc., May 2003

QA/QC Workshop, Advanced Systems, Inc., May 2003

Calibration and Manual Integration, Analytical Excellence, Inc., May 2003

HAZWOPER 40-hour Training Course, July 2002 and yearly refreshers August 2003 and August 2004

Data Integrity Seminar – Ethics Training, Analytical Excellence, Inc., March 2002 and yearly refresher

Environmental GC/MS Instrument and ChemStation Operation, Agilent Technologies, October 2001

Comprehensive Public Training Program

SHELLEY BOURGEOIS

Current Position:

Client Services Manager, Gulf Coast Analytical Laboratories, Baton Rouge, LA, April 2007 – present

Responsible for the management and supervision of Sample Management and Project Management. Duties include implementing systems for increased productivity and coordinating communication among these departments and other areas of the laboratory.

Previous Experience:

Project Chemist, Conestoga-Rovers & Associates, Baton Rouge, LA, May 2004 – April 2007

Responsible for contracting analytical laboratory services and for QA/QC verification of data. Performed data validations and ensured data validation issues were addressed in the day-to-day operations of the investigation.

Inorganics Manager, Gulf Coast Analytical Laboratories, Baton Rouge, LA, May 1998 – May 2004

Responsible for the management and supervision of the Metals Laboratory. Duties include the management and training of personnel, scheduling of sample workloads, supervision of metals sample preparation, analysis of samples by various analytical instrumentation, coordination of laboratory QA/QC projects, and maintenance of procedures to QA/QC guidelines. In addition, responsibilities include comprehensive data review and validation for the laboratory as well as the coordination of higher level QA data packages.

Metals Analyst, Gulf Coast Analytical Laboratories, Baton Rouge, LA, December 1997 – May 1998

Responsible for analysis of samples by various instruments including GFAA, Flame AA, ICP and the mercury analyzer. Additional responsibilities included data reduction and posting in the LIMS.

Head Technician, American Radiation Services, Baton Rouge, LA, November 1996 - December 1997

Responsible for coordinating sample analysis and field services. Supervised sample receipt, preparation, analysis, and report generation.

Analyst, ITS Environmental Laboratories, Baton Rouge, LA, July 1996 - November 1996

Education:

BS/Microbiology - Louisiana State University, Baton Rouge, LA, December 1995

Perkin Elmer Atomic Spectroscopy Workshop, Baton Rouge, LA, April 1998

Perkin Elmer Optima Instrument Series ICP training, Atlanta, GA, June 1998

ROBYN B. MIGUES

Current Position:

Technical Director, Gulf Coast Analytical Laboratories Baton Rouge, LA, April 2005 – Present

Responsible for report validation and review. Responsible for review of Quality Assurance Project Plans on incoming projects and implementation of such plans throughout the laboratory. Assists the lab in method implementation and development. Additional duties include advising the laboratory on reference methods and improving method performance.

Previous Experience:

QA/QC Manager, Gulf Coast Analytical Laboratories Baton Rouge, LA, January 1997 – April 2005

Responsible for implementing and monitoring the laboratory Quality Assurance Program Plan, conducting internal audits, reviewing reports, investigating problem areas, control-chart generation, establishing data-quality criteria, verifying corrective actions are being taken when necessary, and monitoring performance evaluation studies. Additional duties include providing reports concerning QA matters to management.

QA/QC Manager, ITS- Environmental Laboratories, Baton Rouge, LA October 1994 - January 1997

Responsible for implementing and monitoring the laboratory Quality Assurance Program Plan, conducting internal audits, reviewing reports, investigating problem areas, control-chart generation, establishing data-quality criteria, verifying corrective actions are being taken when necessary, and monitoring performance evaluation studies. Additional duties include providing reports concerning QA matters to management.

General Chemistry Supervisor, ITS- Environmental Laboratories, Baton Rouge, LA, June 1994 - October 1994

Responsibility includes the management and training of personnel conducting inorganic analysis using EPA methodologies. Duties include data validation, QC review, instrument maintenance and method set up.

Metals Supervisor, ITS –Environmental Laboratories, Baton Rouge, LA, October 1993 - June 1994

Responsible for the management and supervision of the Metals section which includes supervision of metals sample preparation, supervision and training of analysts, scheduling sample workload, analysis of samples by various analytical instrumentation and reviewing and validating all data.

Research Associate, Louisiana State University, Agronomy Department, Baton Rouge, LA, September 1990 - March 1993

Prepared and analyzed samples by ICP, maintained ICP and other laboratory equipment, assisted associate Professor of soil and environmental chemistry with laboratory courses and research projects and supervised student workers. Computer experience includes Quattro Pro and Wordperfect.

Previous Experience:

Spectroscopy and Water Departments Supervisor, James Laboratories, Lafayette, LA, February 1987 - September 1990
Laboratory Technician

Prepared and analyzed samples by ICP, Flame Atomic Absorption & Emission, Mercury Hydride System and Graphite Furnace. Performed quality control coordination, trained laboratory technicians, maintained equipment . Prepared and analyzed various sample types.

Education:

BS Geology, University of Southwestern Louisiana, Lafayette, LA, May 1985.

Member - American Society for Quality Control

Perkin Elmer Spectroscopy training course - 1987

Basic Statistics - Pittsburgh Conference Continuing Education Program - March 1995

Quality Management/Quality Assurance in Industry and in the Laboratory - ACS Short Course - March 1995

Inchcape Managerial Training Skills Workshop - 1994

Inchcape Testing Services - Environmental Laboratories, Baton Rouge, Manager and Supervisor Training Retreat - June 1996

Executrain Microsoft Excel 5.0 Beginning For Windows - July, 1996

ERTCO - Thermometer Calibration per ISO - October 1997

Assuring Ethical Practices in The Environmental Laboratory, A Training Short Course – Analytical Excellence – October 27, 2000

Member - LADEQ Laboratory Accreditation Task Force

Karen S. Rodrigue-Varnado

Current Position: **Quality Assurance Manager, GCAL Inc., Baton Rouge, LA May 2011**
Responsible implementing and monitoring the laboratory Quality Assurance Program, conducting internal audits, investigating problem areas, establish data quality criteria, verifying corrective actions are getting taken when necessary, directing participation in state and federal accreditation programs, monitoring training records, and monitoring proficiency test studies. Additional duties include administering the ethics training/data integrity program and providing reports concerning QA maters to management.

Previous Experience:

Quality Assurance Manager, Sherry Laboratories, Lafayette, LA February 2009 – May 2011
Responsible implementing and monitoring the laboratory Quality Assurance Program for the environmental and biomonitoring laboratory, air laboratory in Garland TX and the natural gas laboratory in Scott, LA.. Responsible for conducting internal audits, investigating problem areas, establish data quality criteria, verifying corrective actions are getting taken when necessary, directing participation in state and federal accreditation programs, monitoring training records, and monitoring proficiency test studies. Additional duties include administering the ethics training/data integrity program, providing reports concerning QA maters to management. Responsible for maintaining certification of all Sherry Laboratories - Southern Region.

Quality Assurance Manager, Analytical Products Group, Belpre, OH February 2008 – December 2008.
Responsible implementing and monitoring the laboratory Quality Assurance Program for an approved Proficiency Test Provider Responsible for maintaining facility ISO 17025, ISO 17011 and Guide 34 and Guide 43 certification as well as A2LA certification. Responsible for conducting internal audits, investigating problem areas, establish data quality criteria, verifying corrective actions are getting taken when necessary, directing participation in state and federal accreditation programs, monitoring training records, and monitoring proficiency test studies. Additional duties include administering the ethics training/data integrity program and providing reports concerning QA maters to management.

Environmental Scientist Supervisor, Louisiana Department of Environmental Quality, Lab Accreditation Program
October 2001 – February 2008

Responsible for the operation of the laboratory accreditation program with a budget of $9 million. Managed 7 state assessors and 8 contract assessors. Responsible for certifying of 250 laboratories nationally. Louisiana State representative to the National Environmental Laboratory Accreditation Conference (NELAC). Voting member for the State of Louisiana at NELAP. Member of the Board of Directors for NELAP and TNI. Member of Chapter 5, Accreditation, and Proficiency Test Committees of NELAC and TNI.

Environmental Scientist 3, Louisiana Department of Environmental Quality
October 1989 – October 2001
Drafted regulations for the Louisiana Environmental Laboratory Accreditation Program**.** Participated in developing the Laboratory Accreditation Program**.** Responsible for inspecting major and minor facilities for the Department of Environmental Quality and reporting issues to the DEQ and EPA. Responsible for managing support service laboratory contracts for the Department totaling over $5 million. Drafted environmental compliance orders and penalties for DEQ. Acted and Quality Assurance Officer for the Ground Water Protection Division. Participated in drafting the DEQ's strategic plan and the Quality Assurance Manual.

Environmental Scientist 3, Louisiana Department of Health and Hospitals, Office of Public Health, Laboratory Services
April 1988 – October 1989
Performed bacteriological testing on dairy products, potable and non-potable water, animal specimens, blood and various cultures.

TEXACO, Inc.
Products Control Laboratory, March 1981 – October 1982
Performed open-cup flash testing, Pensky-Marten closed cup testing, ash testing, various titrations, viscosity, leco carbon, % moisture testing on all finished products from the oil refinery and crude oil.

Education

B.S in Biology, Lamar University, Beaumont, TX
Minor in Chemistry and Secondary Education

Accreditation Process, Laboratory Ethics, How to Write Quality Documents Training course, Analytical Excellence, Inc. April 2004

Assessments for ISO/IEC 17025 & NELAC (ANSI Course 300), Advanced Systems, Inc. July 2003

Data Assessment Training, Analytical Excellence, Inc., May 2003

QA/QC Workshop, Advanced Systems, Inc. May 2003

Calibration and Manual Integration, Analytical Excellence, Inc., May 2003

DQO/DQA, USEPA

Quality Assurance Quality Control, USEPA

Assessor Training, USEPA June 1997

Hazwoper 40 Hour Training Course, 1990. 8 hour refresher training annually thereafter.

Data Integrity Seminar – Ethics Training, Analytical Excellence, 1998 and annual refresher.

NPDES Inspector Training, USEPA, 1990

Comprehensive Public Training Program

Various computer courses.

Appendix C

GCAL Equipment List

ORGANICS	Location	Date Received	Date in Service	Condition	MAKE/MODEL	SERIAL NUMBER
GCMSSV 4	MSSV Lab	September-05	September-08	new	AGILENT 5975	US52430653
	MSSV Lab	September-05	September-08	new	AGILENT 6890N	CN10532052
GCMSSV 5	MSSV Lab	November-05	November-05	new	AGILENT 5975	US53931245
	MSSV Lab	November-05	November-05	new	AGILENT 6890N	CN10539069
GCMSSV 6	MSSV Lab	July-07	July-07	new	Agilent 7890	CN10717068
	MSSV Lab	July-07	July-07	new	Agilent 5975C	US71235850
GCMSV 0	MSV lab	September-01	September-01	new	HP 5890 SERIES II	3336A58851
	MSV lab	September-01	September-01	new	HP 5972	3501A02325
	MSV lab	September-01	September-01	new	Teledyne/Tekmar-XPT	US05279001
	MSV lab	September-01	September-01	new	T/D Solatek 72	USO2294002 (GCAL# 0337)
GCMSV5	MSV lab	October-03	October-03	new	HP 5890 SERIES II	3310A48460
	MSV lab	October-03	October-03	new	HP 5971	3307A00395
	MSV lab	October-03	October-03	new	Tekmar LCS 2000	90211015/93154002/9115009
GCMSV 8	MSV Lab	October-01	October-01	new	AGILENT 5973	US10441235
	MSV Lab	October-01	October-01	new	AGILENT 6890N	US10134037
	MSV Lab	October-01	October-01	new	Teledyne/Tekmar-XPT	US03240004
	MSV Lab	October-01	October-01	new	T/D Solatek 72	US05283001
GCMSV 9	MSV lab	April-07	April-07	new	AGILENT 5979B	US63234781
	MSV lab	April-07	April-07	new	AGILENT 6890N	CN10647134
	MSV lab	April-07	April-07	new	Teledyne/Tekmar-XPT	US06296004
	MSV lab	April-07	April-07	new	T/D Solatek 72	US07022004
GCMSV 11	MSV Lab	April-04	April-08	new	AGILENT 5973	US33220204
	MSV Lab	April-04	April-08	new	AGILENT 6890N	CN10407013
	MSV Lab	July-07	July-07	new	Teledyne/Tekmar-XPT	US03140007
	MSV Lab	July-07	July-07	new	T/D Solatek 72	US02098018
GCMSV 12	MSV Lab	June-10	June-10	new	AGILENT 5973	US10441235
	MSV Lab	June-10	June-10	new	AGILENT 7890A	CN10211053
	MSV Lab	June-10	June-10	new	Teledyne/Tekmar-XPT	US10160001
	MSV Lab	June-10	June-10	new	T/D Solatek 72	US05283001
FUME HOOD	MSV Lab	January-97	January-97	new	LABCONCO (#20) GCMSV	N/A
FUME HOOD	MSSV Lab	January-97	January-97	new	LABCONCO (#19)	N/A
COOLER	MSV lab	January-97	January-97	new	TRUE (#22)	1330620
COOLER	MSV lab	January-97	January-97	new	TRUE/GDM-45 (#30)	1-3681854
REFRIG/FREEZER	MSV lab	January-97	January-97	new	KENMORE/2538684012	0983108619
REFRIG/FREEZER	MSV lab	January-97	January-97	new	SEARS (V0A 2)	983108619
FREEZER#12	MSV lab	January-97	January-97	new	FRIGIDAIRE, MODEL #MFU17F3GW6 (#12) C	WB02927861
REFRIGERATOR (#41)	MSV lab	February-11	February-11	new	FRIDGIDAIRE (#41)	BU1210823890132
FREEZER (#45)	MSV lab	May-11	May-11	new	Holiday LCM050LC	BFGEW0E1J00BRABF3131
BALANCE	MSV lab	January-97	January-97	new	METTLER AE200	L65273
BALANCE	MSV lab	July-11	July-11	new	METTLER XS2002S	B048091720
GCSV 12	GCSV Lab	November-03	November-03	new	AGILENT TECH 6980N	US10338067
GCSV 14	GCSV Lab	January-04	January-04	new	AGILENT TECH 6980N	US10342128
GCSV 15	GCSV Lab	April-04	April-04	new	AGILENT TECH 6980N	CN10413018

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GCSV 16	GCSV Lab	August-05	August-05	new	AGILENT TECH 6980N	CN10525006
GCSV 17	GCSV Lab	September-05	September-05	new	AGILENT TECH 6980N	CN10529074
GCSV 18	GCSV Lab	September-05	September-05	new	AGILENT TECH 6980N	CN10528084
GCSV 19	GCSV Lab	September-05	September-05	new	AGILENT TECH 6980N	CN10534099
GCSV 20	GCSV Lab	October-05	October-05	new	AGILENT TECH 6980N	CN10534109
GCSV 21	GCSV Lab	December-05	December-05	new	AGILENT TECH 6980N	CN10538039
FUME HOOD	GCSV Lab	January-97	January-97	new	LABCONCO(#33)	301116
GCV 5	GCV Lab	February-08	February-08	new	AGILENT 6890 SERIES	US00026701
GCV 6	GCV Lab	November-05	November-05	new	AGILENT 6890N SERIES	CN10538061
GCV 7	GCV Lab	April-07	April-07	new	AGILENT 6890N SERIES	CN10545063
GCV 8	GCV Lab	April-08	April-08	new	AGILENT 6890N SERIES	CN10636089
GCV9	GCV Lab	March-05	June-10	new	AGILENT 6890N	CN10452003
PURGE/TRAP INSTRUMENT 5	GCV Lab	February-08	February-08	new	TELEDYNE TEKMAR / 14-8900-00T	US05257002
PURGE/TRAP INSTRUMENT 6	GCV Lab	November-05	November-05	new	TEKMAR	BETA 005
PURGE/TRAP INSTRUMENT 7	GCV Lab	April-07	April-07	new	TELEDYNE TEKMAR XPT / 14-8900O0T	US0527002
PURGE/TRAP INSTRUMENT 9	GCV Lab	March-05	June-10	new	TELEDYNE TEKMAR XPT	US0507010
AUTOSAMPLER INSTRUMENT 5	GCV Lab	February-08	February-08	new	TELEDYNE TEKMAR SOLATEK 72	US02277005
AUTOSAMPLER INSTRUMENT 6	GCV Lab	November-05	November-05	new	TELEDYNE TEKMAR AQUATek 70	US05355004
AUTOSAMPLER INSTRUMENT 7	GCV Lab	April-07	April-07	new	TELEDYNE TEKMAR AQUATek 70	US05347003
AUTOSAMPLER INSTRUMENT 9	GCV Lab	March-05	June-10	new	TELEDYNE TEKMAR SOLATEK 72	US0324004
Digital Vortex Meter	GCV Lab	November-08	November-08	new	N/A	080801081
BALANCE	GCSV Lab	August-11	August-11	new	SARTORIUS AY612	26655670
REFRIGERATOR (#43)	GCV Lab	March-11	March-11	new	Frigidaire (#43)	KA03300793
REFRIGERATOR	GCSV Lab	January-97	January-97	new	MASTERBILT (#18)	254034
FREEZER	GCSV Lab	January-97	January-97	new	Frigidaire (#34)	WB44328710
REFRIG/FREEZER	GCSV Lab	January-97	January-97	new	SEARS (#11)	BA01000875
REFRIG/FREEZER	GCSV Lab	January-97	January-97	new	KENMORE (#14)	BA04391055
REFRIG/FREEZER	GCSV Lab	January-97	January-97	new	KENMORE (#15)	BA04391057
REFRIG/FREEZER	GCSV Lab	January-97	January-97	new	KENMORE (#17)	BA03100524
FREEZER	GCSV Lab	January-97	January-97	new	Whirlpool (#37)	EWW3489616
FREEZER	GCSV Lab	January-97	January-97	new	Frigidaire (#26)	WB83724994
HPLC	**Location**	**Date Received**	**Date in Service**	**Condition**	**MAKE/MODEL**	**SERIAL NUMBER**
COLUMN HEATER	MSSV Lab	December-06	December-06	new	EPPENDORF TC-45	N/A
HPLC - 2	MSSV Lab	December-06	December-06	new	AGILENT 1200 SERIES - MWD	DE60555127
	MSSV Lab	December-06	December-06	new	AGILENT 1200 SERIES - FLD	DE60555722
	MSSV Lab	December-06	December-06	new	AGILENT 1200 SERIES - TCC	DE63060177
	MSSV Lab	December-06	December-06	new	AGILENT 1200 SERIES - QUANT PUMP	DE60556714
	MSSV Lab	December-06	December-06	new	AGILENT 1200 SERIES - ALS	DE60557762
	MSSV Lab	December-06	December-06	new	AGILENT 1200 SERIES - DEGASSER	JP62354304
METALS	**Location**	**Date Received**	**Date in Service**	**Condition**	**MAKE/MODEL**	**SERIAL NUMBER**
ICP/MS	Metals Lab	September-10		new	Agilent 7700/7500 Series	JP10280491
ICP/MS Autosampler	Metals Lab	September-10		new	Agilent ASX-500	US071080A520
ICP	Metals Lab	September-05	September-05	new	PERKIN-ELMER OPTIMA 4300DV	077N0050202
AUTOSAMPLER	Metals Lab	September-05	September-05	new	PERKIN-ELMER AS93 Plus	N/A

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ICP	Metals Lab	May-00	May-00	new	PERKIN-ELMER 5300DV	077N5090602
GFAA 2	Metals Lab	January-09	January-09	used	PERKIN-ELMER 800	8411
GFAA Autosampler	Metals Lab	January-09	January-09	used	PERKIN-ELMER AS800	1852
GFAA Chiller	Metals Lab	January-09	January-09	used	N/A	N/A
HG ANALYZER	Metals Lab	January-97	January-97	new	PERKIN ELMER/FIMS 400	4515
CHILLER	Metals Lab	January-97	January-97	new	Polyscience	G51284
FUME HOOD--FLOW SCIENCES	Metals Lab	January-97	January-97	new	FS3100BKFVA	11-j-07-04
FUME HOOD	Metals Lab	January-97	January-97	new	FS3100BKFVA	11-j-07-15
Digital Conductivity Meter	Metals Lab	May-11	May-11	new	Fisher Scientific/09-327	111438708
METALS PREP	**Location**	**Date Received**	**Date in Service**	**Condition**	**MAKE/MODEL**	**SERIAL NUMBER**
MICROWAVE	Metals Prep Lab	January-97	January-97	new	CEM MARS5	DS-6208
DIGESTION BLOCKS (4)	Metals Prep Lab	January-97	January-97	new	CPI MOD BLOCK	N/A
FUME HOOD -FLOW SCIENCES (2)	Metals Prep Lab	January-97	January-97	new	FS3100BKDVA / FS3100BKGVA	05-N-03-02 / 08-M-13-02
BALANCE	Metals Prep Lab	July-07	July-07	new	Mettler Toledo XS 104	1128260845
EXTRACTIONS	**Location**	**Date Received**	**Date in Service**	**Condition**	**MAKE/MODEL**	**SERIAL NUMBER**
FUME HOODS (18)	EXT Area	January-97	January-97	new	N/A	N/A
GLASS WASHER	EXT Area	January-97	January-97	new	AMSCO 400	36911195001
SHAKER (4)	EXT Area	January-97	January-97	new	GLAS-COL 099A	N/A
MILLIPORE(2)	EXT Area	January-97	January-97	new	N/A	N/A
VACUUM PUMP	EXT Area	May-08	May-08	new	Edwards	76434563
GPC (1)	EXT Area	January-97	January-97	new	ABC AP-100	9161SI/AS007-9114-9114
CENTRIFUGE	EXT Area	January-97	January-97	new	IEC HN-SII	N/A
OVEN	EXT Area	January-97	January-97	new	FISHER ISOTEMP 655G	11000184
TCLP/ZHE ROTATOR	EXT Area	January-97	January-97	new	ASSOCIATED DESIGN	NA 05101808
ZHE EXTRACTORS	EXT Area	January-97	January-97	new	ENVIRONMENTAL EXPRESS	NA 05081684
SONICATOR (6)	EXT Area	January-97	January-97	new	FISHER SCIENTIFIC	BBW052140/BBW05101848/BBW025101849/BBW05101850
INCUBATOR SHAKER	EXT Area	January-97	January-97	new	NEW BRUNSWICK SCIENTIFIC/CLASSIC SE	100524881
BALANCE	EXT Area	January-97	January-97	new	METTLER PM 3000	M33557
BALANCE	EXT Area	January-97	January-97	new	METTLER PG 3001 S	1117331005
BALANCE	EXT Area	January-97	January-97	new	AND FX-300	5015502
BALANCE	EXT Area	January-97	January-97	new	OHAUS SCOUT PRO SP2001	7124330243
BALANCE	EXT Area	January-97	January-97	new	OHAUS SCOUT PRO SP402	7124280031
BALANCE	EXT Area	January-97	January-97	new	OHAUS SCOUT PRO SPE4001	7123450167
BALANCE	EXT Area	January-97	January-97	new	OHAUS SCOUT PRO SP2001	7124371673
PH METER	EXT Area	January-97	January-97	new	ORION SA520	QT20A
PH METER	EXT Area	January-97	January-97	new	THERMO ORION 720A	074216
PH METER	EXT Area	January-97	January-97	new	ORION 720A+	085153
PH METER	EXT Area	January-97	January-97	new	ORION 720A+	089622
PH PROBE 01/ATC PROBE	EXT Area	January-97	January-97	new	ORION SURE-FLOW ROSS 8172BNWP	LYI-16730
PH PROBE 03/ATC PROBE	EXT Area	January-97	January-97	new	ORION SURE-FLOW ROSS 8172BNWP	MX3-10451
PH ELECTRODE (03)	EXT Area	January-97		new	ORION SURE FLOW	MP3-10011
COOLER	EXT Area	January-97	January-97	new	TRUE (#5)	1334961
REFRIG/FREEZER	EXT Area	January-97	January-97	new	WHITE WESTINGHOUSE (#8)	LA10903763
REFRIG/FREEZER	EXT Area	January-97	January-97	new	WHITE WESTINGHOUSE (#9)	BA04391056

REFRIG/FREEZER	EXT Area	January-97	January-97	new	Frigadaire (R#34)	BA61019273
FREEZER	EXT Area	January-97	January-97	new	WHITE WESTINGHOUSE (#23)	WB40802629
ULTRASONIC CLEANER	EXT Area	January-97	January-97	new	FISHER SCIENTIFIC/FS30	RTB040265340
MUFFLE FURNACE	EXT Area	January-97	January-97	new	FISHER SCIENTIFIC/ISOTEMP 550 SERIES M	410N0074
STANDARD TEST SIEVE	EXT Area	January-97	January-97	new	WS TYLER/MODEL #RX-812	24372
PYROMETER	EXT Area	January-09	January-09	new	PM20700	SN 8502832
SAMPLE CONCENTRATOR	EXT Area	January-05	January-05	new	OA-SYS	SN 20018
SAMPLE CONCENTRATOR	EXT Area	January-05	January-05	new	OA-SYS	SN 20019
WET CHEMISTRY	**Location**	**Date Received**	**Date in Service**	**Condition**	**MAKE/MODEL**	**SERIAL NUMBER**
TOX	Wet Chemistry	January-97	January-97	new	MITSUBISHI TOX-10E	N/A
TOC (1)	Wet Chemistry	June-08	June-08	new	Shimadzu TOC-V CSH	H51104535288CS
	Wet Chemistry	January-97	January-97	new	Shimadzu Solid Module	H52504500370
	Wet Chemistry	January-97	January-97	new	Shimadzu Autosampler	H52104502483
AUTOANALYZER	Wet Chemistry	June-08	June-08	new	LACHET QUICK CHEM AE	200-474
IC	Wet Chemistry	October-00	October-00	new	DIONEX LC20/ED40/AD20/AS40	900915
COD REACTOR #4	Wet Chemistry	January-97	January-97	new	HACH COD REACTOR	910404575/920800007697
COD REACTOR #5	Wet Chemistry	January-11	January-11	new	Lovibond CSB/Reactor ET125	0310/4260
TURBIDIMETER	Wet Chemistry	January-97	January-97	new	HACH 2100P	960700011424
SPECTROPHOTOMETER	Wet Chemistry	January-97	January-97	new	HACH #3 DR 2800	1209697
SPECTROPHOTOMETER	Wet Chemistry	January-97	January-97	new	HACH #4 DR 2800	11996-79
TITRATOR	Wet Chemistry	January-97	January-97	new	METTLER TOLEDO DL53	S119484414
VISCOMETER	Wet Chemistry	January-97	January-97	new	BROOKFIELD DVII	32587
WATER BATH	Wet Chemistry	January-97	January-97	new	BROOKFIELD TC-200	GCAL# 0311
CLOSED CUP FLASH PT	Wet Chemistry	January-97	January-97	new	PRECISION SCIENTIFIC	10BR-12
FLASHPOINT (FP3)	Wet Chemistry	December-08	December-08	new	Herzog HFP 339	083390442
AMMONIA PROBE	Wet Chemistry	January-97	January-97	new	ORION 95-12	N/A
OXYGEN BOMB CAL	Wet Chemistry	January-97	January-97	new	PARR	6616
CONDUCTIVITY METER 2	Wet Chemistry	January-11	14/11	new	OAKTON pH/CON 510 SERIES	528330
COLIFORM BATH 1	Wet Chemistry	January-92	January-92	new	PRECISION SCIENTIFIC INCUBATOR	10AZ-1
COLIFORM BATH 2	Wet Chemistry	May-08	May-08	new	THERMOSCIENTIFIC INCUBATOR	204785
COLIFORM BATH 3	Wet Chemistry	May-09	May-09	new	THERMOSCIENTIFIC INCUBATOR	207063
PH METER	Wet Chemistry	January-97	January-97	new	ORION 720A+	092891
PH PROBE 04/ATC PROBE	Wet Chemistry	January-97	January-97	new	ORION SURE-FLOW ROSS 8102BNUWP	LUI-18038
PH METER	Wet Chemistry	January-97	January-97	new	ORION 420A	7881
PH PROBE	Wet Chemistry	January-97	January-97	new	*ORION TRIODE*	*N/A*
PH PROBE/ATC PROBE	Wet Chemistry	January-97	January-97	new	*ORION COMB 915600/917006*	*N/A*
PH METER (PH-05)	Wet Chemistry	October-08	October-08	new	ORION 2STAR	B11765
PH PROBE	Wet Chemistry	January-97	January-97	new	ORION 9107APMD	RMR21
PH Meter (PH-07)	Wet Chemistry	September-10	September-10	new	Thermo Scientific/Dual Star	E03025
AUTOCLAVE	Wet Chemistry	September-10	September-10	new	Tuttnauer	10003285
DO METER	Wet Chemistry	January-97	January-97	new	YSI MODEL 59/5905 PROBE	93A01946
DO METER	Wet Chemistry	March-10	March-10	new	YSI MODEL 5100	10A 101264
OVENS (2)	Wet Chemistry	January-97	January-97	new	BLUE M SW17TA-1	SW-5478/SW-5408
OVEN	Wet Chemistry	January-97	January-97	new	FISHER SCIENTIFIC 3510-ISF	1879070606147

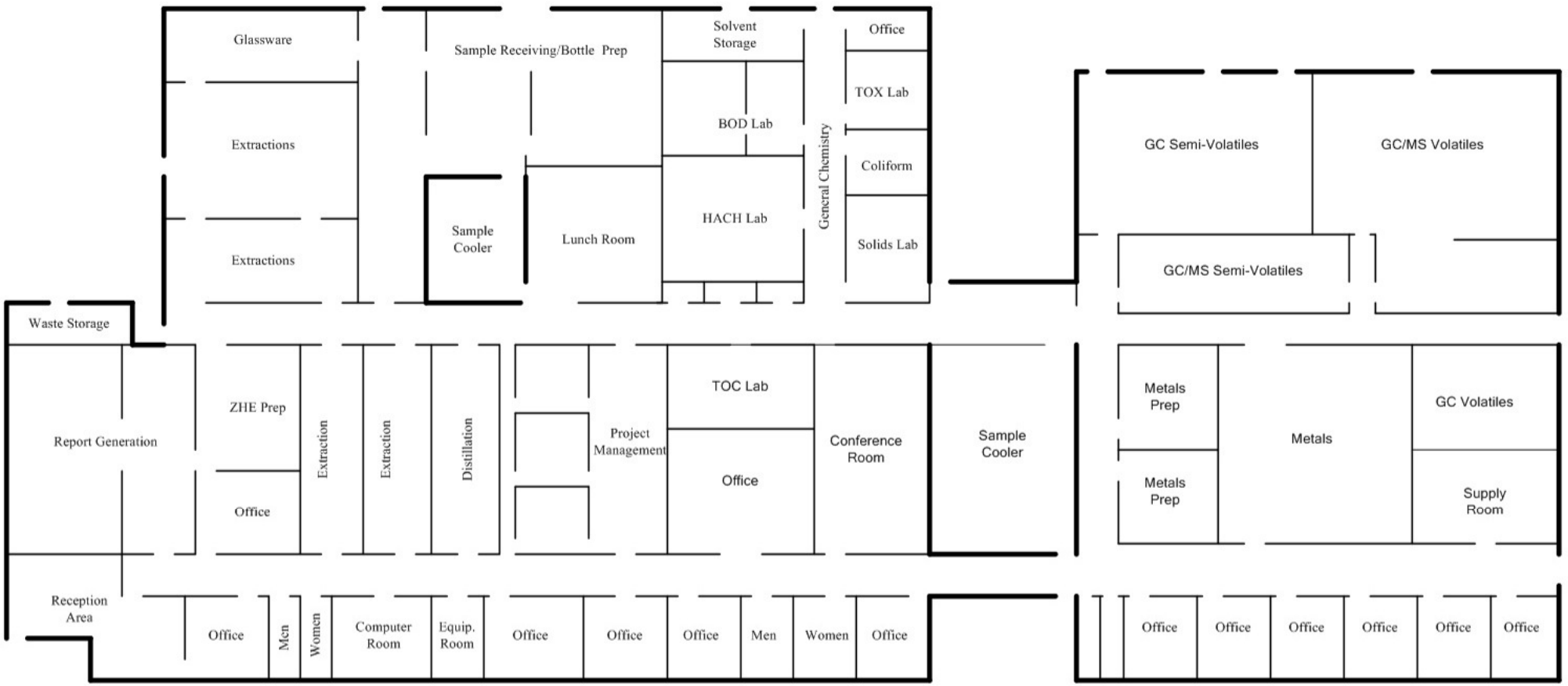
GCAL Equipment List

OVEN	Wet Chemistry	January-97	January-97	new	GRIEVE PL-326	444341
OVEN	Wet Chemistry	January-97	January-97	new	FISHER SCIENTIFIC ISOTEMP/MODEL 516G	506NO196
OVEN	Wet Chemistry	January-97	January-97	new	FISHER SCIENTIFIC ISOTEMP/MODEL 650G	508N0138
OVEN	Wet Chemistry	January-97	January-97	new	FISHER SCIENTIFIC ISOTEMP/MODEL 650G	508N0137
FURNACE	EXT area	January-97	January-97	new	THERMOLYNE 1500	N/A
DESSICATORS (7)	Wet Chemistry	January-97	January-97	new	DRY KEEPER	N/A
INCUBATOR	Wet Chemistry	January-97	January-97	new	FISHER SCIENTIFIC(#3)	WB93928030
BALANCE	Wet Chemistry	January-97	January-97	new	METTLER AE160	C05693
BALANCE	Wet Chemistry	January-97	January-97	new	METTLER AX504	1122043050
BALANCE	Wet Chemistry	January-97	January-97	new	SARTORIUS / PT6-000V2	60802675
BALANCE	Wet Chemistry	January-97	January-97	new	FISHER SCIENTIFIC / ACCU-224	F224075004
FUME HOODS (5)	Wet Chemistry	January-97	January-97	new	N/A	N/A
INCUBATOR (BOD#6)	Wet Chemistry	January-97	January-97	new	REVCO	T28C-142152-TC
INCUBATOR (BOD#2)	Wet Chemistry	January-97	January-97	new	PRECISION SCIENTIFIC	10AZ-12
INCUBATOR (BOD#7)	Wet Chemistry	January-97	January-97	new	FISHER SCIENTIFIC	407N0211
INCUBATOR (BOD#5)	Wet Chemistry	January-97	January-97	new	FISHER SCIENTIFIC	WB93928030
INCUBATOR (BOD#8)	Wet Chemistry	January-97	January-97	new	FISHER SCIENTIFIC	WB53337398
INCUBATOR (BOD#9)	Wet Chemistry	January-97	January-97	new	FISHER SCIENTIFIC	2018080398339
INCUBATOR (BOD#10)	Wet Chemistry	January-97	January-97	new	FISHER SCIENTIFIC	2018080607337
REFRIG/FREEZER	Wet Chemistry	January-97	January-97	new	SEARS (#19)	LA91905856
REFRIG/FREEZER	Wet Chemistry	January-97	January-97	new	WHITE WESTINGHOUSE (#1)	WB10507478
VACUUM PUMP	EXT Area	May-08	May-08	new	Edwards	7643558
GRINDING MILL	Wet Chemistry	January-97	January-97	new	THE STRAUB CO./MODEL 4E	N/A
LOG-IN	**Location**	**Date Received**	**Date in Service**	**Condition**	**MAKE/MODEL**	**SERIAL NUMBER**
FUME HOOD (1)	LOGIN Area	January-97	January-97	new	FUME HOOD #9	N/A
COOLER	LOGIN Area	January-97	January-97	new	TRUE (#2)	708391
COOLER	LOGIN Area	January-97	January-97	new	TRUE (#3)/GDM-72	1-3792963
WALK-IN COOLER (2)	LOGIN Area	January-97	January-97	new	N/A	N/A
REFRIG/FREEZER	LOGIN Area	January-97	January-97	new	KENMORE (#4)	BA01902878
IR THERMOMETER	LOGIN Area	May-08	May-08	new	FISHER SCIENTIFIC	72704761
REFRIG/FREEZER	LOGIN Area	January-97	January-97	new	FRIDGIDAIRE (#33)	BA454622395
FREEZER	LOGIN Area	January-97	January-97	new	FRIGIDAIRE(#27) MFU17F3GW6	WB03102969
SCANNER	LOGIN Area	January-97	January-97	new	HEWLETT PACKARD SCANJET 5470C/C9850	CN1B41HOTZ
FREEZER	LOGIN Area	May-11	May-11	new	FRIGIDAIRE (#44) LFFH21F7HWG	WB11142000
FREEZER	LOGIN Area	January-97	January-97	new	FRIGIDAIRE (#29) FFC15C4CWO	WB40427812

Appendix D

GCAL

GULF COAST ANALYTICAL LABORATORIES, INC



Approximate Square Footage: 20,244 Sq. Ft.

Scale: 1 in. = 25 ft.

Sample Receiving/Bottle Prep:	1320
Extractions/Prep:	2913
General Chemistry:	2025
Metals:	840
Metals Prep:	450
Supply Room:	345
Offices/Storage:	8200

GCMS Volatiles:	1406
GCMS Semi-Volatiles:	394
GC Volatiles:	405
GC Semi-Volatiles:	906
Report Generation:	713
Sample Coolers:	327

Drawing: flrpln.vsd
Revised: 6//2011

Appendix E

GULF COAST ANALYTICAL LABORATORIES
CERTIFICATIONS

Scopes of Accreditation are maintained by the QA/QC department and are available for review upon request.

< State of Illinois Environmental Protection Agency, NELAP Accreditation #200048, Certification No. 001202 (Expiration: February 2012)

< State of California Environmental Laboratory Accreditation Program, (Expiration: May 2013)

< State of New Jersey, Department of Environmental Protection (Expiration: June 2012)

< State of Florida, Department of Health, Bureau of Laboratories, NELAP, Lab ID: E87854 (Expiration: June 2012)

< South Carolina Department of Health and Environmental Control, Environmental Laboratory Certification Program, Certificate Number: 73006001 (Expiration: June 2012)

< Louisiana Department of Environmental Quality, Environmental Laboratory Accreditation Program, NELAP, Certificate Number 01955 (Expiration: June 2012)

< Oklahoma Department of Environmental Quality, Laboratory Certification Program, ID # 9403 (Expiration: August 2012)

< Texas Commission on Environmental Quality, Certificate Number: T104704178-05-TX (Expiration: August 2011, pending)

< State of Arkansas, Department of Pollution Control and Ecology, Laboratory Certification Program (Expiration: August 2011, pending)

< State of Kansas, Department of Health and Environment, NELAP, Certificate No. E-10354 (Expiration: October 2011)

< Arizona Department of Health Services, License AZ0718 (Expiration November 2011)

< State of North Carolina, Division of Water Quality Laboratory Certification Program, Certificate 618 (December 2011)

< DoD ELAP, Certificate ADE-1482 (Expires September 2012)

< State of Georgia Environmental Protection Division accreditation based on LA NELAP

Appendix F

GULF COAST ANALYTICAL LABORATORIES, INC
STANDARD OPERATING PROCEDURES

SOP	METHOD	REVISION #	DATE	LAST REVIEW
Extractions				
EXT-001	BNA Solid/Low/3550C	17	02/25/2011	
EXT-002	Pest/PCB Low/3550C	16	12/23/2009	2/25/2011
EXT-003	BNA Prep SEP Funnel/3510C	20	02/25/2011	
EXT-004	BNA Prep Continuous/3520C	9	03/01/2011	
EXT-010	Pest/PCB Prep SEP Fun/3510C	14	04/07/2010	
EXT-011	Pest/PCB Prep Cont/3520C	9	03/01/2011	
EXT-017	Herbicide Preparation	21	03/11/2011	
EXT-019	ZHE Cleanup	7	03/01/2011	
EXT-026	TCLP/1311	9	03/01/2011	
EXT-027	TPHD Solid/Low Level Ext	13	09/13/2010	
EXT-029	TPHD Prep SEP Funnel	11	09/13/2010	
EXT-031	Herbicide Prep Soils	16	08/16/2010	
EXT-032	pH-Solids & Wastes	10	04/05/2011	
EXT-033	pH-Waters	8	12/18/2009	3/1/2011
EXT-034	Orgphos Pest Soil Prep/8141A	11	12/22/2010	
EXT-035	Orgphos Pest/SEP Fun/8141A	10	12/22/2010	
EXT-036	TCLP-Volatiles/1311	7	01/06/2010	2/25/2011
EXT-037	Pest-Organic Prep	9	03/01/2011	
EXT-038	BNA-Organic Prep	8	03/01/2011	
EXT-050	BNA Sep OLM04.2	6	01/05/2010	
EXT-051	Pest/PCB OLM04.2	5	01/05/2010	
EXT-052	Oil & Grease-1664	15	04/01/2011	
EXT-056	PAH/Soil/3550C	7	12/23/2009	03/04/2011
EXT-057	PAH/Water/3510C	8	03/07/2011	
EXT-058	Sulfuric Acid/Permanganate Clean-up	4	01/05/2010	03/04/2011
EXT-059	Florisil Clean-up	4	01/05/2010	
EXT-064	Oil & Grease/Soxhlet-29B	8	04/29/2011	
EXT-065	Explosives Prep/Soil Samples	8	01/04/2010	3/2/2011
EXT-066	Explosives Prep/Water Samples	7	04/22/2010	
EXT-068	Formaldehyde Derivatization/Soil	5	03/07/2011	
EXT-069	Formaldehyde Derivatization/Water	6	03/07/2011	
EXT-070	SPLP/1312 Water & Solids	3	02/01/2010	03/04/2011
EXT-071	SPLP-Volatiles/1312 Water & Solids	1	10/09/2003	03/04/2011
EXT-073	Extraction of Tissue Samples	4	03/14/2011	
EXT-074	% Lipids in Tissue	4	08/25/2010	
EXT-076	625 SIM/Water	4	12/21/2009	
EXT-077	Method 619 Extraction	4	08/16/2010	
EXT-078	Formaldehyde Extraction	1	12/22/2009	
EXT-079	Homogenizing Tissue	0	06/27/2011	
GC				
GC-002	Volatiles/602	9	04/11/2011	

GULF COAST ANALYTICAL LABORATORIES, INC
STANDARD OPERATING PROCEDURES

SOP	METHOD	REVISION #	DATE	LAST REVIEW
GC-004	DRO/ORO	17	09/29/2011	
GC-006	Gasoline Range Organics	16	09/13/2010	
GC-007	TPH by Texas 1005/1006	9	01/18/2011	
GC-008	Organophosphorous Pest/8141A	7	05/24/2010	
GC-011	Chlorinated Herbicides/8151A	10	09/29/2011	
GC-012	Pesticides/PCB 608	8	02/21/2011	
GC-013	Pesticides/8081B	14	09/29/2011	
GC-022	BTEX/8021A	8	04/28/2011	
GC-023	PCB/8082A	12	02/06/2011	
GC-024	Dissolved Gas/RSK-175	7	09/06/2011	
GC-025	EPH-Extractable Pet. Hydrocarbons	6	02/15/2011	
GC-028	Methanol/NCASI Method	3	02/22/2011	
GC-029	Methanol/Method 8015D	6	07/27/2010	
GC-031	Florida PRO	7	02/16/2011	
GC-032	Volatile Petroleum Hydrocarbons	3	02/07/2011	
GC-033	Triazine Pesticides – Method 619	3	02/22/2011	
GC-034	Method 8011	7	09/29/2011	
GCMSSV				
GCMSSV-001	Semivolatiles/8270C	19	04/11/2011	
GCMSSV-002	Semivolatiles/625	11	11/10/2010	
GCMSSV-003	Semivolatiles/625 SIM	4	09/29/2011	
GCMSSV-004	Semivolatiles/8270D	5	01/26/2011	
GCMSSV-005	Parent/Alkyl PAH	1	09/29/2011	
GCMSV				
GCMSV-002	Volatiles/624	11	03/31/2011	
GCMSV-003	Volatiles/8260B	23	09/14/2011	
GCMSV-004	Oxygenates/8260B	1	03/07/2011	
General Laboratory				
GEN-001	Laboratory Glassware Prep.	5	10/02/2006	1/28/2010
GEN-002	Balance Calibration	8	05/05/2010	03/16/2011
GEN-003	Temperature Monitoring	11	03/23/2011	
GEN-005	Mechanical Pipette Calibration	5	09/29/2006	03/16/2011
GEN-006	Standard Preparation	7	06/17/2010	
GEN-007	GCAL Training	7	04/11/2011	
GEN-008	Documentation of Data (Logbooks)	6	06/26/2002	03/16/2011
GEN-009	Waste Handling	8	03/23/2011	
GEN-010	General Lab Monitoring	8	04/11/2011	
GEN-012	Preventive Maintenance	4	02/02/2010	
GEN-013	Spill Clean Up	1	07/23/1998	1/28/2010
GEN-015	Laboratory Contingencies	1	08/31/2000	1/27/2010
GEN-018	Non-conformances/Corrective Actions	5	05/14/2010	03/15/2011

GULF COAST ANALYTICAL LABORATORIES, INC
STANDARD OPERATING PROCEDURES

SOP	METHOD	REVISION #	DATE	LAST REVIEW
GEN-019	Project Specific Requirements	2	03/10/2010	
GEN-020	Standard Tracking	1	05/06/2010	03/16/2011
GEN-021	Calibration Modules for Target	0	05/26/2009	03/15/2011
GEN-022	Linear Least Square Regression	0	05/26/2009	03/15/2011
HPLC				
HPLC-001	PAH'S/8310	12	9/29/2011	
HPLC-003	Explosives/8330A	8	03/24/2011	
HPLC-004	Formaldehyde by HPLC (8315A)	6	09/06/2011	
Lab Administration/General				
LAD-001	Master Signature List	3	07/14/1998	03/15/2011
LAD-002	Visitor Procedure	4	02/26/2003	03/15/2011
LAD-003	Report Generation	9	09/06/2011	
LAD-005	Vehicle Inspection	3	07/14/1998	03/11/2011
LAD-008	Postage Machine	7	11/10/2009	03/14/2011
LAD-009	Mail	7	11/10/2009	03/14/2011
LAD-011	Answering the Telephone	7	11/09/2009	03/14/2011
LAD-012	Sending a Fax	6	09/15/2006	03/14/2011
LAD-013	Receptionist/Arriving and Departing	9	11/10/2009	
LAD-014	Project Management	9	06/08/2010	
LAD-018	Confidentially	4	03/15/2007	11/13/2009
LAD-019	Data Assembly	1	03/11/2011	
LADNR				
LADNR-001	29B Sample Preparation	1	04/29/2011	
LADNR-002	29B Saturated paste	1	04/29/2011	
LADNR-003	29B Soluble Cations and SAR	0	04/04/2011	
LADNR-004	29B Cation Exchange Capacity	1	04/29/2011	
LADNR-005	29B Electrical Conductivity	0	04/04/2011	
LADNR-006	29B ESP	0	04/04/2011	
LADNR-007	29B Leachable Chlorides Test	0	04/04/2011	
LADNR-008	29B True Total Barium	0	04/04/2011	
LADNR-009	29B Leachable TPH Test	0	04/04/2011	
Metals				
MET-001	Glassware Prep-Metals	8	11/09/2009	2/21/2011
MET-002	Digestion for GFAAS	10	10/19/2009	2/28/2011
MET-003	Digestion for As & Se-GFAAS	6	10/19/2009	2/28/2011
MET-004	Digestion Solids/3050B	14	03/28/2011	
MET-005	Digestion for ICP-water	14	03/28/2011	
MET-006	Digestion for Mercury	19	05/19/2010	

GULF COAST ANALYTICAL LABORATORIES, INC
STANDARD OPERATING PROCEDURES

SOP	METHOD	REVISION #	DATE	LAST REVIEW
MET-008	Mercury Analysis	17	09/21/2010	
MET-010	ICP Analysis	18	05/19/2010	
MET-013	Hardness/Calc. Method	5	11/02/2009	2/21/2011
MET-015	GFAAS Analysis	6	05/19/2010	
MET-018	Microwave Digestion/Organics	5	02/22/2011	
MET-019	Total Recoverable Metals	2	11/09/2009	2/28/2011
MET-020	ICP Water Preparation/200.7 & 200.8	3	03/28/2011	
MET-021	ICP MS Analysis	2	07/15/2011	
Quality Assurance				
QA-001	Document Control	9	08/10/2010	03/16/2011
QA-002	Data Reduction Validation	7	07/08/2010	
QA-003	Report Validation	5	7/19/2010	
QA-004	Laboratory Audits	4	04/19/2011	
QA-007	Data Archive	5	06/14/2010	03/16/2011
QA-008	Generation of SOP's	5	04/11/2011	
QA-009	Determination of MDL's	9	01/30/2007	1/26/2010
QA-010	Proper Handling of Raw Data	4	11/02/2006	1/26/2010
QA-011	Data Integrity and Ethical Practices	3	08/28/2004	03/16/2011
QA-012	Control Charts	4	05/03/2011	
QA-013	Estimation of Uncertainty	2	06/14/2010	
QA-014	Demonstration of Capability	2	06/10/2010	03/16/2011
QA-015	Performance Evaluation Studies	1	06/17/2010	
Sample Administration				
SAD-001	Sample Log-In	15	08/02/2010	
SAD-002	Sample Custodian	10	03/14/2011	
SAD-003	Sample Kit Preparation	9	03/14/2011	
SAD-004	LIMS Log-In Procedure	9	03/14/2011	
SAD-006	Sample Couriers	0	11/17/2010	
Wet Lab (General Chemistry)				
WL-002	Total Solids	10	04/12/2011	
WL-003	Total Dissolved Solids	10	03/14/2011	
WL-004	Total Suspended Solids	12	03/14/2011	
WL-005	Vol. Suspended Solids	8	03/14/2011	
WL-006	Sulfate/Turbidimetric	10	09/28/2011	
WL-007	Sulfite	7	03/10/2011	
WL-008	Color	8	09/28/2011	
WL-009	Paint Filter Test	10	03/10/2011	
WL-012	Hexavalent Chromium	10	04/05/2011	
WL-014	Phenols	10	09/28/2011	
WL-015	Cyanide	9	05/18/2010	
Wl-015a	Cyanide –South Carolina	1	11/19/2009	

GULF COAST ANALYTICAL LABORATORIES, INC
STANDARD OPERATING PROCEDURES

SOP	METHOD	REVISION #	DATE	LAST REVIEW
WL-016	Chlorine	8	09/28/2011	
WL-017	Fluoride	8	09/28/2011	
WL-018	BOD	20	05/19/2010	
WL-019	Specific Gravity	9	03/14/2011	
WL-020	Flashpoint (Has this been archived?)		08/25/2008	
WL-021	COD/HACH	11	10/1/2011	
WL-022	Ash/D482-80	11	04/14/2011	
WL-025	Surfactant	7	05/18/2010	
WL-026	Fecal Coliform	13	03/14/2011	
WL-028	Silica	8	03/10/2011	
WL-029	Specific Conductance	7	02/17/2010	03/09/2011
WL-032	Turbidity	9	11/04/2010	
WL-033	Sulfide/MB	10	09/28/2011	
WL-034	Total Phosphorus	9	04/11/2011	
WL-035	Total Settable Solids	6	04/19/2011	
WL-037	TOX	5	04/11/2011	
WL-038	Chlorides	9	09/28/2011	
WL-041	Nitrate/Nitrite/N+N	10	09/28/2011	
WL-042	Anions by Ion Chromatography	16	09/28/2011	
WL-043	TOC Waters	11	09/02/2011	
WL-044	Heat of Combustion	8	03/10/2011	
WL-045	TKN/Titration	8	09/13/2010	
WL-046	NH3 by ISE	11	02/22/2011	
WL-047	Ferrous Iron	6	09/28/2011	
WL-048	Orthophosphate	10	09/28/2011	
WL-051	Sulfide Titration	8	03/10/2011	
WL-052	Viscosity	4	03/10/2011	
WL-054	Reactive Cyanide & Sulfide	9	05/18/2010	
WL-056	Corrosivity Towards Steel	7	03/14/2011	
WL-057	TOC Solid	3	10/11/2010	
WL-060	Flashpoint-Automated	6	03/10/2011	
WL-061	Water by Karl Fisher	3	03/10/2011	
WL-062	Automated Ammonia Titration	6	09/13/2010	
WL-063	Automated Alkalinity	7	03/14/2011	
WL-064	Automated Low Alkalinities	6	03/14/2011	
WL-066	Ignitability of Solids	4	03/10/2011	
WL-068	Perchlorate	2	01/11/2010	03/09/2011
WL-069	Total Acidity	3	03/14/2011	
WL-070	Volatile Fatty Acids	2	03/10/2011	
WL-073	Desiccator Monitoring	1	11/09/2009	03/09/2011

APPENDIX G

QAPP for Tissue Homogenization, Preparation and Analysis

Introduction

GCAL has performed tissue analysis for over a decade in support of remedial investigation and risk assessment studies. The analytical analysis of tissues is performed over a wide range of tests, including trace metals and mercury, PAHs, PCBs, and lipid determination. GCAL is accredited through the Louisiana DEQ for tissue analysis with an extensive scope of accreditation in this area.

Each type of tissue sample represents a unique challenge due to the sample matrix. GCAL has developed methods to deal with tissue homogenization, sample prep, clean-up, and analysis of tissue samples. All lab procedures are documented in laboratory SOPs. The analytical techniques follow SW-846 methodologies; including instrument calibration, QC requirements, and detection limit studies. All analysts performing sample prep and analysis must complete a demonstration of capability.

Sample Receipt and Chain of Custody

Samples are received at the laboratory, generally on ice, and following all sample receipt requirements outlined in SOP SAD-001. All samples are logged into the LIMS system, and given unique sample identification. Samples will then be transferred to the laboratory for homogenization or stored in a temperature controlled and monitored freezer. GCAL uses a bar code system for sample chain of custody and tracking, which is stored in the LIMS from receipt through disposal. Unused samples are stored frozen for a period of 60 days following receipt unless other arrangements are agreed upon. Please note that GCAL does not accept samples that require radiation treatment to destroy potential biological hazards such as rabies.

Tissue Homogenization

All tissue samples are subjected to homogenization and/or dissection techniques prior to analysis, which are designed to ensure a representative sub-sample is obtained for each analytical parameter. Refer to SOP EXT-079 for detailed procedures for tissue homogenization. The procedures used may vary significantly depending on the tissue type, the technical specifications of the project, and the requested analysis. Special blades are employed when metals analysis is requested to avoid contamination of samples. Following homogenization, a representative sub-sample is placed in a labeled pre-cleaned jar(s) and transferred to the appropriate departments for sample prep and analysis. Any unused portions are labeled and frozen.

Tissue Prep for Semi-volatile Organic Analysis

Sample prep is dependant on the project requirements including detection limits. The sample weight and final extract volume is carefully selected in order to achieve requested reporting limits and limit sample matrix interferences. Homogenized tissues are thawed, and then further homogenized by grinding in a mortar and pestle and mixing with C18. Samples are then extracted with solvent. Clean-up procedures selected depend on the requested analysis and sample matrix. These may include silica gel clean-up for PAHs and acid clean-up for PCBs. All samples are prepped with quality control samples, including method blanks, blank spikes (LCS), and matrix spikes (if sample volume is sufficient). All samples are spiked with surrogate standards as required by the method. Refer to SOP EXT-073 for detailed procedures for tissue prep.

Lipids Determination

Lipids are analyzed gravimetrically. A homogenized sample is weighed and extracted in methylene chloride using sonication. The extract is allowed to air dry and the residue is weighed. Results are reported as percent lipids. Refer to SOP EXT-074 for complete details on Lipid Determination in tissue.

Tissue Prep for Trace Metal and Mercury Analysis

Tissue prep of trace metals is typically performed in a closed Teflon vessel under high temperature and pressure. For mercury, the laboratory follows similar procedures as for other solids, except the initial sample weight is larger (typically 6 grams). This allows a more representative sub-sample for tissues. The digestion procedure is carried out using similar ratios of digesting/oxidizing reagents as suggested in SW-846 procedures to account for the larger sample volume.

Sample Analysis

There are typically no modifications needed for the analysis of tissue extracts/digestates. Procedures are outlined in laboratory SOPs.

APPENDIX H

GLOSSARY

ACCEPTANCE LIMITS – data quality limits specified by the test method or generated by the laboratory. Specified limits placed on an item, process, or service defined in the requirement document.

ACCURACY – a measure of how close a measured value is to a known true value. Accuracy is assessed by means of reference samples and percent recoveries of spiked samples. The degree of agreement between an observed value and an accepted reference value. Accuracy includes combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator.

ALIQUOT – a discrete, measure, or representative portion of a sample taken for analysis.

ANALYTE – the chemical element or compound an analyst seeks to determine; the chemical element of interest.

ANALYTICAL BATCH – the basic unit for analytical quality control, defined as samples that are analyzed together with the same method sequence and the same lots of reagents and with the manipulations common to each sample within the same time period or in continuous sequential time periods. Samples in each batch should be of similar composition (e.g., groundwater, sludge, ash).

ANALYTICAL SAMPLE – any solution or media introduced into an instrument on which an analysis is performed, excluding instrument calibration, initial calibration verification, initial calibration blank, continuing calibration verification, and continuing calibration blank. The following are all analytical samples: undiluted and diluted samples (EPA and non-EPA), predigestion spike samples, duplicate samples, serial dilution samples, analytical spike samples, post digestion spike samples, interference check samples (ICS), CRDL standard for AA(CRA), CRDL standard for ICP(CRI), laboratory control sample(LCS), preparation blank(PB), and linear range analysis sample(LRS).

ANALYST – the designated individual who performs the "hands on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.

AREA UNITS – a term used in gas chromatography that indicates the peak area of a compound exiting a chromatographic column. The size or area of the peak is proportional to the amount of analyte in the sample.

ATOMIC ABSORPTION (AA) – a technique for analyzing metal using an element-specific lamp that emits a characteristic light spectrum. A sample is heated in a flame or graphite furnace and the light beam is passed through it. When the sample absorbs light, an energy loss is detected and is translated into a concentration of metal in the sample. This technique detects one metal at a time.

AUDIT – a systematic check to determine the quality of some function or activity. Two basic types are performance audits and system audits. Perform audits involve a quantitative comparison of the laboratory's results to those of a proficiency sample containing known concentration of analytes. A

system audit is a qualitative evaluation that normally consists of an onsite review of a lab's quality assurance system and physical facilities.

BACKGROUND CORRECTION – a technique usually employed relative to metals analysis, which compensates for variable background contribution to the instrument signal in the determination of trace elements.

BATCH – environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A batch is composed of a maximum of twenty environmental samples. A preparation batch is composed of environmental sample of the same matrix, meeting the above-mentioned criteria and with a maximum time between the start of processing the first and last sample in the batch to be 24 hours. An analytical batch is composed of prepared environmental samples (extracts, digestates or concentrates) and/or those samples not requiring preparation, which are analyzed together as a group using the same calibration curve or factor. An analytical batch can include samples originating from various environmental matrices.

BIAS – the deviation of the mean of replicate analytical measurements from a reference analyte concentration. Relative bias is represented by analytical measurement mean minus the reference analyte concentration and the difference divided by the reference analyte concentration. See accuracy and precision.

4-BROMO-FLUOROBENZENE (BFB) – the compound used to check the tuning of the instrument, and is used as a surrogate compound spiked into every sample for volatile analysis. A compound utilized in EPA gas chromatography/mass spectrometry (GC/MS) volatile methods to establish mass spectral instrument performance.

BIOCHEMICAL OXYGEN DEMAND (BOD) – A measure of the amount of oxygen consumed in the biochemical processes that break down organic matter in water. A larger BOD value indicates a greater degree of organic pollution. A related term, BOD5, is the amount of dissolved oxygen consumed in five days.

BIOSEED – the bacterial culture used to inoculate a sample for testing.

BLANK – an artificial sample designed to monitor the introduction of artifacts into the measurement process. For aqueous samples, reagent water is used as a blank matrix. There are several types of blanks, which monitor a variety of processes:1.) *laboratory blank* is taken through sample preparation and analysis only. It is a test for contamination in sample preparation and analyses. 2.) *storage blank* is stored and analyzed with samples at the laboratory. It is a test for contamination in sample storage as well as sample preparation and analysis. 3.) *trip blank* is shipped to and from the field with the sample containers. It is not opened in the field and, therefore, provides a test for contamination from sample preservation, site conditions, and transport as well as sample storage, preparation, and analysis. It is most commonly used for volatile organics. 4.) *field blank* is opened in the field and tests for contamination from the atmosphere as well as those activities listed under the trip blank.

BNA – base, neutral and acid extractable compounds. The term base, neutral and acid refer to the pH condition of the sample undergoing extraction. Certain compounds extract more efficiently from water under acidic conditions. Such compounds are often referred to as "acid extractables."

CALIBRATE – to determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter or other device, or the correct value for each setting of a control knob. The levels of the applied calibration standard should bracket the range of planned or expect sample measurements.

CALIBRATION – The systematic determination of the relationship of the response of the measurement system to the concentration of the analyte of interest. Instrument calibration performed before any samples are analyzed is called the initial calibration. Subsequent checks on the instrument calibration performed throughout analysis are called continuing calibration verification.

CALIBRATION BLANK (CB) – a volume of reagent water in the same matrix as the calibration standards but without the analyte.

CALIBRATION CURVE – the graphical relationship between the known values, such as concentrations, of a series of calibration standards and their analytical response.

CALIBRATION METHOD – a defined technical procedure for performing a calibration.

CALIBRATION STANDARD – a certified material used to calibrate an instrument.

CERTIFIED REFERENCE MATERIAL (CRM) – reference material, one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body. (ISO Guide 30)

CONTINUING CALIBRATION VERIFICATION (CCV) – used to evaluate the performance of the instrument system with respect to a defined set of method criteria. The CCVs are used to verify instrument performance during analysis. The CCV shall be prepared from the same stock standard solution used to prepare the calibration curve.

CHAIN-OF-CUSTODY–Procedures and associated documents designed to trace the custody of a sample from the point of origin to final disposition, with the intent of legally demonstrating that custody remained intact and the tampering or substitutions were precluded.

CHEMICAL OXYGEN DEMAND (COD) – A measure of the oxygen required to oxidize all compounds in water, both organic and inorganic.

COMBINED STANDARD UNCERTAINTY – The standard uncertainty of the analytical measurement result that is the sum in quadrature (square-root-of-the-sum-of-the-squares) of the component standard uncertainties.

CORRECTIVE ACTION – the action taken to eliminate the causes of an existing non-conformity, defect, or other undesirable situation to prevent reoccurrence.

COVERAGE FACTOR – the numerical factor used as a multiplier of the combined standard uncertainty to expand the uncertainty corresponding to a specific level of confidence. The Student's *t*-distribution is used for determining the coverage factor.

DEMONSTRATION OF CAPABILITY (DOC) – a procedure used to establish the ability of the analyst to generate acceptable accuracy.

DEIONIZED WATER (DI) – water from which the majority of ions have been removed. Water that is contaminant free and used in the laboratory, the resistivity should be ≤ 18 megaohms.

DISSOLVED METALS –- metallic elements determined on a water sample that has been passed through a 0.45-um filter.

DISSOLVED OXYGEN (DO) – the oxygen freely available in water, an indicator of water quality.

DISSOLVED SOLIDS – disintegrated organic and inorganic material contained in water. Excessive amounts make water unfit to drink or use in industrial processes.

DRY WEIGHT – the weight of a sample based on percent solids. The weight of a sample after drying in an oven at a specified temperature.

DUPLICATE MEASUREMENT – a duplicate measurement is a second measurement made on the same or identical sample of material to assist in the evaluation of measurement of variance.

DUPLICATE SAMPLE – two samples taken from the same population and carried through certain stages of sampling and testing. Duplicate sample include field co-located duplicate samples, field-split duplicate samples, and laboratory duplicate subsamples.

EXPANDED UNCERTAINTY – the quantity defining an interval enveloping the analytical measurement that captures a large fraction of the distribution of analyte concentrations that could be attributable to the quantity measured. The combined standard uncertainty is multiplied by the coverage factor to calculate the expanded uncertainty.

EXTERNAL STANDARDS – a method of quantifying chromatographic data in which standards of known concentration are analyzed prior to unknown samples. The chromatographic peak area (or height) of a sample component is compared to a calibration curve of a peak area constructed from the standard data for that component. This comparison allows the concentration of the component in the sample to be determined.

FECAL COLIFORM BACTERIA – bacteria found in mammals' intestinal tracts. Their presence in water or sludge is an indicator of pollution and possible contamination by pathogens.

FLAME IONIZATION DETECTOR (FID) – a gas chromatography detector in which the column effluent gas is mixed with hydrogen and burned in air or oxygen. The ions and electrons produced in the flame generate an electric current proportional to the amount of materials in the detector. The FID responds to nearly all organic compounds, but it does not respond to air and water, which makes it exceptionally suited to environmental analysis.

FLASHPOINT – the lowest temperature at which a flammable liquid gives off sufficient vapor to form an ignitable mixture with air near its surface or within a vessel. Combustion does not continue.

GAS CHROMATOGRAPHY (GC) – a technique for detecting organic compounds by using their physical and chemical properties to separate a mixture. The compounds are identified and quantified with various types of detectors as they exit the chromatograph. Selection of detectors is dependent on the particular compounds of interest.

GAS CHROMATOGRAPHY MASS SPECTROMETRY (GCMS) – a technique in which sample analytes are bombarded with electrons as they exit a gas chromatography column and are fragmented into characteristics ion patterns. The mass spectrometer is the detector. It can determine which fragments are present and therefore the identity of the compounds.

GLUCOSE GLUTAMIC ACID (GGA) – used as a laboratory control standard in BOD procedures.

GRAPHITE FURNACE – a technique used for the analysis of metals. An atomic absorption spectrophotometer heats the sample within a graphite tube using an electrical current. It is also commonly called a flameless furnace and generally provides greater sensitivity for certain metals than flame or inductively coupled argon plasma techniques.

GRAVIMETRIC - analyses based on the direct or indirect weighing of the analyte in question. This technique usually requires the use of an analytical balance with a sensitivity of 0.1 mg or better.

HALL ELECTROLYTIC CONDUCTIVITY DETECTOR – an element-selective gas chromatography detector primarily intended for trace analysis of organic compounds containing chlorine, nitrogen or sulfur. In operation, this detector pyrolyzes the column effluent gas into soluble electrolytes that are dissolved in a stream of deionized liquid. The observed change in electrical conductivity, proportional to the amount of material present, is measured.

HAZARDOUS WASTE – waste regulated under RCRA that can pose a substantial or potential hazard to human health or the environment when improperly managed. Such wastes possess at least one of four characteristics (ignitability, corrosivity, reactivity, or toxicity) or appear on special EPA hazardous waste lists. The term is not interchangeable with hazardous substances or material.

HEADSPACE - Any area in a container not completely filled by the sample in which gases can collect.

HEAVY METALS – metallic elements with high atomic weights, i.e., mercury, chromium, cadmium, arsenic, and lead. They can damage the health of plants and animals at low concentrations and tend to accumulate in the food chain.

HOLDING TIME – the maximum times that samples may be held before analysis and still be considered valid or not compromised. The storage time allowed between sample collection and sample analysis when the designated preservation and storage techniques are employed.

HYDROCARBONS – chemical compounds that consist entirely of carbon and hydrogen.

ICP – Inductively coupled plasma is a type of instrument used for metals analysis. Because the temperature of the plasma is considerable higher (10,000^{o}K) than the temperature of a flame atomic

absorption spectrophotometer, it is especially useful for refractory metals. Some instruments are also capable of performing simultaneous multielement analysis.

ICP-MS - Inductively coupled plasma mass spectrometry (ICP-MS) is a type of mass spectrometry highly sensitive and capable of the determination of a range of metals and several non-metals at concentrations below one part in 10^{12} (part per trillion). It is based on coupling together an inductively coupled plasma as a method of producing ions with a mass spectrometer as a method of separating and detecting the ions. In trace elemental analysis, the method has advantages of high speed, precision and sensitivity.

IGNITABLE – capable of burning or causing a fire.

INORGANIC CHEMICALS – chemical substances of mineral origin, unlike organic chemicals whose structure relies on carbon atoms.

INITIAL CALIBRATION VERIFICATION (ICV) - also referred to as the Independent Calibration Verification for this laboratory. A standard solution used to verify the calibration curve derived from a source independent of the instrument calibration standard. The ICV is use to quantify second source standard variance and bias.

INSTRUMENT CALIBRATION STANDARD - a reference material used to standardize an analytical instrument.

INSTRUMENT DETECTION LIMIT (IDL) - a term utilized in the EPA Inorganic Contract Laboratory Program. The IDL is three times the standard deviation obtained for the analysis of a standard solution (each analyte in reagent water) at a concentration of three to five times that of the IDL on three nonconsecutive days with seven consecutive measurements per day. The IDL is the concentration equivalent to a signal, due to the analyte of interest, which is the smallest signal that can be distinguished from background noise by a particular instrument. The IDL should always be below the method detection limit, and is not used for compliance data reporting, but may be used for statistical data analysis and comparing the attributes of different instruments.

INSTRUMENT PERFORMANCE CHECK - The analyses of one of the ICSs to verified initial and continuing calibration (CCV). The IPC is used to quantify the instrumental testing repeatability variance and bias.

INSTRUMENT TUNING - a technique used in gas chromatography/mass spectrometry procedures to verify that the instrument is properly calibrated to produce reliable mass spectral information. See 4-Bromofluorobenzene under “B”.

INTERNAL STANDARDS - compounds added to every standard, blank, matrix spike, matrix spike duplicate, sample (for volatile organics), and sample extract (for semivolatiles) at a known concentration, prior to analysis. Internal standards are used as the basis for quantification of the target compound.

IONIZATION - Utilized in mass spectrometry to fragment analyte molecules into smaller segments. These smaller mass segments are then separated and plotted to form a “mass spectrum” which is used to identify the parent molecule. Electron impact is one example of ionization used in mass

spectrometry. In more technical terms. Ionization is the process by which neutral atoms or groups of atoms become electrically charged, either positively or negatively, by the loss or gain of electrons.

ISOMERS - chemical compounds with the same molecular weight and atomic composition by differing molecular structure, e.g., n-pentane and 2-methylbutane.

LABORATORY CONTROL SAMPLE (LCS) - a clean-matrix reference sample spiked with a standard with an established analyte concentration. The LCS is carried through the entire chemical preparation and testing procedures. The LCS is used to quantify the variance and bias of the chemical preparation and instrumental testing stages without matrix interference. Also called a Laboratory fortified blank (LFB).

LABORATORY CONTROL SAMPLE DUPLICATE (LCSD) – a duplicate of the laboratory control sample in a clean matrix that is carried through the entire chemical preparation and testing procedures.

LABORATORY DUPLICATE SAMPLE (LAB DUPLICATE) - a portion of the collected sample that is carried through the chemical preparation and testing. The laboratory duplicate subsample is used to quantify the variance of the chemical preparation and instrumental testing stages with matrix interferences.

LEACHATE - a liquid that results from water collecting contaminants as it trickles through wastes, agricultural pesticides or fertilizers. Leaching may occur in farming areas, feedlots, and landfills, and may result in hazardous substances entering surface water, groundwater or soil.

LDEQ – Louisiana Department of Environmental Quality

LIBRARY SEARCH - a technique in which an unknown mass spectrum of a compound is compared to the mass spectra of compounds contained in a computer library in an effort to identify the compound. Compounds identified in this manner are referred to as tentatively identified compounds (TICs).

LIMIT OF DETECTION (LOD) – an estimate of the minimum amount of a substance that an analytical process can reliable detect. An LOD is analyte and matrix specific and may be laboratory dependent.

LIMIT OF QUANTIATION (LOQ) – the minimum levels, concentrations, or quantities of a target variable (e.g. target analyte) that can be reported with a specified degree of confidence..

LIMS – laboratory information management system. Horizons is the LIMS used by GCAL.

LINEAR CALIBRATION RANGE – the concentration range over which the instrument response is linear.

LOG-IN - the receipt and initial management of an environmental sample. It generally includes identifying who sent the sample; maintaining chain-of-custody; checking report and invoice information; recording analysis requested, including methodology and special instructions; and assigning a discreet in-lab identification, usually a number or bar code.

MASS SPECTRUM - a plot of ion mass/charge ratio versus intensity. A fragmentation pattern results from the particles whose mass distribution is characteristic of the parent molecule. Qualitative information is provided by a mass spectrum.

MATERIAL SAFETY DATA SHEET (MSDS) - a compilation of information required under the OSHA Communication Standard on the identity of hazardous chemicals and their associated health and physical hazards, exposure limits and precautions.

MATRIX - The physical characteristics or state of a sample – e.g., water, soil, sludge.

MATRIX INTERFERENCE - the influence of the sample matrix or sample components upon the ability of qualitatively identifies and quantitatively measures compounds in environmental samples.

MATRIX MODIFIERS - chemicals added to samples for metals analysis, which are used to lessen the effects of chemical interference, viscosity and surface tension.

MATRIX SPIKE (MS) – aliquot of a sample fortified (spiked) with known quantities of specific compounds and subjected to the entire analytical procedure in order to indicate the appropriateness of the method for the matrix by measuring recovery of the spike. Matrix spiked samples are used to quantify the variance and bias of the chemical preparation and testing stages with matrix interference.

MATRIX SPIKE DUPLICATE (MSD) - a second aliquot of the same matrix as the matrix spike that is spiked to determine the precision of the method.

METHOD DETECTION LIMIT (MDL) - the minimum concentration of compound that can be measured and reported within 99% confidence that the value is above zero and is determined from analysis of a sample in a given matrix containing the analyte.

MUST – denotes a mandatory requirement.

NARRATIVE - in an analytical report, a descriptive documentation of any problems encountered in processing the samples, along with corrective action taken and problem resolution.

NUTRIENT - any substance assimilated by living things that promote growth. The term is generally applied to nitrogen and phosphorus in wastewater, but is also applied to other essential and trace elements.

ORGANIC - generally, any compound that contains carbon bonded to a hydrogen or halogen atom.

OXIDATION - the process in chemistry whereby electrons are removed from a molecule.

PCBs - Polychlorinated biphenyl, a group of toxic persistent chemicals used in transformers and capacitors for insulating purposes and in gas pipeline systems as a lubricant. Sale of PCBs for new uses was banned by law in 1979.

PERCENT RECOVERY - a measure of accuracy that is calculated as the measured value relative to the true value expressed as a percent.

PERFORMANCE AUDIT - a quantitative evaluation of a measurement system that involves the analysis of standard reference samples or materials which are certified as to their chemical composition or physical characteristics.

PROFICIENCY TEST (PT) SAMPLE - a sample of known composition (unknown to the laboratory), provided by an external source, which is used to evaluate lab performance. For certification purposes the PT sample is purchased from an approved provider.

pH - a numerical designation of relative acidity and alkalinity. A pH of 7.0 indicates precise neutrality. Progressively higher values indicate increasing alkalinity and lower values increasing acidity.

POLLUTANT - generally, any substance introduced into the environment that adversely affects the usefulness of a resource.

PRACTICAL QUANTITATION LIMIT (PQL) - the lowest level that can be reliable achieved within specified limits of precision and accuracy routine laboratory operating conditions. The lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value.

PRECISION - a measure of the ability to reproduce analytical results. It is generally determined through the analysis of duplicate samples. The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range in either absolute or relative terms.

PRESERVATIVE - a chemical or reagent added to a sample to prevent or slow decomposition or degradation of a target analyte or a physical process. Physical and chemical preservation may be used in tandem to prevent sample deterioration.

PURGE AND TRAP - a technique used in the analysis of volatile organic where analytes are purged from a sample by means of an inert gas and trapped on a sorbent column. The sorbent is then flashheated and the analytes are transferred onto a gas chromatographic column for separation and identification.

PURGEABLE ORGANIC - an organic compound that is generally less than 20% soluble in water and has a boiling point at or below 200^{o}C. A volatile organic. An organic compound is generally considered to be purgeable if it can be removed from water using the purging process.

QC BASED NESTED APPROACH - a procedure for estimating the uncertainty of measurement using quality control data. The procedure is described in SOP QA-013.

QUALITY ASSURANCE (QA) - all those planned and systematic actions necessary to provide adequate confidence in laboratory results. An integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets the defined standards of quality with a stated level of confidence.

QUALITY ASSURANCE PROGRAM PLAN - a written assembly of management policies, objectives, principle and general procedures that outlines how the laboratory intends to generate data of known and accepted quality.

QUALITY CONTROL (QC) – the overall system of technical activities whose purpose to measure and control the quality of a product or service so that it meets the needs of the users.

QUALITY CONTROL CHART - a graph of analytical measurement results for a specific QC standard plotted sequentially with upper and lower control limits (±3SD). A central line that is the best estimate of the average variable plotted, and upper and lower marginal exceedence limits (±4SD) are usually included in the Quality Control Chart. The chart may also include upper and lower warning limits (±2SD).

QUALITY SYSTEM – a structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items) and services. The quality system provides the framework for planning, implement and assessing work performed by the organization and for carrying out required QA and QC.

r^2 – Correlation Coefficient Squared – paramet6er used to evaluate the fit of linear or quadratic regression curve fit of initial calibration data.

RAW DATA – any original information from a measurement activity or study recorded in a laboratory note book, worksheets, records, memoranda, notes, or exact copies thereof that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data may include photography, microfilm or microfilm copies, computer printouts, magnetic media, including dictated observations, and recorded data from automated instruments.

REACTIVITY - the tendency of a chemical to explode under normal management conditions, to react violently when mixed with water, or to generate toxic gases.

REAGENT WATER - water in which an interference is not observed at or above the minimum quantitation limit of interest.

REFERENCE MATERIAL - a traceable standard with an established analyte concentration. Material or substance whose property values are sufficiently homogenous, stable and well established to be used for the calibration of an apparatus, the assessment of a measurement method or for assigning values to materials (ISO Guide 30)

REFERENCE METHOD – a method of known and documented accuracy and precision issued by an organization recognized as competent to do so.

RELATIVE RETENTION TIME – a measure of the shift in retention time of an analyte when referenced to an internal standard.

RELATIVE RESPONSE FACTOR (RRF) - a measure of the relative mass spectral response of an analyte compared to its internal standard. RRFs are determined by analysis of standards and are used in the calculation of concentrations of analytes in samples.

REPLICATE ANALYSES - two or more results representing the same sample parameter. Replicate analyses are used to quantify the analytical measurement repeatability precision.

RPD – Relative Percent Difference, a relative difference between two analyses calculated by dividing the absolute difference of thos two results by the average of therir two values, then multiplying by 100.

RESOLUTION - the degree of separation between peaks eluting from a chromatographic column. Sufficient resolution between peaks is required for proper quantitation of unknown analytes.

RETENTION TIME - a term used in gas and liquid chromatography describing the time elapsed from the sample injection until the specific compound elutes or exits the chromatographic column at the detector. Each compound has a characteristics retention time on a specific column; therefore, this information is used to qualitatively identify the compounds in the sample.

SAMPLE – portion of material collect for chemical analysuis, identified by a unique number assigned by the LIMS.

SHALL – denotes a requirement that is mandatory whenever the criterion for conformance with the specification requires that there be no deviation. This does not prohibit the use of alternative approaches or methods for implementing the specification so long as the requirement is fulfilled.

SHOULD – denotes a guideline or recommendation whenever noncompliance with the specification is permissible.

SOLID WASTE – non-liquid, non-soluble materials, ranging from municipal garbage to industrial waste, that contain complex, and sometimes hazardous, substances. Solid wastes include sewage sludge, agricultural refuse, demolition wastes, mining residues, and even liquids and gases in containers.

SOLVENT - a substance, usually liquid, capable of dissolving or dispersing one or more other substances.

SPIKE – a known mass of target analyte added to a blank sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.

STANDARD CURVE - a curve that plots concentrations of known analyte standards versus the instrument response to the analyte. Calibration standards are prepared by diluting the stock analyte solution in graduated amounts that cover the expected range of the samples being analyzed. The calibration standards must be prepared by using the same type of acid or solvent at the same concentration as for the samples following sample preparation. This is applicable to organic and inorganic chemical analyses.

STANDARD OPERATING PROCEDURE - a detailed written description of how a laboratory executes a particular procedure or method intended to standardize its performance.

STANDARDIZED REFERENCE MATERIAL (SRM) – a certified reference material produced by the U.S. National Institute of Standards and Technology or other equivalent organization and characterized for absolute content, independent of analytical metho9d.

STANDARD UNCERTAINTY - the analytical measurement uncertainty expressed as a standard deviation. The relative standard deviation represents the relative standard uncertainty.

SURROGATE - an organic compound similar to the analyte of interest in chemical composition, extraction and chromatography, but not normally found in environmental samples. Primarily used in chromatography techniques, the surrogate is spiked into quality control blanks, calibration and check standards, samples (including duplicated and QC reference samples) and spiked samples before analysis. A percent recovery is calculated for each surrogate.

SUSPENDED SOLIDS - small pollutant particles that float on the surface of, or are suspended in, sewage or other liquids. They resist removal by conventional means.

TARGET COMPOUND - specific compounds that are to be quantified in a sample based on a standard list of potential compounds.

TENTATIVELY IDENTIFIED COMPOUNDS (TICs) - compounds detected in samples that are not target compounds, internal standards, system monitoring compounds or surrogates. TICs usually consist of up to 30 peaks that are greater than 10% of the peak areas, or heights, of the nearest internal standard. They are subjected to mass spectral library searches for tentative identification. A client may specify the number of unknown peaks in its samples it wishes the laboratory to tentatively identify.

TOTAL METALS - metallic elements that have been digested prior to analysis.

TYPE A EVALUATION UNCERTAINTY - the method of evaluation of uncertainty by the statistical analysis of a series of test results.

TYPE B EVALUATION OF UNCERTAINTY - the method of evaluation of uncertainty by means other than statistical analysis.

UNCERTAINTY - the parameter associated with the analytical measurement results that characterizes the dispersion of the values that could be reasonable attributed to the quantity measured.

UNCERTAINTY INTERVAL - the range of analyte concentrations that an analytical measurement could represent at a specified level of confidence. The relative standard deviation is used to represent the relative standard uncertainty in the QC-based Nested Approach.

VALIDATION –the process for evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, or contractual specifications. It essentially evaluates performance against predetermined specifications.

VOA - volatile organic analysis

VOA BOTTLE - a vial used to contain samples for volatile organic analysis.

VOLATILE COMPOUNDS - compounds amendable to analysis by purge and trap. Synonymous with purgeable compounds.

VOLATILE ORGANIC COMPOUND (VOC) - any organic compound that participates in atmospheric photochemical reactions, except for those designated by the EPA Administrator as having negligible photochemical reactivity.

WET CHEMISTRY - procedures that involve distillations, colorimetric determinations and titrimetric measurements. Examples are chloride, nitrates, sulfates and biochemical oxygen demand.

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STANDARD OPERATING PROCEDURES
MICROBAC LABORATORIES
OHIO VALLEY DIVISION
LABORATORY QUALITY ASSURANCE PLAN

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Laboratory Quality Assurance Plan

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3.0 STATEMENT OF POLICY

This Quality Manual summarizes the policies and operational procedures of Microbac Laboratories, Inc. Ohio Valley Division (OVD), located at 158 Starlite Drive in Marietta, Ohio. Specific protocols for sample handling and storage, chain-of-custody, laboratory analyses, data reduction, correction action, and reporting are described. All policies and procedures have been structured in accordance with the National Environmental Laboratory Accreditation Conference (NELAC) standards adopted in June 2003 (current as of the date of this publication) and applicable Environmental Protection Agency (EPA) requirements, regulations, guidance, and technical standards. This manual has been prepared in accordance with the guidance documents listed in Section 17.0. Further details on these policies and procedures are contained in Standard Operating Procedures (SOP) and related documents. This Quality Manual, SOPs, and related documentation describe the quality system for Microbac. Top management makes the following quality policy statements and commitments:

- Laboratory management is committed to good professional practice, to the quality of our testing, and to providing excellent service to our customers.
- Microbac's management commitment to providing the highest standard of service, with respect to data quality and information to our clients, is embodied in Microbac's corporate policy on quality assurance.
- The purpose of our management system is to ensure that all of our work shall be performed in an absolutely professional manner, and all data shall be scientifically valid, legally defensible, of known precision and accuracy.
- Management will assure through documented, annual refresher training that all laboratory staff are familiar with relevant and applicable aspects of the quality management, and will implement these policies and procedures in their work.
- Laboratory management has established policies and procedures to comply with the quality system requirements of ISO/IEC 17025:2005, and is committed to a mission of continuous quality improvement.

Every level of management, the laboratory staff, and project scientists are committed to the quality assurance (QA) program described in this Quality Manual and as such ensure that the appropriate facilities and resources are available before producing any analytical results.

All of our work will be performed in accordance with standards developed by the NELAC and any applicable state or EPA regulations or requirements. A Certification Statement (see Appendix A) has been recorded to this effect.

This program will be revised as needed to address special client or project requirements and to keep pace with developing technologies, good laboratory practices and total management of testing services.

All new employees are educated and trained in their ethical and legal responsibilities including the potential punishments and penalties for improper, unethical or illegal actions. Our written policy for ethical standards of behavior exists in a separate document entitled "Ethics Policy".

Microbac performs chemical analyses for inorganic and organic constituents in water, solid, and hazardous waste. Microbac's goal's are as follows:

- to protect our clients' interests by providing them with fully documented, legally defensible data useable for sound environmental decisions;
- ensure our client's confidentiality through safeguards related to data reporting by telephone, facsimile, modem, diskette, mail or other means;
- shelter our company's two most important resources, our people and our reputation, by maintaining an environment that fosters excellence and;
- guard against and correct performance shortcomings which could erode data or technical quality

Microbac-OVD is licensed and/or accredited by several state programs. A copy of each license and a list of licensed parameters is maintained in a notebook in the laboratory reception area. Another copy is maintained electronically on the network COMMON drive.

4.0 ORGANIZATION AND RESPONSIBILITY

Microbac Laboratories, Inc. has its corporate headquarters in Pittsburgh, Pennsylvania. The corporate organizational chart for Microbac Laboratories, Inc. is given in Figure 4-1. Microbac's laboratory in Marietta, Ohio (Ohio Valley Division) is a full service environmental laboratory facility for analysis of groundwater, municipal and industrial waste water, soil and solid waste. The Ohio Valley Division's organizational chart is presented in Figure 4-2 along with a laboratory floor plan, which is provided in Figure 4-3. Microbac's Analytical Statement of Qualifications provides the qualifications and experience summaries for key professionals within Microbac. The duties and responsibilities of all key positions at the Ohio Valley facility are provided below.

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4.1 Responsibilities and Authorities

All employees, including the Managing Director, have the responsibility and authority to identify and report nonconforming work, to initiate actions to prevent QMS departures and nonconformances, to participate in internal audits and corrective action investigations, and to adhere to the QMS procedures.

4.2 Key Personnel

See Appendix D for job descriptions.

4.3 Coverage for Temporary Absence of Key Personnel

Microbac has sufficient staff redundancy and level of experience to cover for extended absence of all personnel described above. The production and report review duties of the Laboratory Director are covered by the Technical Director / QAO. The duties of the QAO are delegated to a senior staff QC chemist with oversight from the Laboratory Director. Responsibilities of departmental supervisors are delegated to the senior chemist or analyst in the department, with oversight from the Laboratory Director. A senior programmer is assigned the duties of the IT Manager in his absence. All key personnel have an average of over ten years experience and are cross-trained for multiple positions.

Figure 4-1

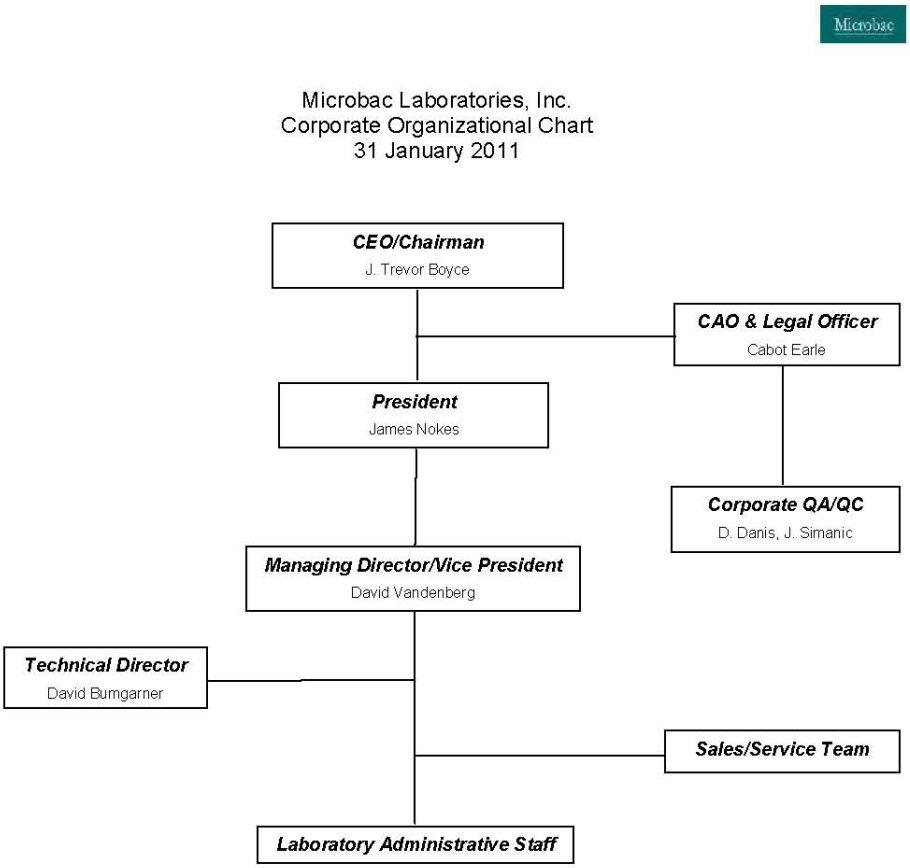

Microbac
Microbac Laboratories, Inc.
Corporate Organizational Chart
31 January 2011
CEO/Chairman
J. Trevor Boyce
CAO & Legal Officer
Cabot Earle
President
James Nokes
Corporate QA/QC
D. Danis, J. Simanic
Managing Director/Vice President
David Vandenberg
Technical Director
David Bumgarner
Sales/Service Team
Laboratory Administrative Staff

Figure 4-2

Microbac Laboratories, Inc.
Organizational Chart
21 FEB 2012

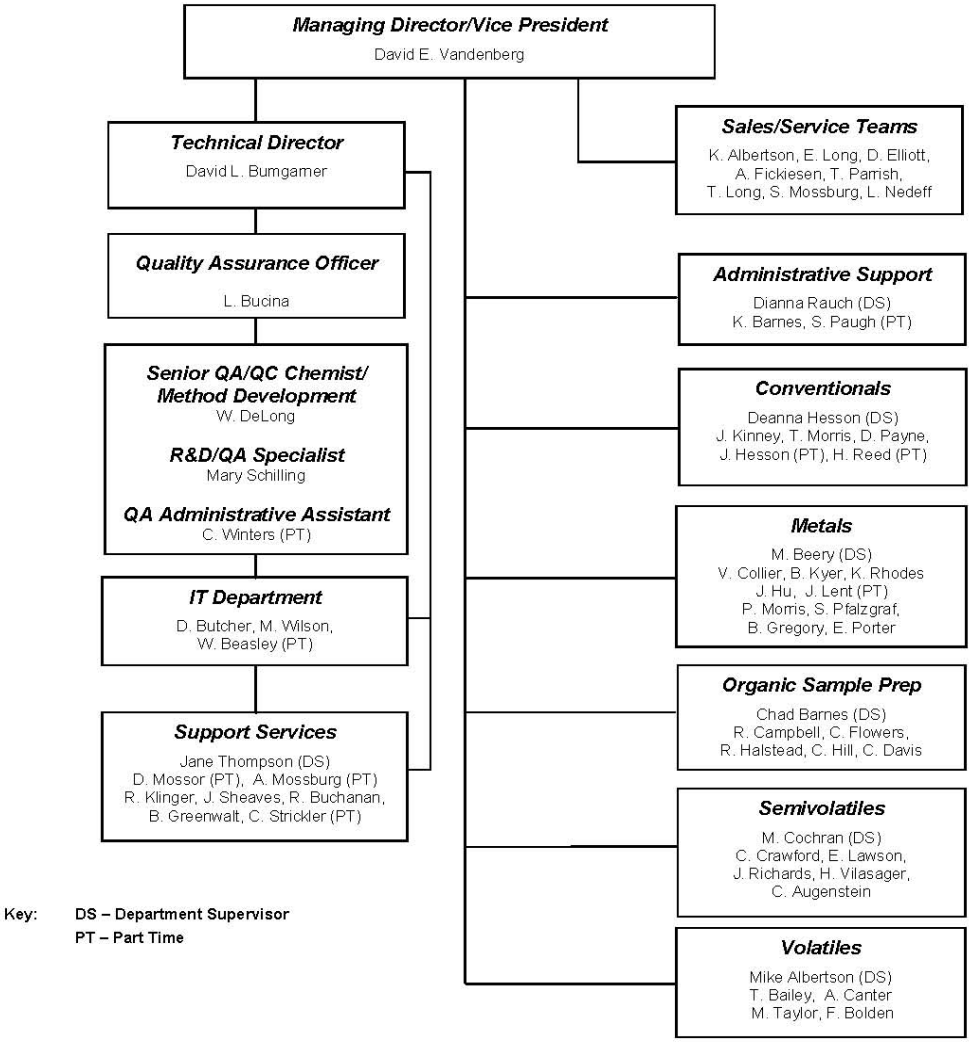
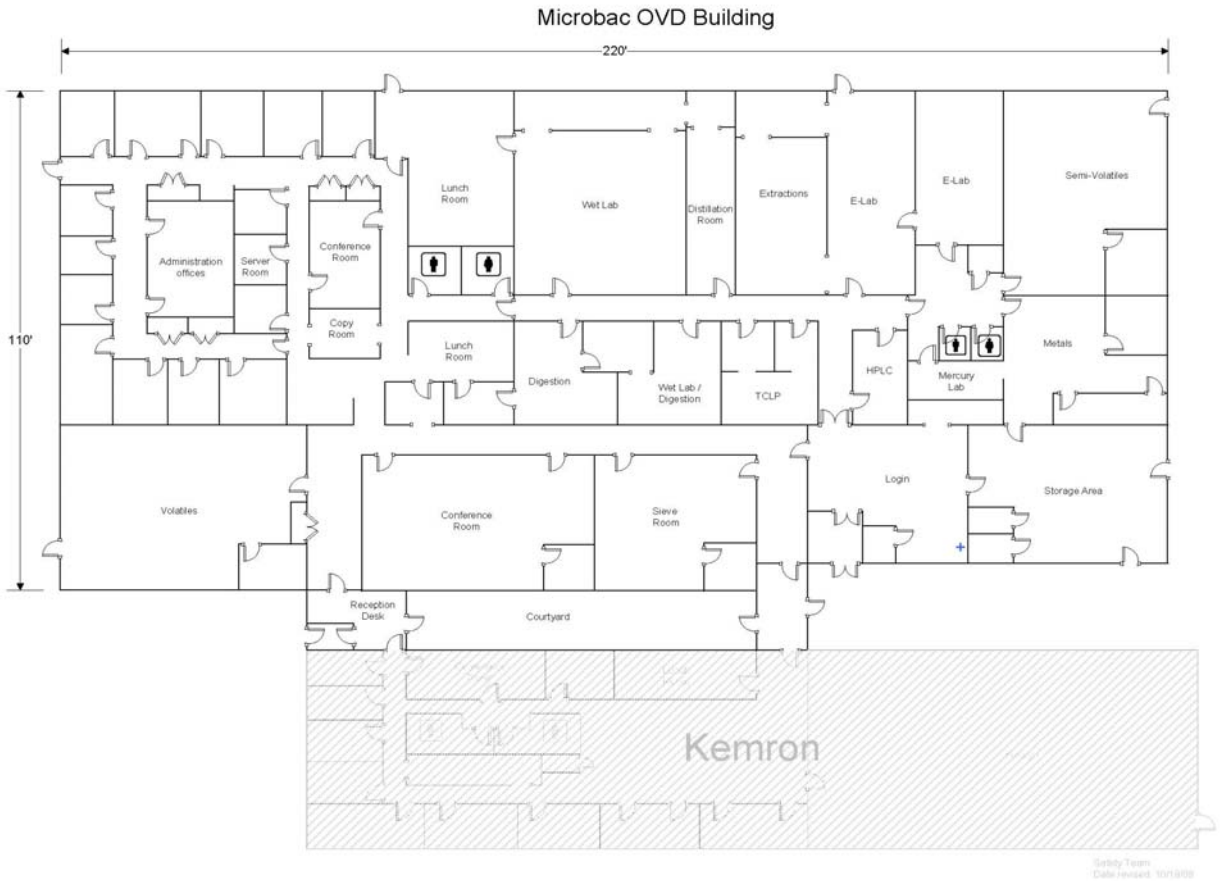


Figure 4-3
Microbac Laboratories, Inc.
Laboratory Floor Plan



5.0 GENERAL POLICIES AND PROCEDURES

5.1 NELAC Policy Statement

This quality manual, also known as the Laboratory Quality Assurance Plan (LQAP), addresses the elements defined in Section 5.4.2 of the NELAC. A list of National Environmental Laboratory Accreditation Program (NELAP) approved test methods and analytes is presented in Appendix C to this manual. Microbac will comply with all NELAC requirements for all laboratory work covered by our NELAP accreditation.

5.2 Employee Protection from Undue Pressure

It is the policy of this company to protect laboratory employees from undue outside pressures from commercial, financial, or other sources originating from management or clients. This protection is afforded through the implementation of related policies for capacity evaluation, ethics training, and an “open door” policy from upper management. All employees are encouraged to discuss their concerns about such pressures with management.

5.3 Ethics Training

The laboratory requires all new employees to participate in formal training sessions on professional laboratory ethics. Refresher training is also provided to all employees on an annual basis. All employees are educated and trained in their ethical and legal responsibilities including the potential punishments and penalties for improper, unethical, or illegal actions. All training is documented in accordance with the policy “Ethical Conduct and Data Integrity Agreement”. The Ethics Policy is presented in Microbac SOP ETH01. Microbac has an “Employee Handbook” that specifies requirements for ethical behavior and general performance expectations. The handbook provides formal policies for disciplinary action and consequences of unethical behavior and other general policy violations.

5.4 Departures from Documented Policies and Procedures

All workload performed under our NELAP certification will be in accordance with this quality manual and all supporting standard operating procedures and policies. In the unlikely event that departures from documented policies and procedures (either technical or non-technical) becomes necessary, only the Managing Director or Technical Director have the authority to approve such deviations.

5.5 Reviewing New Work and Capacity Evaluation

The laboratory adheres to the following mechanism to evaluate new work. The first step is the evaluation of method capability, which includes an initial review of the procedure supplied by the client requesting the work. Management then assesses the laboratory's ability to perform the work with existing apparatus, instrumentation, facilities, and personnel. If management determines that the capability exists, or may be developed, it then evaluates the financial feasibility of performing the new work. The managing director has the sole authority for approval of new work after the above evaluation is completed. All new method development is performed in accordance with Microbac SOP 45 – ***Method Validation Procedures***.

Laboratory capacity is periodically evaluated in conjunction with scheduling and forecasting tools, status updates on outstanding proposals, and the current backlog. The laboratory requires client notification of all sample shipments and clients are advised when large shipments may tax the laboratory ability to meet holding times or delivery dates. It is the policy of laboratory management to evaluate production capacity prior to acceptance of all major delivery orders.

5.6 Complaints

Microbac Laboratories is committed to complete satisfaction of customers and other interested parties. If for any reason a party believes we have not complied with agreed upon specifications or policies, then the following procedures will be implemented:

1. Documentation of Complaint

The appropriate service representative or manager will document in writing the nature of the complaint. The contact form displayed as Figure 5-1 will be used and all appropriate correspondence and records shall be attached.

2. Investigation of Complaint

The problem will be investigated to verify the validity of the complaint or concern. If the issue is one of quality control, or breach of policy or procedure, an internal audit will be conducted. If Microbac is found negligent in meeting the written specifications or policies, or if our data is judged to be invalid or unusable for any reason, the problem is referred to the Technical Director/Quality Assurance Officer (QAO), or other authorized laboratory representative, for a resolution. If the proposed course of action is not

acceptable, the problem is referred to the Managing Director. In cases of laboratory negligence the following courses of action are offered:

- Offer to perform services/analyses again at no charge; or
- refund or credit for specific services
- Assist client in dealing with the consequences, i.e. consultation with agency, letter of explanation, re-sampling assistance; and
- seek a resolution that is acceptable to all involved parties.

Written documentation of problem and resolution is maintained in the document control office with an additional copy in the master project (report) file. Summary reports are generated periodically outlining complaints for a specified period of time. These are discussed in management and laboratory staff meetings to verify trends and to establish preventive measures.

5.7 Document Control and Maintenance

Microbac-OVD has written procedures for controlling both internally generated and external documents that comply with the requirements of ISO 17025:2005, Section 4.3.1. These procedures are presented in detail in Microbac SOP GP-DOC-CONTROL.

5.7.1 Laboratory management shall approve, prior to distribution, all internal and external documents that are part of the management system.

5.7.2 The laboratory shall uniquely identify all quality system documents and include date of issuance, revision number, page numbering, total number of pages, and the issuing authority.

5.7.3 The document control officer, under the oversight of the QAO, shall maintain a master list that uniquely identifies each document, revision status, and record of distribution of all controlled documents. The master list shall be readily available for review.

5.7.4 The document control system and associated master list shall preclude the use of any invalid or obsolete documents.

5.7.5 Authorized versions shall be made available (either electronically or hardcopy) to all laboratory units where documents are essential to effective operations.

5.7.6 All controlled documents are reviewed periodically and revised as necessary to comply with all applicable requirements.

5.7.7 All obsolete or invalid documents are promptly removed to prevent any unintended use.

5.7.8 All obsolete documents are retained in an archive system to meet legal requirements and to maintain historical continuity.

5.7.9 All changes in documents shall be reviewed by the same function (management personnel) that performed the original review. These personnel shall have access to the pertinent background and information that is needed for review and approval.

5.7.10 Document Integrity

Laboratory management will ensure the integrity of the quality management system as required by ISO 17025:2005, Section 4.2.7. An important element of the annual document reviews will be to assess and eliminate any contradictions within and between internal documents.

5.7.11 Archiving

The QAO is responsible for maintaining an archive copy of each controlled document. Archive copies will be retained for ten years.

5.8 Laboratory Records

The laboratory has written procedures for managing laboratory records and established policies for records retentions that comply with ISO 17025:2005, Section 4.13.1.1. The laboratory has established a policy to archive and retain analytical data, reports, and other records in electronic format, consisting of magnetic tape, CDs, or other equivalent media. Most contracts specify a minimum retention time of five or ten years, however, Microbac will retain all electronically archived data in accordance with contractual and regulatory agency requirements. The disposition or transfer of laboratory records will be negotiated with individual clients upon any change in business status. Additional details are found in Microbac SOP GP-RECORDS.

5.9 Analyst Training and Demonstration of Capability

All analysts must go through a formal training program that includes initial and annual Demonstration(s) of Capability (DOC) for each procedure they perform.

These demonstrations are performed in accordance with the requirements of NELAC Section 5.0 Appendix C, and details are presented in Microbac SOP 47 - Employee Training. Alternatively, the laboratory uses the following option to assess Demonstration of Capability when the method is not amenable to Proficiency Testing evaluation, or standard measures of precision and accuracy:

- Four consecutive samples are analyzed with direct observation from another certified analyst, or;
- Results of four analyses are compared to those performed by another certified analyst.

5.10 Protecting Confidentiality and Proprietary Rights

Two factors must be observed regardless of the method chosen to convey information and data to a client. These are client confidentiality and accurate record keeping. The need to preserve the clients' confidentiality must never prevent recording of the date, time, person contacted and subject of the communication. Data capture software allows entire case files/final reports to be captured and put into a file format. This then can be put on disk, or sent by email to a client. This has great value for providing preliminary data to clients on quick turn projects.

5.10.1 Confidentiality Agreements

Protecting the confidentiality of client information and data is of the utmost importance to Microbac. All Microbac employees, as a condition of employment, must sign the Employee Confidential Information and Non-compete Agreement, which was developed to protect the proprietary records and data of Microbac and all of our clients. Upon request from Ohio Environmental Protection Agency (OEPA), Microbac will provide access to OEPA data and documents or information related to Ohio Voluntary Action Program (OVAP).

5.10.2 Client Data

The following standard operating procedures provide methods for ensuring that, where clients require transmission of test results by telephone, facsimile or other electronic or electromagnetic means, confidentiality is preserved.

5.10.2.1 Telephone Communications

In cases where analytical results must be communicated by telephone, a Client Service Specialist (CSS) calls the contact person/client whose name has been provided by the client at telephone number also supplied by the client. Verbal results are not released to any other person unless explicit instructions are received from the relevant client. The date and time of the client contact is recorded in the CSS telephone log.

5.10.2.2 Facsimile Transmissions

Analytical results are transmitted by facsimile to the attention of the contact person/client whose name has been provided by the client at a fax number also provided by the client. Following each fax transmission, a fax return sheet is printed automatically by the fax machine. This sheet is carefully checked against the originals. The confirmation sheet must be added to the client case file along with a copy of materials faxed. If this is not possible, the CSS must maintain a fax folder.

5.10.2.3 Electronic (Modem) Deliverables

All modem transmissions are done on direct lines to the client and are set up through our modem system using our dedicated lines. The client, where applicable, supplies telephone numbers and passwords.

5.10.2.4 Data Diskette and CD ROM Deliverables

Diskette deliverables are shipped to the client or designated contact person accompanying the hard copy report to which they apply. The client supplies the address and attention name.

5.10.2.5 Email

Where possible, email will be used to transmit information and data to a client. Care must be taken to insure the client receives the email and that the sender at Microbac maintains a record of the transmission. This can be done with our current email system by maintaining a sent file directory.

5.10.2.6 SOP's

Care must also be taken to protect client confidentiality in Standard Operating Procedures because they are often read by clients that may be considered a competitor of the client mentioned in the SOP. The utmost care must be taken to not identify specific or specialized procedures as belonging to any one client if possible. If it is necessary to name a client in an SOP then the information

naming the client will have to be sanitized or removed before the SOP is given to any other potential or current client for review.

5.11 Identification of Approved Signatories

The Managing Director has the authority to sign contracts, approve new company policies and procedures (SOP's) and certify (sign) laboratory reports. The Technical Director / QAO has the authority to approve laboratory policies and procedures (SOP's) and to certify laboratory reports. The Managing Director may grant authority to other qualified personnel to certify laboratory reports or other official documents for special projects, or in case of emergency.

5.12 Monitoring and Controlling System Time

The system date and time reported by our KOBRA LIMS (and all networked data systems) is synchronized to the data/time of the mail server, which is further synchronized with the internet using network time protocol. Hourly adjustments in time are made automatically, and laboratory staff are not authorized to make manual changes. Unauthorized changes in data system date or times may be considered a violation of the laboratory ethics policy (see also Section 5.3).

5.13 Changes of Ownership/Key Staff

In the event of change in ownership, the laboratory must notify all customers, certifying bodies, and relevant agencies within 30 days of any changes in ownership. This letter will clearly identify the extent of these changes, and discuss policies for ownership, storage, and access to historical data and records. The laboratory must also notify certifying bodies within 30 days or any changes in any key management staff, including the Managing Director or Technical Director(s).

5.14 Method References

The laboratory will include the official method references on laboratory documents including benchsheets, laboratory SOP cover pages, and laboratory analysis reports. These references shall correspond to those listed in the NELAP Scope of Accreditation.

5.15 A2LA Advertising Policy

The laboratory will adhere to the most recent directives established by The American Association for Laboratory Accreditation (A2LA) in regard to display

and use of symbols and documents reflecting its accreditation by A2LA. The laboratory will ethically and accurately represent areas of products and services for which this accreditation is applicable, and where used, the laboratory will assure clear exception of products and services outside the scope of that accreditation. Where used, the following restrictions are to be observed:

- The "A2LA" symbol cannot be used by the laboratory for any purpose. Only the "A2LA Accredited" symbol can be used by the laboratory to indicate its accreditation by A2LA. The A2LA Accredited Symbol may be modified for size and/or color, but the integrity of the symbol must be maintained in all respects.

- The laboratory can use the A2LA accredited symbol on business cards, but the location of the symbol is important. The symbol should not be placed near the name of the individual, to in any way suggest accreditation of that individual.

- Only the individual laboratory accredited by A2LA can use the A2LA Accredited symbol; therefore, corporate stationary, websites and marketing materials, which encompass all laboratories under the corporate structure, cannot carry the A2LA Accredited symbol.

As acknowledged by the A2LA directive, not every possible inappropriate use of the A2LA Accredited symbol is addressed in P101-Reference to A2LA Accredited Status-A2LA Advertising Policy; however, all laboratory personnel involved in the promotion of the laboratory's capabilities and credentials are required to review the specific examples, including graphics presented in the Appendix, for unacceptable usage of the A2LA Accredited Symbol. Review and training of staff to insure clear and unambiguous understanding of the proper use of the A2LA Accredited Symbol and ramifications of non-compliance will be conducted annually.

5.16 Purchasing Supplies and Services

The laboratory has developed written policies and procedures in Microbac SOP GP-PURCHASING for the selection and purchasing services and supplies that comply with ISO 17025:2005, Section 4.6.1.

5.17 Uncertainty - Estimating Uncertainty of Measurement

Microbac states on the cover page all laboratory reports that uncertainty data is available when requested by the client. Microbac will produce a separate report in comma separated value (CSV) format that presents the data as a

concentration interval about the reported value for each analyte. The lower and upper limits of the interval express the uncertainty estimate for each result, and where applicable are based on the analyte's quality control limits for laboratory control samples (LCS). The expressed uncertainly makes no attempt to address sampling error. Detailed procedures for estimating measurement uncertainty in accordance with ISO 17025:2005, Section 5.4.6.2, are found in SOP GP-UNCERTAINTY.

5.18 Review of Requests, Proposals, and Contracts

Microbac-OVD has established policies, procedures, and a system of record for the review of requests (RFP), tenders (proposals), and contracts. The review includes any work that is subcontracted, and all contract amendments. The customer is informed of any deviations to contracts before the work begins. Details of the procedures are found in Microbac SOP GP-CONTRACTS.

6.0 SAMPLING PROCEDURES

Microbac functions as an environmental analytical facility and as such is not directly responsible for the sampling events. However, Microbac does utilize independent field personnel. Below are sampling guidelines that were developed to outline the primary objective of any external sampling event. The objective is the collection of samples which, when analyzed, will consistently generate accurate, precise and representative data. By developing comprehensive standard sampling procedures and training personnel in the procedures, this objective can be met. These sampling procedures are offered as guidance to field project managers to assure sample integrity. Following the sampling procedures promotes sample integrity and the highest degree of quality control throughout the sampling event.

6.1 General Sampling Guidelines

SOPs should be utilized by all field project managers for potential sample sources. The SOPs should be based on State and USEPA guidance documents. SOPs should be available to and reviewed by all field personnel. Following are general guidelines to be used in the collection of environmental samples:

6.1.1 Sample containers which are prepared in the laboratory may contain measured volumes of preservative. Such containers must not be rinsed prior to filling with sample.

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6.1.2 Sample containers for VOA, pH, and TOX must be completely filled with no headspace. All other sample analyte containers must be filled to approximately 95% capacity.

6.1.3 VOA samples must be collected in a manner which minimizes disturbance of the sample and potential for volatilization. Fill vials until a convex meniscus forms then carefully place the septum cap on the vial. Invert the vial and check for the presence of air bubbles.

6.1.4 Field sampling equipment must always be appropriately decontaminated before and after use.

6.1.5 During the collection of all environmental samples, appropriate personal protective gear must be worn. Gloves and safety glasses are the minimum acceptable level of personal protective equipment (PPE) to be worn when samples are collected.

6.1.6 Use pre-cleaned laboratory prepared glassware for the collection of samples whenever possible.

6.2 Microbac Sampling Containers

The measurement of trace constituents in environmental samples demands methods capable of maximum precision and sensitivity. The selection and proper care of laboratory glassware and sample containers is an important part of the quality control program to eliminate errors due to contamination from improper cleaning procedures.

Laboratory supplied containers constructed of materials which are both compatible and non-reactive with the material to be sampled will be used. Microbac uses commercial sample containers which are certified pre-cleaned to EPA standards. These containers are shipped in sealed boxes with custody seals. Glassware is certified cleaned according to Protocol A, B, or C described below. Sample containers used by Microbac follow washing procedures equivalent to these protocols.

Table 6-1
Glassware Cleaning Protocol

Protocol A	Protocol B	Protocol C
Laboratory-grade detergent wash and rinse	Laboratory-grade detergent wash and rinse	Laboratory-grade detergent wash and rinse
Acid, deionized water, and solvent rinse	Multiple deionized water rinses	Acid rinse Multiple deionized water rinses
Oven drying, capping, and packing under quality control conditions	Oven drying, capping, and packing under quality control conditions	Oven drying, capping, and packing under quality control conditions

Table 6-2 lists the container type and volume required for each sample type.

6.3 Sample Preservation

Use of cooling, pH control, and chemicals to retard biological activity or to stabilize the chemical species of a sample is known as preservation. Sample kits prepared by the laboratory include sample containers prepared with the appropriate type and volume of preservative for the analyte of interest. Addition of preservative to samples in the field is not normally required when using the prepared kits. This procedure minimizes the potential for incorrect or inadequate sample preservation. The most common form of preservation is cooling the sample to 0-6° C using ice or refrigeration. Other common preservatives used include:

- Hydrochloric acid - dilute 1:1
- Nitric acid - dilute 1:1
- Sulfuric acid - dilute 1:1
- Sodium hydroxide - 50% solution
- Sodium thiosulfate - for dechlorination

Table 6-2 lists the preservation techniques and holding times employed by Microbac for each sample type. Holding time is defined as time elapsed from sample collection date and time to the analysis date and time with the exception of semivolatile extractables. Semivolatile holding times in the table denote designated timing allowed from collection to sample extraction. Hold time for semivolatile analysis from date of extraction is 40 days.

6.4 Sample Documentation

6.4.1 Sample labels

When using laboratory prepared sample kits, pre-labeled and preserved sample containers are provided. Each sample collected by Microbac is clearly labeled using waterproof ink with the following information:

- Client name
- Date and time of collection
- Sample source
- Preservative required
- Name(s) of sampler
- Analyses requested
- Sample identification

6.4.2 Field records

Sampling personnel should maintain complete and accurate records of all field activities. Bound field notebooks and/or field logs specific to the media sampled should be completed during each sampling project. All pertinent information on the sampling event is included in the field record.

6.4.3 Chain-of-Custody

All samples should be accompanied by a completed chain-of-custody form when shipped or hand delivered to the laboratory. Information required on the chain-of-custody includes:

- Sample date and time
- Name(s) of sampler(s)
- Sample ID
- Project name and number
- Analyses requested
- Number of sample containers
- Signature and date of all individuals who have custody of the samples

6.5 Sampling Equipment Decontamination

All field sampling equipment must be appropriately pre-cleaned prior to leaving the base of operations. Use phosphate-free detergent, hot tap water, and analyte free rinse water for this cleaning following the procedure specified for analytes of interest. Cleaned equipment must be wrapped or enclosed to maintain cleanliness during transport to the field for use. Adequate quantities of sampling equipment must be provided for each event to minimize the need for field decontamination.

Decontamination procedures for sampling equipment may include:

- Phosphate-free detergent and tap water wash
- Rinse with tap water

For equipment to be used for trace metals sampling, rinse with 1:1 reagent grade nitric acid solution. **Do not rinse stainless steel sampling equipment with nitric acid**.

- Rinse thoroughly with deionized water
- Rinse with isopropanol or methanol
- Thoroughly rinse with analyte-free water (if available)
- Air dry
- Wrap securely to prevent contamination if equipment is to be stored

Information on specific decontamination procedures are provided in each sampling SOP. Special decontamination procedures will be implemented as necessary, based upon contaminant encountered.

Equipment which is heavily soiled may require steam cleaning and/or high pressure washing. Drilling equipment and other heavy equipment used in field sampling activities will likely require this type of cleaning. If equipment cannot be adequately decontaminated, it will be discarded.

6.6 Field Waste Disposal Practices

Field generated waste must be disposed as required by project specifications and in accordance with applicable local, state, and federal requirements. Wastes commonly generated include drill cuttings, drilling fluids, well development water, well purge water, decontamination fluids, and contaminated personal protective equipment.

Based upon site and project specific requirements, liquid wastes should be containerized for characterization and disposal or discharged directly to an appropriate discharge location. Solid wastes should be containerized and left on-site for disposal or, if appropriate, disposed as general refuse.

Prior to initiating any sampling activity the waste handling requirements should be determined to ensure timely disposal in compliance with regulatory requirements.

6.7 Laboratory Sub-Sampling Procedures

6.7.1 Soil

Microbac employs the following procedures for taking soil subsamples in all methods and departments except for percent moisture determinations and volatile organic analyses:

a) Remove sample bottle contents and place in tray lined with wax paper (metals lab) or aluminum foil (organics extraction lab). Alternatively, remove vertical core section(s) (top to bottom) that is representative of the bottle contents and transfer to the tray.
b) Mix sample with an inert rod or scoop and break up lump. Remove all large stones, sticks, leaves, etc. Do not over mix the sample.
c) Obtain representative sample either by random removal of 3-10 portions of the sample from the pan or by using a "standard" scoop designed to retrieve a linear cross-section of the pan contents.
d) The analyst will not attempt to target an exact weight once a method specified minimum amount is weighed.
e) The remaining sample will be returned to the sample container.

NOTE: These procedures do not apply to samples for volatile organics analysis, except the requirement not to target a specific mass of sample

6.7.2 Water and Liquid Wastes

Unless otherwise stated in the method SOPs, the analyst will homogenize water and low viscosity liquid wastes by shaking each sample vigorously immediately prior to taking the sample aliquot. Viscous liquids such as oils shall be stirred with a glass rod prior to aliquot removal.

6.7.3 Multiphasic Samples

The laboratory will attempt to identify multiphasic sample prior to login. Our policy is to contact the client to determine whether to attempt homogenization, or to do a phase separation, and log as separate samples. Homogenization may require special procedures such as the use of a blender, however, our recommended approach is to separate the phases. The analyst should notify the project chemist if a muliphasic sample is discovered after receipt.

6.8 Sample Dilutions

The laboratory may dilute samples prior to analysis for the following reasons:

- A previous analysis yielded a result above the upper calibration range for the method.
- The sample contains a target, or non-target analyte, at sufficient concentration to damage sensitive instrumentation.
- Sample matrix interference, confirmed by poor surrogate or spike recoveries, prevents accurate analysis without dilution.

In each case the laboratory will document the sample dilution by reporting the dilution factor, adjusting the reporting and detection limits by that factor. The report narrative will provide additional detail as needed. If dilution analysis is not performed, the laboratory will assign appropriate qualifiers to any results reported above the upper calibration range.

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Table 6-2
Sample Containers, Preservation and Hold Times

CONVENTIONALS - WATER

PARAMETER	MINIMUM VOLUME	CONTAINER TYPE	PRESERVATIVE	HOLD TIME
Acidity	100	P, G	Cool, 4° C	14 Days
Alkalinity	100	P, G	Cool, 4° C	14 Days
Total Solids	50	P, G	Cool, 4° C	7 Days
Ash Content @ 750° C	25	P, G	Cool, 4° C	---
Biochemical Oxygen Demand	500	P, G	Cool, 4° C	48 Hours
Boron	20	P	Cool, 4° C	6 Months
Bromide	1000	P, G	Cool, 4° C	28 Days
BTU	10	P, G	Cool, 4° C	---
Formaldehyde	20	G	Cool, 4° C	7 Days
Chloride	25	P, G	Cool, 4° C	28 Days
Chloride, Total Residual	100	P, G	Cool, 4° C	6 Hours
Cyanide (midi)	50	P, G	Cool, 4° C, NaOH, pH>12	14 Days
Cyanide, Amenable to Chlorination (midi)	100	P,G	Cool, 4° C, NaOH, pH>12	14 Days
Chemical Oxygen Demand	25	G	Cool, 4° C, H_2SO_4, pH<2	28 Days
Color, Platinum-Cobalt	50	P, G	Cool, 4° C	48 Hours
Coliform, Fecal	120	P, G	Cool, 4° C, $Na_2S_2O_3$	6 Hours
Fecal Streptococcus	100	P, G	Cool, 4° C, $Na_2S_2O_3$	6 Hours
Coliform, Total	100	P, G	Cool, 4° C, $Na_2S_2O_3$	6 Hours
Specific Conductance	100	P, G	Cool, 4° C	28 Days
Corrosivity	500	P, G	Cool, 4° C	---
Corrosivity (pH)	40	P, G	Cool, 4° C	---
Chromium, Trivalent	200	P, G	Cool, 4° C	---
Chromium, Hexavalent	150	P, G	Cool, 4° C	24 Hours
Dissolved Oxygen	300	G	Cool, 4° C	6 Hours
Fluoride	25	P, G	Cool, 4° C	28 Days
Ignitability	75	P, G	Cool, 4° C	---
Fluoride, Total (Distilled/Non-Distilled)	200	P, G	Cool, 4° C	28 Days
Hardness	100	P, G	Cool, 4° C, HNO3, pH<2	6 Months
Iodide	400	P, G	Cool, 4° C	24 Hours
Surfactants (MBAS)	100	P, G	Cool, 4° C	48 Hours
Coliform Fecal (MPN)	100	P, G	$Na_2S_2O_3$	6 Hours
Nitrogen, Ammonia (Distilled/Non-Distilled)	100	P, G	Cool, 4° C, H_2SO_4, pH<2	28 Days
Nitrogen, Nitrite	50	P, G	Cool, 4° C	48 Hours
Nitrogen, Nitrate	75	P, G	Cool, 4° C	48 Hours
Nitrogen, Nitrate-Nitrite	25	P, G	Cool, 4° C, H_2SO_4, pH<2	28 Days
Nitrogen, Organic	100	P, G	Cool, 4° C, H_2SO_4, pH<2	28 Days
Threshold Odor	1000	G	Cool, 4° C	48 Hours
Oil and Grease	1000	G	Cool, 4° C, H_2SO_4, pH<2	28 Days

1. P = Polyethylene (preferred when acceptable)
2. G = Borosilicate glass with Teflon lined cap

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Table 6-2 (continued)
CONVENTIONALS - WATER

PARAMETER	MINIMUM VOLUME	CONTAINER TYPE	PRESERVATIVE	HOLD TIME
Phenolics, Total	100	Amber, G	Cool, 4° C, H_2SO_4, pH< 2	28 Days
Phosphorus, Total	50	P, G	Cool, 4° C, H_2SO_4, pH< 2	28 Days
pH Lab	40	P , G	Cool, 4° C	6 Hours
Orthophosphate	50	P, G	Cool, 4° C	48 Hours
Reactivity, Cyanide	10	P, G	Cool, 4° C	---
Reactivity, Sulfide	10	P, G	Cool, 4° C	---
Sulfite	50	P, G	Cool, 4° C	24 Hours
Settleable Solids	1000	P, G	Cool, 4° C	48 Hours
Silica, Dissolved	100	P	Cool, 4° C	28 Days
Sulfate	100	P, G	Cool, 4° C	28 Days
Specific Gravity	50	P, G	Cool, 4° C	---
Total (Organic) Sulfur	10	P, G	Cool, 4° C	---
Sulfide	200	P, G	Cool, 4° C, Zinc Acetate, NaOH, pH> 9	7 Days
Total Dissolved Solids	50	P, G	Cool, 4° C	7 Days
Total Suspended Solids	200	P, G	Cool, 4° C	7 Days
Turbidity	50	P, G	Cool, 4° C	48 Hours
Volatile Dissolved Solids	50	P, G	Cool, 4° C	7 Days
Total Volatile Solids	50	P, G	Cool, 4° C	7 Days
Volatile Suspended Solids	200	P, G	Cool, 4° C	7 Days

VOLATILE ORGANICS (VOA) - WATER

PARAMETER	MINIMUM VOLUME	CONTAINER TYPE	PRESERVATIVE	HOLD TIME
Gasoline Range Organics	40 mL	G, Septa Caps	Cool, 4° C, HCl, pH< 2	14 Days
Volatile Aromatics	40 mL	G, Septa Caps	Cool, 4° C, HCl, pH< 2	14 Days
Volatile Organics (VOA)	40 mL	G, Septa Caps	Cool, 4° C, HCl, pH< 2	14 Days
VOA – Method 624	40 mL	G, Septa Caps	Cool, 4° C, $Na_2S_2O_3$	7 Days

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Table 6-2 (continued)
SEMIVOLATILE ORGANICS - WATER

PARAMETER	MINIMUM VOLUME	CONTAINER TYPE	PRESERVATIVE	HOLD TIME
Diesel Range Organics	1000 mL	G	Cool, 4° C	7 Days
Pesticides/PCBs	1000 mL	G	Cool, 4° C	7 Days
Polyaromatic Hydrocarbons	1000 mL	G	Cool, 4° C	7 Days
Herbicides	1000 mL	G	Cool, 4° C	7 Days
Semivolatile Organics	1000 mL	G	Cool, 4° C	7 Days

1. P = Polyethylene (preferred when acceptable)
2. G = Borosilicate glass with Teflon lined cap

METALS - WATER

PARAMETER	MINIMUM VOLUME	CONTAINER TYPE	PRESERVATIVE	HOLD TIME
All Metals (26)	500 mL	P, G	HNO_3, pH< 2	6 Months*
Mercury	50 mL	P, G	HNO_3, pH< 2, 4°C	28 Days
Furnace Metals	100 mL	P, G	HNO_3, pH< 2	6 Months

TCLP - WATER

PARAMETER	MINIMUM VOLUME	CONTAINER TYPE	PRESERVATIVE	HOLD TIME
TCLP Volatiles	100 mL	G	Cool, 4° C	14 Days
TCLP Semi-Volatiles	100 mL	G	Cool, 4° C	14 Days
TCLP Pesticides	100 mL	G	Cool, 4° C	14 Days
TCLP Herbicides	100 mL	G	Cool, 4° C	14 Days
TCLP Metals	100 mL	P, G	Cool, 4° C	6 Months*

* For (1) TCLP parameter 100 mL required; for full TCLP (2) 1000g
* Mercury is 28 days

Notes:

1. P = Polyethylene (preferred when acceptable)
2. G = Borosilicate glass with Teflon lined cap
3. Triple the volumes above for MS/MSD samples
4. Sample hold time is defined as time elapsed from sample collection date and time to sample analysis date and time.
5. TCLP and Semivolatile Organics hold time is defined as time elapsed from sample collection date and time to sample preparation date and time.
6. Refer to the Method specific SOP for further information regarding holding time.

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Table 6-2 (continued)
SOIL HOLD TIME

METHOD	MINIMUM VOLUME	CONTAINER TYPE	PRESERVATIVE	HOLD TIME
Coliform Fecal	1g	G	Cool, 4° C	6 Hours
Chromium, Hexavalent	50g	G	Cool, 4° C	24 Hours
5035	5 g	P, G	Cool, 4° C	48 Hours
TCLP-VOA	105g	G	Cool, 4° C	14 Days
TCLP-SV	105g	G	Cool, 4° C	14 Days
TCLP-Pest/Herb	105g	G	Cool, 4° C	14 Days
TCLP-Metals	105g	G	Cool, 4° C	6 Months*
Total Metals (except Hg)	3g	G	Cool, 4° C	6 Months
Hg	2g	G	Cool, 4° C	28 Days
TPH	30g	G	Cool, 4° C	28 Days
Semi-Volatiles	30g	G	Cool, 4° C	14 Days
Herbicides	50g	G	Cool, 4° C	14 Days
Volatiles	1g	G	Cool, 4° C	14 Days
Conventionals (where applicable)	1g – 100g	G	Cool, 4° C	14 Days
Petroleum Hydrocarbons	30g	G	Cool, 4° C	14 Days
Percent Moisture	25 g	P, G	Cool, 4° C	---
Percent Solids	25 g	P, G	Cool, 4° C	---
Paint Filter Liquids Test	100 g	P, G	Cool, 4° C	---

* Mercury is 28 days
** All soils stored at 4° C

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7.0 SAMPLE CUSTODY

In recognition of the critical nature of sample custody protocols, Microbac Laboratories has implemented stringent standard operating procedures, designed to ensure sample integrity and thorough documentation. This section provides a clear description of sample traceability from sampling kit to final sample disposition.

7.1 Sampling Kits

Microbac Laboratories, at the client's request, will provide sampling kits to the client. Additional information on sampling kits can be found under Section 5.0 of this document and in Microbac SOP LOGIN01.

7.2 Field Custody (Also see Section 6.1)

A vital component of Microbac's quality assurance program is to ensure that a clear and detailed record is kept of all samples and sampling activity. Chain-of-Custody (COC) forms (Figure 7-1) are submitted with all samples. These are kept in the appropriate project files. Water-proof ink is used to label samples as protection against loss of information due to accidental erasure. Microbac's sample custody protocol requires that the following information be recorded.

7.2.1 Date and Time of Sample Collection

7.2.2 Specific description of sample location. This may include a monitoring well number in the case of groundwater sampling. For soil sampling, sample points may be sketched on a site map and confirmed via surveying. For surface water and sediment sampling, the drum number, (if labeled), drum location, suspected contents and phase of drum materials (liquid, solid, or sludge) may be noted, as well as, which layer or layers within the drum were sampled.

7.2.3 Name(s) of sampler(s) will be identified.

7.2.4 A description of weather conditions and general site conditions (disturbed soils, standing water, ongoing activities, etc.) may be provided.

7.2.5 A description of the sampling equipment used, including method for purging monitoring wells may be indicated.

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7.2.6 The specific field ID number for a sample may be recorded. The sample sequence number is the order in which a particular sample was taken with respect to all other samples retrieved at the site. The sample sequence number may also be recorded.

7.2.7 Components or constituents of sample to be analyzed are to be noted.

7.2.8 Signature(s) of sampler(s) will be provided.

7.2.9 Types of preservatives and, if necessary, the results of field check (pH, etc.) may be recorded.

7.2.10 Field measurement data (such as VOA reading, pH, specific conductance) may be recorded.

7.3 Sample Transport

Samples are transported to Microbac's laboratory by one of three modes:

7.3.1 Microbac Courier - on many projects, Microbac will have responsibility for preparation of sample bottles, sample kit assembly and delivery of sample kits to the project site. Microbac will also pick up the samples at the project site and transport them to the laboratory. Microbac drivers will follow these established protocols:

- They will carry proper Microbac identification, which they will be prepared to display before entering project sites;
- They will sign the Chain-of-Custody forms when picking up the samples;
- They are responsible for the integrity and security of samples while in their custody;
- They must secure the vehicle at all times when it is necessary to stop and be away from the vehicle for any reason during the transportation of samples to the laboratory.

All samples returned by Microbac personnel are delivered immediately to the Sample custodian in the sample logging station. The Shipping and Receiving entrance is to be used for such deliveries. If delivery is made after hours, the driver will take the cooler temperature, fill out the appropriate form for the sample custodian and store the cooler in a locked sample storage unit.

7.3.2 UPS, FEDEX, or Other Common Carrier - Transporters are directed to the Shipping and Receiving entrance and the samples are delivered to the Sample custodian.

7.3.3 Client Deliveries - Clients may deliver samples in person via the designated Receiving entrance but must be escorted while within the facility.

7.4 Laboratory Custody Procedures

The National Enforcement Investigations Center (NEIC) of EPA defines custody of evidence in the following manner:

- It is in your possession, or;
- It is in your view after being in your possession, or;
- It was in your possession and then you locked or sealed it to prevent tampering, or;
- It is in a secure area.

7.4.1 Normal Custody Procedures

For the purpose of sample custody, Microbac Laboratories maintains that the laboratory in its entirety is a secure area and all samples received and logged into the laboratory remain in the custody of the Sample custodian, Supervisor or Analyst, until time of disposal. Refrigerators, freezers and other designated sample storage areas will be securely maintained or locked. Only the designated Sample custodian or supervisory personnel will have keys to locked sample storage units until removed for sample preparation or analysis. The following minimum custody procedures are followed for all samples:

- All samples are received and inspected in accordance with Section 7.5.
- The sample custodian signs and dates the chain-of-custody form provided by the client.
- The samples are stored in the appropriate storage unit. (The storage unit is also designated in the KOBRA LIMS when the samples are logged in.)
- Several laboratory documents are used to document which laboratory personnel handled the samples, including bench sheets, sample preparation logbooks, and instrument run logbooks.
- The original copy of the chain-of-custody form is included in the laboratory report to the client and a copy is maintained in the laboratory files.

7.4.2 Internal Laboratory Custody (Internal Chain of Custody (ICOC))

- In order to satisfy more stringent chain-of-custody requirements, the following standard operating procedures can be implemented by Microbac Laboratories, Inc. upon the request of the client:

- The work request prepared by the CSS must specify which projects require extended internal laboratory custody. All sample bottles designated for ICOC are identified on the label for easy identification.

- After the samples are logged into the KOBRA LIMS, a unique container number and barcode is generated and printed on the bottle label (Figure 7-4). Each laboratory staff member is also assigned a badge and barcode in order to quickly record all exchanges.

- Samples must remain in secure sample storage units until removed for sample preparation or analysis. All transfers of samples into and out of storage will be posted to the KOBRA LIMS using a standard barcode reader.

- Removal of samples from storage requires a barcode scanning procedure that produces an electronic record of the transaction in the KOBRA LIMS.

- After a sample container has been removed from storage, the analyst is responsible for the custody and integrity of the sample. While the samples are in the custody of the laboratory, they must be locked in the storage units if not in immediate custody of the analyst.

- Samples returned to the storage units must be scanned to document the transfer from analyst back to the custodian.

- The custodian will scan each container at the time of disposal of the sample container. (Transfer of sample extracts and digests are documented on the laboratory preparation benchsheets.)

- A special report from the KOBRA LIMS is used to produce an Internal Sample Custody Form (See Figure 7-3). These records are included in the final report to the client as well as the signed original copy of the field COC form.

7.5 Sample Receipt and Inspection

The sample custodian or designated assistant will receive all incoming samples. The following procedures are outlined in Microbac SOP LOGIN01. The following information is documented on the Sample Receipt Form (Figure 7-2). The custodian will frisk the cooler for radioactivity if required by the project Quality Assurance Project Plans (QAPP). The custodian will open the shipping containers and note the presence/absence of Chain-of-Custody forms and seals, airbills, or bills-of-lading. The sample temperature is then read. The custodian will examine the shipping container to verify the integrity of the

sample(s) and examine the sample documentation and identification to assure it is correct and the proper preservative has been used. The preservatives are checked by the sample custodian. If inspection indicates samples were damaged in transit, the shipping container will be moved to the hood in Log-in, assessments of the damage will be made and the appropriate services representative will be notified. The client will be immediately contacted and determination of the degree of hazard will be made. If damage is minimal and the client requests it, an attempt to salvage the sample(s) will be made if it can be done safely. In the event of damaged hazardous samples, Microbac's Spill Response Team will be notified per the Chemical Hygiene Plan.

Samples received after hours, when the sample custodian is absent, will be placed in the walk-in refrigerator. The person receiving the shipping container will sign for the container, take the cooler temperature if appropriate and place the dated forms on the Custodian's desk. The sample custodian will log in the samples on the next business day. The KOBRA LIMS system will indicate the actual date and time received and the original receipt documentation will be included with the COC form.

The sample custodian will compare the COC forms and labels to verify agreement of information contained therein. If major discrepancies are found, they will be documented on the Sample Receipt Form and the services representative will be immediately notified. Written documentation of all problem resolutions will be placed in the project/case file. If there are no problems with the samples received, the sample custodian files the signed COC form and Sample Discrepancy Form in the project/case file. After the sample is logged in, it will be immediately stored under the proper conditions.

Sample labels or other sample documents that appear to be contaminated due to sample breakage or other problems will be dried under a fume hood and be separately sealed in plastic bags, if necessary, prior to being placed in case files. The services representative must also be notified.

7.6 Sample Logging Procedures

The following procedures are outlined in Microbac SOP LOGIN01. The sample custodian is responsible for logging all samples into the Laboratory Information Management System (KOBRA LIMS), signing the COC form, completing the Sample Receipt Form, reporting all problems, inconsistencies, or anything questionable to the services representative, placing all samples in storage, monitoring conditions in sample storage areas, and maintaining records for laboratory COC.

As a new login number is initiated in the KOBRA LIMS, the sample custodian generates and/or enters the following information about the project shipment:

- Microbac Login Number
- Client Project Identification
- Mode of Transportation
- Date and Time Received/Date Due
- Matrix/Sample ID
- Date and Time of Sample Collection
- Storage Location/Container Size/Type/Preservative
- List of Analyses
- Notation of Problems/Special Instructions

In order to maintain sample identity, each sample received will be assigned a unique sample I.D. number. The KOBRA LIMS will assign the unique Microbac Sample Number at the time of log-in, as shown in the following example:

EXAMPLE: L08010001-01

The first nine digits identify a group of related samples and becomes the login number and report number. The two-digit number after the dash identifies a specific sample in the order. These numbers are used by Microbac for continuous identification of the sample from receipt to completion of analysis. In the event of multiple samples for a single analysis, such as 2 vials for volatile organic compounds, letter designations will be added to the end of the identification number. Sample containers will be clearly identified with the appropriate sample number. The sample labeling process is accomplished by the KOBRA LIMS system which prints the required number of computer labels (Figure 7-5). Extract vial numbers and metal digests will correspond to the Microbac sample number from which they originated. These numbers will also be recorded on sample tracking documentation.

7.7 Sample Storage

Samples and extracts will be stored in uniquely identified refrigerators which are in secure areas of the laboratory. The sample custodian or designated assistant will check the temperature of each refrigerator in the log-in area, twice daily (once on weekends and holidays) and maintain a record book. This record book will be reviewed on a monthly basis by the Support Services Supervisor to note any trends or inconsistencies. The acceptable range for sample storage is 0-6° C. The sample custodian will notify the Support Services Supervisor of any refrigerator temperature problem which cannot be

corrected by simple thermostat adjustment. A list of emergency repair numbers for the refrigeration units is attached to the walk-in refrigerator's exterior.

7.8 Sample Distribution and Tracking

Both the preparation and the analysis of samples will be documented using special forms (logbooks). Once analysis is complete, the analyst will return the unused sample to the sample custodian area for return to the main cooler or to the Sample Archive Room, whichever is appropriate. Figure 7-3 provides an Microbac Internal Sample Custody form. Samples will be returned to their original storage units after completion of analyses. Samples which have exceeded their regulated holding period will be placed in the Sample Archive Room. They are routinely stored in this area for a minimum of 14 days after the due date for the analytical report. They are then disposed per protocol listed in Microbac's "Waste Management SOP". Extended archive beyond 14 days with refrigeration is available for specific projects or as required by contract.

It is important to note that samples received for analysis of VOA are segregated from other samples. Standards are also segregated from all samples in designated storage units.

7.9 Sample Security

All sample storage refrigerators are equipped with a lock. The units are monitored by the sample custodian during business hours. After business hours, the unit is kept locked and only selected personnel have access (by key) to the sample storage unit. All samples, extracts and digests will be stored in segregated areas.

7.10 Laboratory Building Security

All access doors to the building, with the exception of the main entrance to the reception area and the employee entrance, remain locked. Only select Microbac employees have keys to the access doors to the building. The main entrance and the employee entrance is unlocked only on business days between the hours of 8:00 AM and 5:00 PM. The facility is also equipped with an electronic alarm system and employees are assigned unique pass codes for entry.

7.10.1 Employee Access

All employees must enter the building through the employee entrance. Keys are required except during normal business hours. Employees may exit

through the employee entrance when it is locked without the use of a key, but keys are required for re-entry.

7.10.2 Visitors, Vendors and Deliveries

All visitors to the office or laboratory must enter the main lobby through the main entrance and sign in with the receptionist. Visitors must be escorted at all times and in all areas of the facility. Vendors and delivery personnel are directed to use the door to the Shipping and Receiving area. Access to this door is controlled by the Microbac employee on duty, and upon entrance, the visitor must be escorted at all times.

7.11 Sample Subcontracting/Shipping

For certain projects, it may be necessary for Microbac to subcontract some analyses. Samples to be analyzed will be shipped to the contracted laboratory using the Microbac sample kit. To prevent sample breakage, only EPA-approved sample containers will be used. Freezer packs will be included in each sample kit to serve as a separation divider for the samples and to increase the cooling capacity.

In order to maintain the temperature of samples at ≤ 6° C, wet ice will be supplied by the client when required. Each shipping kit will contain the following:

- Partitions to hold sample bottles;
- Freezer pack(s) (if ice is not used);
- Chain-of-Custody form/Log-out form;

The sample kit will be packed in a hardside cooler. The sample kit will be sealed with Microbac Chain-of-Custody seals.

7.12 Electronic Data Security

Data integrity is insured through KOBRA LIMS multi-level security. Access to the specific user privileges can be individually controlled. Each user has their own user name and password which allows certain privileges. Hard copy data, which contains all of the data regarding a group of samples, are kept in a master file, labeled with the login numbers. Microbac provides electronic data deliverables (EDD) in client specified formats. Both e-mail and CD-ROM are commonly used for electronic transfer of data.

7.13 Automated Field Procedures

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Microbac has developed electronic field tools for special projects to assist the sampler and sample custodian in many of the activities described previously in this section. The use of pre-programmed personal data assistants (PDA), barcode technology, and laptop computers enable the field personnel to focus on sample collection, while relying on the electronic tools to handle the laborious paper handling chores. Microbac enters the project sampling locations and the required analytical methods into the KOBRA LIMS, and downloads the information to the PDAs database tables prior to sampling. The sampler uses the barcode enabled PDA and the pre-labeled sample containers to more quickly and accurately collect the appropriate samples. After each sampling event the data from the PDA is transferred to a laptop computer, and the associated files are then uploaded to the KOBRA LIMS. Thus, many of the manual data field and laboratory data handling chores are handled electronically.

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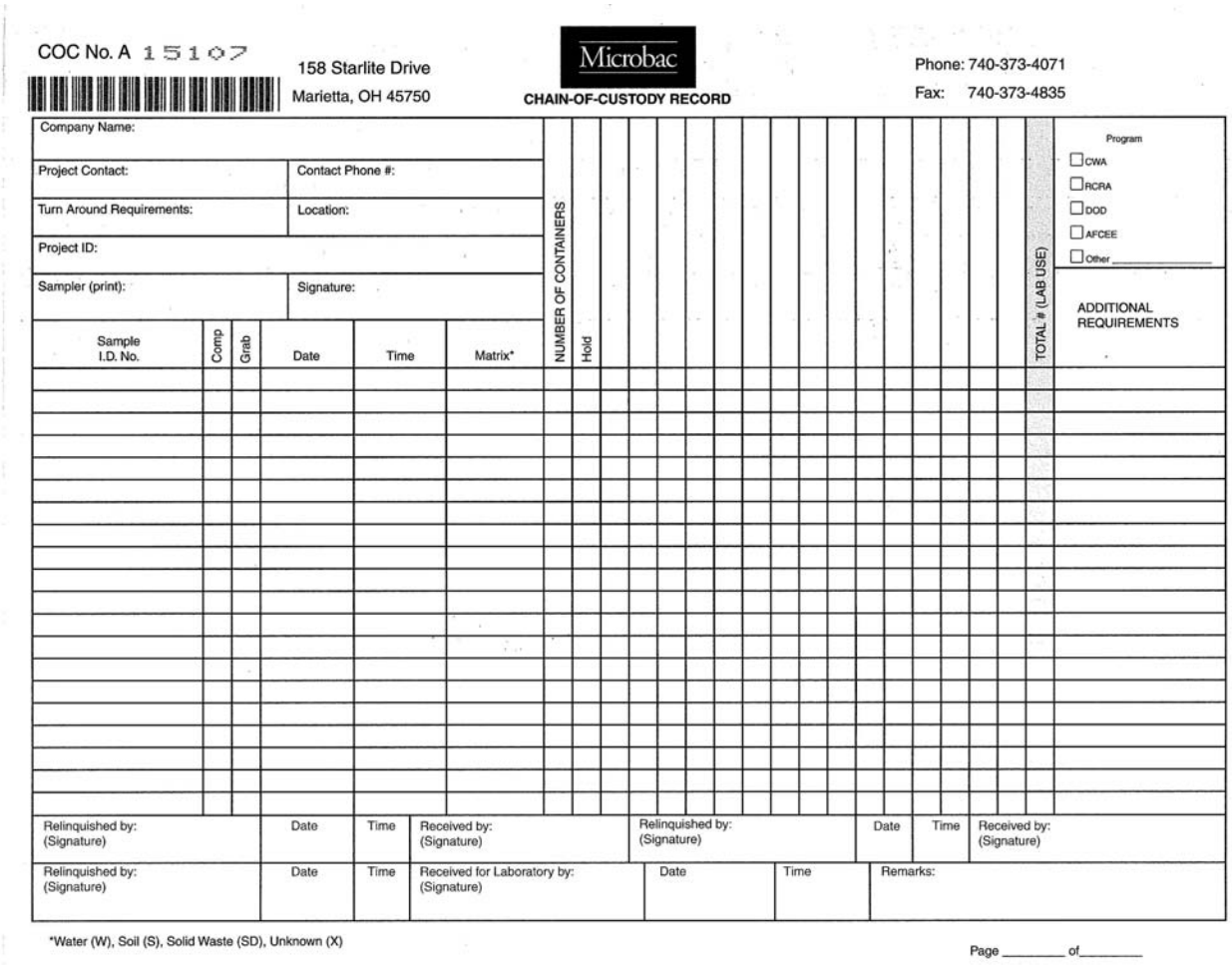
Figure 7-1
MICROBAC CHAIN-OF-CUSTODY RECORD



COC No. A 15107

158 Starlite Drive
Marietta, OH 45750

Microbac
CHAIN-OF-CUSTODY RECORD

Phone: 740-373-4071
Fax: 740-373-4835

Company Name:

Project Contact: | Contact Phone #:

Turn Around Requirements: | Location:

Project ID:

Sampler (print): | Signature:

Program: ☐ CWA ☐ RCRA ☐ DOD ☐ AFCEE ☐ Other

ADDITIONAL REQUIREMENTS

Sample I.D. No.	Comp	Grab	Date	Time	Matrix*	NUMBER OF CONTAINERS	Hold	TOTAL # (LAB USE)

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Relinquished by: (Signature)	Date	Time	Received by: (Signature)

Relinquished by: (Signature)	Date	Time	Received for Laboratory by: (Signature)	Date	Time	Remarks:

*Water (W), Soil (S), Solid Waste (SD), Unknown (X)

Page _____ of _____

Figure 7-2
Sample Receipt Form

1000001675

COOLER INSPECTION

Received: 09/14/2009 10:02
Delivery Method: UPS
Opened By: Robin Klinger
Comments:

Login(s): L09090265 L09090266 L09090267

Cooler(s)

Cooler #	Temp Gun	Temp	Tracking #	COC #	Comments
0013836	H	18.0	1Z63V9170192071486	091209-01-F	

1	Yes	Were shipping coolers sealed?
2	Yes	Were custody seals intact?
3	NA	Were cooler temperatures in range of 0-6?
4	NA	Was ice present?
5	Yes	Were COC's received/information complete/signed and dated?
6	Yes	Were sample containers and labels intact and match COC?
7	Yes	Were the correct containers and volumes received?
8	Yes	Were correct perservatives used? (water only)
9	Yes	Were pH ranges acceptable? (voa's excluded)
10	NA	Were VOA samples free of headspace (<6mm)?
11	Yes	Were samples received within EPA hold times?

Look closer. Go further. Do more.

Microbac - Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750
Tel: (740)373-4071 Fax: (740)373-4835

Figure 7-3
MICROBAC INTERNAL SAMPLE CUSTODY FORM

Microbac Laboratories Inc.
Internal Chain of Custody Report
Login: L12020203
Account: 2551
Project: 2551.094
Samples: 35
Due Date: 17-FEB-2012

Samplenum	Container ID	Products
L12020203-01	935121	826-SPE

Bottle: 1

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish	pH
1	LOGIN	COOLER	V1	07-FEB-2012 17:09	RLK		<2
2	ANALYZ	V1	ORG4	08-FEB-2012 08:13	MRT	JKT	

Bottle: 2

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish	pH
1	LOGIN	COOLER	V1	07-FEB-2012 17:09	RLK		<2
2	ANALYZ	V1	ORG4	08-FEB-2012 08:13	MRT	JKT	
3	STORE	ORG4	A1	21-FEB-2012 08:09	JKT	MRT	

Samplenum	Container ID	Products
L12020203-02	935122	826-SPE

Bottle: 1

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish	pH
1	LOGIN	COOLER	V1	07-FEB-2012 17:09	RLK		<2
2	ANALYZ	V1	ORG4	08-FEB-2012 08:13	MRT	JKT	
3	STORE	ORG4	A1	21-FEB-2012 08:09	JKT	MRT	

Bottle: 2

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish	pH
1	LOGIN	COOLER	V1	07-FEB-2012 17:09	RLK		<2
2	ANALYZ	V1	ORG4	08-FEB-2012 08:13	MRT	JKT	
3	STORE	ORG4	A1	21-FEB-2012 08:09	JKT	MRT	

Bottle: 3

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish	pH
1	LOGIN	COOLER	V1	07-FEB-2012 17:09	RLK		<2
2	ANALYZ	V1	ORG4	08-FEB-2012 08:13	MRT	JKT	
3	STORE	ORG4	A1	21-FEB-2012 08:09	JKT	MRT	

A1 - Sample Archive (COLD)
A2 - Sample Archive (AMBIENT)
F1 - Volatiles Freezer in Login
V1 - Volatiles Refrigerator in Login
W1 - Walkin Cooler in Login

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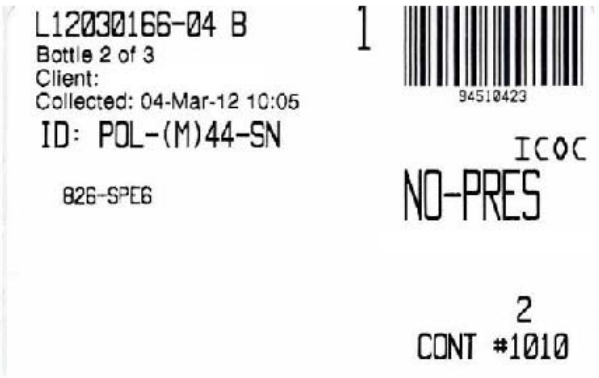
Figure 7-4
MICROBAC BOTTLE LABEL



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8.0 ANALYTICAL PROCEDURES, STANDARDS, AND REAGENTS

This section provides information about the method selection process and provides general analytical policies and procedures which are common to all methods in use in the laboratory. The process for method selection is described along with our policy on multiple versions of the same method, and addresses method validation and project specific criteria. Procedures are outlined for selection and cleaning of laboratory glassware, the requirements for Class A glassware, and the preparation and documentation for reagents and analytical standards. Also included are procedures for logbooks, proper container labeling, and requirements for storage and disposal. This information is addressed in more detail for each analytical method in the specific SOPs which are listed in Appendix B.

8.1 Analytical Methods

8.1.1 Selection

Methods which are used for compliance with local, state, US-EPA or other regulatory authorities must meet minimum performance criteria. Methods for which Microbac maintains performance criteria are listed in the SOP list found in Appendix B. Other methods exist that can be used for screening, or for estimating concentrations, or may not have defined performance specifications. Such methods are used for limited applications, or when written approval is granted by the client or agency. In general, analytical methods that are selected for implementation by Microbac must meet one of the following criteria:

- It is a promulgated version of an EPA approved method;
- It is another version of an EPA method that is specified in writing by the client or the project specific QAPP;
- It is a modified EPA method, or a standard method other than EPA which has been specified by the client or in the project specific QAPP. Examples include American Society for Testing and Materials (ASTM), National Institute for Occupational Safety and Health (NIOSH), or a client written method for which an official authorization has been given for use.

8.1.2 Method References

It is Microbac's policy to reference preparatory and analytical methods in appropriate documents including SOPs, preparation logsheets, instrument runlogs, method detection limit (MDL) studies, and analysis reports. The SOP will reference the official source the current version of each method. Unless

directed otherwise, Microbac will use the latest version of a method for which a validation study and SOP exists. It is our goal to implement the latest promulgated version of a method within the deadlines established by the agency or project specific QAPP. It may be necessary to maintain multiple versions of the same method due to project specific QAPPs which are often several years old. Project management tools are used by the client Chemist/Data Specialist (CDS) to assure proper versions are used. Additional information on this process may be found in Microbac SOP 44.

8.1.3 Method Validation

The procedures employed for method validation are found in Microbac SOP 45. The basic requirements include meeting all the reference method criteria for sample preparation, calibration and linearity checks, analytical precision and accuracy, MDL, method blank, surrogates, and the development and approval of the method SOP. Complete records of each validation study are maintained on file.

8.1.4 Project or Client Specific Criteria

The performance criteria established in the tables found in Microbac's analytical SOPs represent laboratory generated statistics often from multiple analysts and instruments. The reporting limits (RL), for example do not necessarily represent the lowest analyte concentrations that can be achieved by the method, nor are they guaranteed for every sample. In other cases, these basic laboratory statistics are superseded by client or project specific requirements for MDL, RL, acceptable control limits, or other special requirements. These situations will require the use of project specific QAPPs and/or SOPs. These are separate documents that are reproduced and distributed in project "kick-off" meetings in which specific project requirements are communicated to the QC and production staff. In such cases, project specific analysis codes are programmed into the KOBRA LIMS which specify the required RLs and control limits.

8.2 Glassware

The measurement of trace constituents in water, demands methods capable of maximum precision and sensitivity. Since the very sensitive analytical systems are subject to errors from improper choice of apparatus, as well as, the contamination effects due to improper cleaning procedures, the selection and proper care of laboratory glassware and sample containers play an important role in our quality control program. Laboratory vessels serve three functions: storage of reagents and samples, measurement of solution volumes, and

confinement of reactions. Borosilicate glass, i.e., "Pyrex" or "Kimax," is the mainstay of the laboratory. The analytical method usually states whether or not borosilicate type glassware is acceptable. A notable example is the analysis of boron, where the digestions are carried out in plastic or Vycor.

8.2.1 Volumetric Glassware

The precision of volumetric work depends in part, on the precision with which volumes of samples and other reagents can be measured. By common usage, accurately calibrated glassware for precise measurement of volume has become known as volumetric glassware. Glassware that meets Federal Specification for Volumetric Glassware is designated as Class A. Except for The National Institute of Standards and Technology (NIST) certified glassware, Class A is the most precise grade and is available in burettes, volumetric flasks, and volumetric pipettes. Class A glassware must be used in the following laboratory procedures:

- Preparation of all primary standards require Class A volumetric flasks and pipettes;
- Preparation and dilution of stock standards require Class A flasks and Class A pipettes;
- All titrimetic standardizations require the use of Class A burette, volumetric flasks and pipettes;
- Class A glassware will be used at all times as specified in the standard analytical method.

8.2.2 Glassware Cleaning Requirements

Table 8-1 summarizes the general cleaning procedures to be used for all laboratory glassware and reusable sample bottles (glass). All glassware must be scrupulously cleaned in order to remove any possibility of contamination of the sample. (**NOTE**: Under no circumstances are sample containers for trace level inorganic or organic analyses ever cleaned and reused).

8.3 Reagents and Solvents

8.3.1 Reagent Water

Reagent water produced at Microbac meets the standards of ASTM Type II Water (for the electrical conductivity and resistivity requirements). Reagent water is produced by an IonPure System maintained by US Filter and consists of a series of 5 filter beds:

- Carbon bed (removes chlorine and organics)
- Cation bed (removes heavy metals)
- Anion bed (removes negatively charged ions)
- Mixed bed (removes remaining negatively and positively charged ions)
- Mixed bed (removes remaining negatively and positively charged ions)

The electrical resistivity is checked daily by means of a remote sensor electrical resistivity meter and recorded by login department personnel. This remote sensor is located in-line, immediately following the filter beds. The finished reagent water must maintain at a minimum a resistivity of 17 MΩ-cm at 25° C. This is an in-house point of reference for monitoring only.

The two mixed bed tanks are both equipped with a 5 range purity light. These tanks are in series so a light monitoring system is utilized as a control to determine when tanks need to be replaced. When the first in the series shows an indicator light change from green to red, US Filter is called and service is requested. The second mixed bed tank continues to service the laboratory during this periods of time. The tanks indicator lights and the electrical resistivity meter are checked twice daily until the tanks are changed. After the tanks are changed, the lines are flushed and the electrical resistivity is rechecked. This system maintains if not exceeds a resistivity of 1.0 MΩ-cm resistivity and 1.0 μS/cm conductivity.

The electrical conductivity is checked daily (Monday – Friday) by means of an electrical conductivity meter and recorded by conventional laboratory personnel. The finished reagent water must have a maximum electrical conductivity of 1.0 μS/cm at 25° C to meet acceptance criteria. This reading is taken on water from the deionized water tap in the conventionals laboratory. This is the furthest point-of-use tap from the filter beds. Additional UV polishing systems are used in the volatile laboratory to eliminate any trace organics and an ion polishing system is used in the metals laboratory.

8.3.2 Raw Materials

The raw materials which are used in the laboratory must be of a grade which meets or exceeds the method specifications. Inorganic reagents must be American Chemical Society (ACS) reagent grade or better. Acids used for preservatives or digestion for metals methods must be of a grade specified for trace metals. Solvents which are used to prepare standards, reagents and to extract samples must be of the highest grade available for the applicable method. Each lot of solvents or acids must be tested prior to use in the laboratory by using the analysis of a solvent (or reagent) blank which is concentrated to the same level as the sample extracts. Analysis by the method

must confirm the absence of interfering substances before the lot is introduced for client sample analysis. Reagents which are used in the digestion/extraction/analysis process are certified as an ultra pure grade by the manufacturer with certification papers kept on file. All chemicals and reagents are labeled with the date received, date opened and date of expiration.

The laboratory will ensure that all solvents, reagents, standards, and other materials that affect the quality of the analyses, will not be used until they have been inspected for compliance with required method or program specifications. The laboratory will not report data from any analysis, if quality control checks fail to confirm acceptability of solvents, reagents, standards, or materials consumed in the analysis. The laboratory will test and verify all reagents, solvents, and standards prior to use on Department of Defense (DoD) samples.

8.3.3 Preparation Logbooks

The preparation of reagents is done in accordance with requirements and the method specific SOP. The laboratory maintains detailed recipes and preparation records within the KOBRA LIMS, or in hardcopy, for each analytical reagent. Required content of the reagent records are outlined below and an example KOBRA LIMS record is presented as Figure 8-1.

- Reagent ID
- Recipe – lists the preparation details
- Preparer's initials
- Date prepared
- Expiration Date
- Disposal Date
- Concentrations of constituents
- Units
- Reviewer's initials

The preparation date and expiration date must be the same for all reagents prepared fresh daily. The department supervisor is required to perform a periodic review of the logbooks.

8.3.4 Labeling

Labeling of laboratory reagents must contain the following minimum content:

- Reagent name
- Concentration and units
- Initials of preparer

- Date prepared (mm-dd-yy)
- Expiration Date (mm-dd-yy)
- Reagent ID

The reagent ID provides traceability to the KOBRA LIMS records for the preparation described in Section 8.3.3.

8.3.5 Storage

All reagent storage at Microbac is done in such a way that safety is always considered first. All flammable compounds are stored in a flammable cabinet. Volatile reagents are always stored and used in a well-ventilated area. Table 8-2 gives a list of common reagents and solvents used at Microbac and the method with which they are stored. Unless otherwise stated, borosilicate glass or polyethylene bottles are acceptable for storage of reagents used in inorganic analyses.

8.3.6 Waste Disposal

Since all laboratory work with chemicals eventually produces waste, we are aware of our moral and regulatory obligations to utilize sound waste management policies and procedures. Therefore, the disposal of reagent waste at our facility is an issue of great importance and one which has been given much attention. All laboratory waste is accumulated, stored and disposed in accordance with all federal and state laws and regulations. The specifics of Microbac's waste management system are included in the Microbac SOP33 – Laboratory Waste Management, a copy of which may be reviewed upon request.

8.4 Analytical Standards

This section describes all of the procedures required to document the preparation and use of calibration and quality control standards. Policies covered include source material selection, receipt, traceability, preparation and labeling of stock, intermediate, and working standards, KOBRA LIMS records, labeling, storage, and disposal. Microbac maintains complete records for standards preparation and traceability electronically within the KOBRA LIMS. Figures 8-2 through 8-5 present example records from the electronic system.

8.4.1 Standard Sources and Preparation

The accuracy of data produced from analytical instrumentation depends primarily on the quality of calibration standards. Microbac uses fully

documented procedures to assure that calibration and quality control standards are prepared to the highest level of accuracy available for a particular analyte. Concentrated stocks are prepared only with the highest purity standards available. Only standards that are certified traceable to NIST or are A2LA certified will be used. ISO Guide 34 in conjunction with ISO 17025.

8.4.2 Standard Receipt and Traceability

Once purchased standards are received, they are immediately brought to the area in which they are to be used. At this point, the supervisor or analyst will place the standard in its proper storage area. Volatile standards are stored in a freezer. Semi-volatile standards which are purchased neat are stored at room temperature. Stock standards purchased commercially are stored according to the following:

- Water or methanol based standards are stored at 4° C.
- Methylene chloride or hexane based standards are stored in a freezer.
- Standards of compounds which easily precipitate are stored at room temperature.
- PCB spiking standards are stored at room temperature.

All standards will be stored separately from samples. Material Safety Data Sheets (MSDS) provided with all standards, will be stored in a notebook and will be freely available to any analyst. Other certification sheets will be kept on file within each lab division and stored for future reference. Since much of the important information is provided on the label, (manufacturer, lot number, concentration, purity, formula, compound name and health information), it also serves as a good source of information.

8.4.3 Certificate of Analysis

The laboratory will maintain a system for identifying and filing certificates of analysis (COA) for all purchased standards. The analyst will log the COA into the KOBRA LIMS, which assigns a unique serial COA number. The laboratory will file electronic (pdf) copies of each COA in the COA folder of the network. The filename is in the format <COA#.pdf>. See Figure 8-2.

8.4.4 Primary Standards

Primary standards are used in the classical chemistry laboratory to standardize selected titrants. These chemicals must specify “primary standard grade” to be acceptable for this purpose. The laboratory maintains primary standards for potassium hydrogen phthalate (KHP) and potassium dichromate, which can be

used to standardize a wide variety of acid/base and redox titrants, if necessary. The department supervisor is responsible for the custody of these and other standard reference materials.

8.4.5 Neat Standard Materials

Most calibration and quality control standards are purchased as a concentrated stock solution from an approved vendor, however high purity neat standards may be used in some custom applications. Only materials of a known, certified purity are chosen for this purpose. Certificates of analysis for each of these neat materials are archived in KOBRA LIMS to provide complete documentation and traceability.

8.4.6 Stock Solutions

A record of the preparation of concentrated stock standards will be maintained for each parameter. When a primary standard or concentrated stock standard is prepared, a number is assigned to that standard, along with the date, analyst, compound, lot number, purity net weight, weight adjusted for purity, dilution volume and actual concentration are recorded. When a standard solution is prepared from a neat compound, if the entire sample is used the label is removed from the container and attached to the standards form. When the parent stock is purchased through a commercially prepared source, these standards (i.e., 1000 ppm metal standards for atomic absorption) must have the vendor, concentration, expiration date and lot number of this stock recorded into the standard logbook. Often commercially prepared mixes are purchased.

8.4.7 Intermediate Standards

Once the stock standards are prepared, they are then diluted to prepare intermediate-level standards and/or final working standards using volumetric pipettes and glassware. The choice of the correct apparatus is very important (see Section 8.0). It is in the intermediate stage that more than one parameter is mixed in the right concentration for the final mix. This dilution must also be documented in the same manner as the concentrated stocks. An example KOBRA LIMS record is presented in Figure 8-3.

8.4.8 Working Standards

These are the final dilutions that are used in the calibration or analysis stage of the method. The same procedures and KOBRA LIMS documentation that were described for intermediate standards also apply to the working solutions.

8.4.9 Electronic Records

Electronic records for the preparation, documentation, and traceability of calibration and quality control standards are maintained in the KOBRA LIMS. Each stock, intermediate, and working standard has a unique number that is cross-referenced to the electronic tables. See Figures 8-2- 8-5.

8.4.10 Labeling

Labeling of calibration and quality control standards must contain the following minimum content:

- Standard name
- Concentration and units
- Initials of preparer
- Date prepared
- Expiration date
- Standard number (unique reference)

Due to the very small size of standard containers employed in gas chromatographic analyses, space may not allow for all of the above information.

8.4.11 Storage

Analytical and quality control standards are stored in the individual laboratories. (See Table 8-3) The conventionals, extraction, semivolatile organic, and volatile organic have refrigerators which are dedicated to reagents and standards. Standards for organic methods are stored in borosilicate glass containers with a Teflon lined cap which have been cleaned and solvent rinsed. Standards used in the conventionals laboratory are stored in containers compatible with the analyte and solvent i.e., of the same composition as the required sampling container. Metals standards are stored at room temperature and placed in a storage cabinet. Storage of standards used in atomic absorption analyses must be in a polyethylene container, except where noted in the method, i.e., silver. Standards which have expired must be immediately removed from the storage unit and taken to the support services supervisor for proper disposal. Samples and standards must never be stored in the same refrigerator.

8.4.12 Disposal

The disposal of all standards is done in accordance with procedures outlined in the Microbac “Waste Management SOP” referenced previously.

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8.5 Standardization of Titrating Solutions

Table 8-4 gives a listing of the reagents used as titrants. All solutions are purchased pre-standardized by the manufacturer. The manufacturer's certificate of analysis provides the following information:

- Nominal Concentration (Normality)
- Concentration Limits
- Lot Number
- Primary Standard (Certified traceable to NIST)

As a daily quality control check on the commercial solutions, the laboratory verifies the certified values through the analyses of a laboratory control sample. The standardization is checked monthly using the primary standard. If the results of this analysis indicates a problem, i.e. an out of control situation, then re-standardization against primary standards is required. Alternatively, the out-of-specification solutions are discarded and fresh solutions are obtained as replacements.

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TABLE 8-1
LAB GLASSWARE CLEANING PROCEDURES

Analysis/Parameter	Cleaning Procedure (in order specified)
Extractable Organics (including Pesticides and Herbicides)	1-3, 8, 4, 7, 10, 12, 13
Purgeable Organics	Use either disposable glassware or steps 2, 3, 4, 7
Trace Metals: glass plastic	1-6 1-4, 15, 6
Nutrients	1-4, 12
Minerals, COD,BOD, Radiochemistry, Cyanide, Phenols	1-4, 12
Residues	1-4, 9 or 10, 12
MBAS	1-4, 14, 12
Petroleum Hydrocarbons	1-4, 7, 14, 13
Oil & Grease	1-4, 7, 14, 9

Cleaning Procedures:

1. Remove all labels using sponge or acetone.
2. Wash with hot tap water and a brush to scrub inside of glassware, stopcocks, and other small pieces, if possible, using a suitable laboratory-grade detergent.
   - Organics - Liquinox, Alconox or equivalent
   - Inorganic anions - Liquinox or equivalent
   - Inorganic cations - Liquinox, Alconox, Micro or equivalent
   - Bacteriologicals - must pass an inhibitory residue test
3. Rinse thoroughly with hot tap water.
4. Rinse thoroughly with deionized water.
5. Rinse or soak with 10% Nitric Acid.
6. Rinse 3 times with deionized water.
7. Rinse thoroughly with pesticide grade Methanol.
8. Rinse with 25% sulfuric acid.
9. Bake at 105°C for 3-4 hours.
10. Bake at 180°C for 3-4 hours (prior to use as per method).
11. After use, rinse with last solvent used.
12. Store inverted or capped with suitable material or suitable container stopper.
13. Last step (prior to use) must be a rinse with the solvent used in analysis.
14. Rinse thoroughly with acetone.
15. Rinse or soak with 1:1 HCl (Hydrochloric Acid).

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TABLE 8-2
REAGENT STORAGE

REAGENT	METHOD OF STORAGE
Hydrochloric Acid (HCl) Sulfuric Acid (H_2SO_4) Nitric Acid (HNO_3) Acetic Acid ($C_2H_4O_2$) Phosphoric Acid (H_3PO_4)	Stored in original containers in a vented cabinet designed for acid storage.
Ammonium Hydroxide (NH_4OH)	Stored in original containers in a vented cabinet designed for base storage.
Acetone (C_3H_6O) Methanol (CH_3OH) Propyl Alcohol (C_3H_8O) Isopropyl Alcohol (C_3H_8O) Pyridine (C_5H_5N) Ethyl Acetone ($C_4H_8O_2$)	Stored in original containers in a vented cabinet designed for flammable materials.
Chloroform ($CHCl_3$) Methylene Chloride (CH_2Cl_2) Ethyl Ether ($C_4H_{10}O$) Hexane (C_6H_{14})	Stored in original containers in a vented cabinet designed for volatile organics storage.
Freon-113	Stored in original containers in a vented corner of the liquid-liquid continuous extraction sample prep area.

TABLE 8-3
STANDARD PREPARATION AND SOURCES

Instrument Group	Concentration	Storage	Preparation from Source	Standard Expiration
Volatile				
Gas Chromatography/ Mass Spectrometry (GC/MS)	primary stock mixture is at variable concentrations	Freezer	primary stock mixtures are commercially prepared solution mixes	6 months or manufacturer recommended expiration date
	intermediate standards are at variable concentrations	Freezer	intermediate standards are prepared from commercially purchased stock mixes	6 months
	working concentration	Used immediately	working standards are prepared from intermediates	prepared fresh daily
Semi-volatile				
Gas Chromatography (GC)	primary stock mixture is at variable concentrations	Freezer	primary stock mixtures are commercially prepared solution mixes	6 months or manufacturer recommended expiration date
	intermediate standards are at variable concentrations	Freezer	intermediate standards are prepared from commercially purchased stock mixes	6 months
	working concentration	Used immediately	working standards are prepared from intermediates	prepared fresh daily
Gas Chromatography/ Mass Spectrometry (GC/MS)	primary stock mixture is at variable concentrations	Freezer	primary stock mixtures are commercially prepared solution mixes	6 months or manufacturer recommended expiration date
	intermediate standards are at variable concentrations	Freezer	intermediate standards are prepared from commercially purchased stock mixes	6 months
	working concentration	Freezer	working standards are prepared from intermediates	1 months
HPLC	primary stock mixture is at variable concentrations # 100 ppm	Freezer	primary stock mixtures are commercially prepared solution mixes	6 months (8310),1 month (8330) or manufacturer recommended expiration date
	working concentration	Freezer	working standards are prepared from commercial stocks	24 hours
Atomic Absorption furnace and cold vapor	primary stock mixture is at variable concentrations ≥ 1000 ppm	Room temperature	primary stock mixtures are commercially prepared solution mixes	12 months or manufacturer recommended expiration date
	intermediate standards are at variable concentrations ≥ 10 ppm (high standard)	Room temperature	intermediate standards are prepared from commercially purchased stock mixes	6 months
	working concentration	Room temperature	working standards are prepared from intermediates	24 hours

TABLE 8-3 (continued)
STANDARD PREPARATION AND SOURCES

Instrument Group	Concentration	Storage	Preparation from Source	Standard Expiration
Inductively Coupled Plasma	primary stock mixture is at variable concentrations ≥ 1000 mg/L	room temperature	primary stock mixtures are commercially prepared solution mixes	12 months or manufacturer recommended expiration date
	intermediate standards are at variable concentrations ≥ 10 mg/L (high standard)	room temperature	intermediate standards are prepared from commercially purchased stock mixes	1 month
	Working concentration	room temperature	working standards are prepared from intermediates	prepared fresh daily
Total Organic Carbon (TOC)	primary stock 1000 mg/L solution	room temperature	primary stock is a commercially prepared solution	6 months or manufacturer recommended expiration date
	Working concentration	used immediately	working standards are prepared from intermediate	prepared fresh daily
pH Meters	pH = 4,7,10 Premixed	room temperature	used as received commercial stocks	fresh daily
Turbidimeters	Pre-mixed 4 Gelex Standards NTU 0-1 NTU 1-10 NTU 10-100 NTU 100-1000 scale Check Standard Primary (Formazin)	room temperature	used as received commercial stocks prepared from 4000 NTU Stock	restandardized quarterly manufacturer recommended expiration date
Specific Conductivity Meter	Neat	Room temperature.	stock: 14,130 umho/cm working Standard:	6 months
	Working concentration	4° C	1413 umho/cm	24 hours
Conventional (SmartChem)				
Ammonia	primary stock = 1000 mg/L	Room temperature	used as received commercially prepared	Manufacturer recommended expiration date
	working standards are at variable concentrations	Room temperature	working standards are prepared from commercially prepared primary stock	1 month
Chloride	primary stock = 1000 mg/L	Room temperature	used as received commercially prepared	manufacturer recommended expiration date
	working standards are at variable concentrations	Room temperature	working standards are prepared from commercially prepared primary stock	1 month

TABLE 8-3 (continued)
STANDARD PREPARATION AND SOURCES

Instrument Group	Concentration	Storage	Preparation from Source	Standard Expiration
Nitrate	primary stock = 100 mg/L	Room temperature	used as received commercially prepared	manufacturer recommended expiration date
	working standards are at variable concentrations	Room temperature	working standards are prepared from commercially prepared primary stock	1 month
Alkalinity	primary stock = 1000 mg/L	Room temperature	prepared by Microbac from sodium carbonate	6 months
	working standards are at variable concentrations	Room temperature	working standards are prepared from Microbac's prepared primary stock	1 month
Sulfate	primary stock = 1000 mg/L	Room temperature	used as received commercially prepared	Manufacturer recommended expiration date
Phosphorus	primary stock = 200 mg/L	Room temperature	prepared by Microbac from KH_2PO_4	6 months
	working standards are at variable concentrations	Room temperature	working standards are prepared from Microbac's prepared primary stock	1 month
Total Kjeldahl Nitrogen	primary stock = 200 mg/L	Room temperature	prepared by Microbac from $(NH_4)_2SO_4$	6 months
	working standards are at variable concentrations	Room temperature	working standards are prepared from Microbac's prepared primary stock	1 month

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TABLE 8-4
STANDARDIZATION OF TITRATING SOLUTIONS

Parameter	Titrating Solution	Primary Standard	Frequency of Standardization
Acidity	NaOH	KHP NIST traceable	Prestandardized by the manufacturer checked monthly
Alkalinity	H_2SO_4	Sodium Carbonate Standard Solution NIST traceable	Prestandardized by the manufacturer checked monthly
Hardness	EDTA	Calcium carbonate as $CaCl_2$ NIST traceable	Prestandardized by the manufacturer checked monthly

Note: All titration solutions are purchased pre-standardized.

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Figure 8-1
Example – KOBRA LIMS Reagent Record

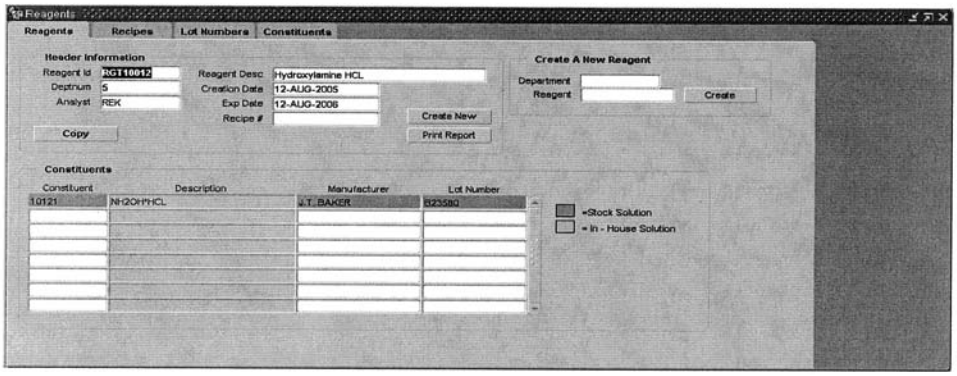


Figure 8-2
Example – KOBRA LIMS Certificate of Analysis Record

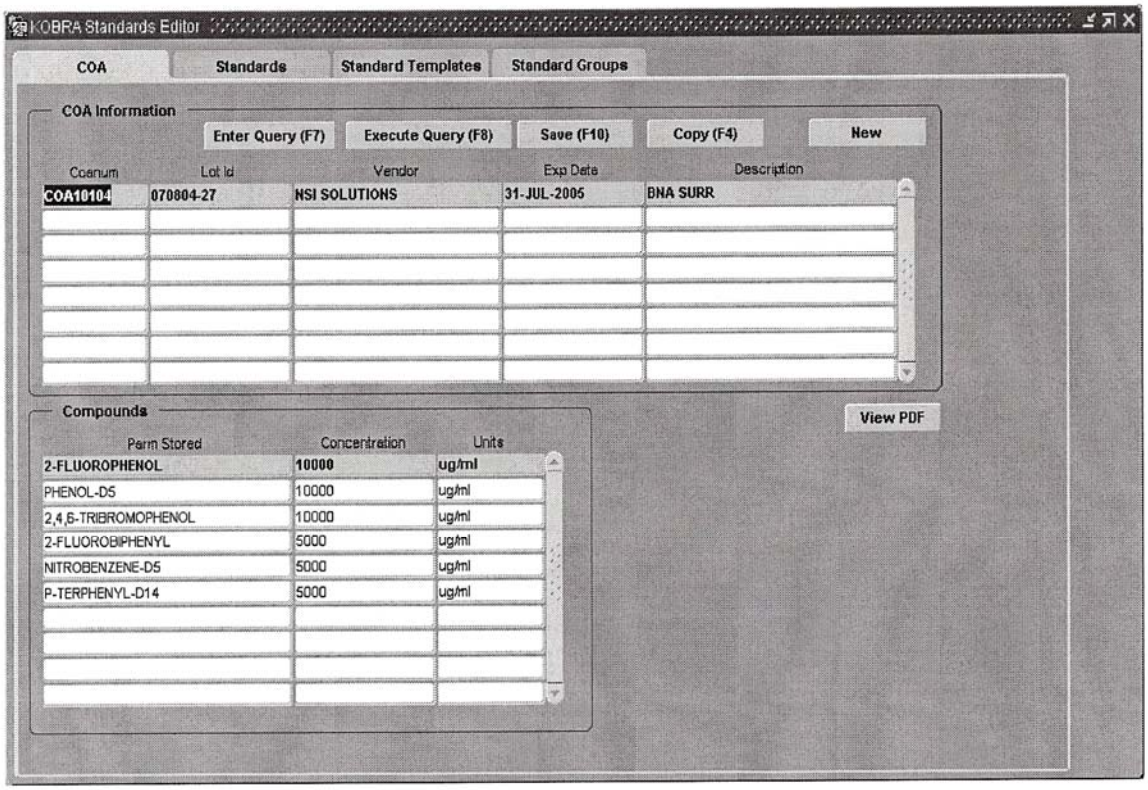


Figure 8-3
Example – KOBRA LIMS Standard Record

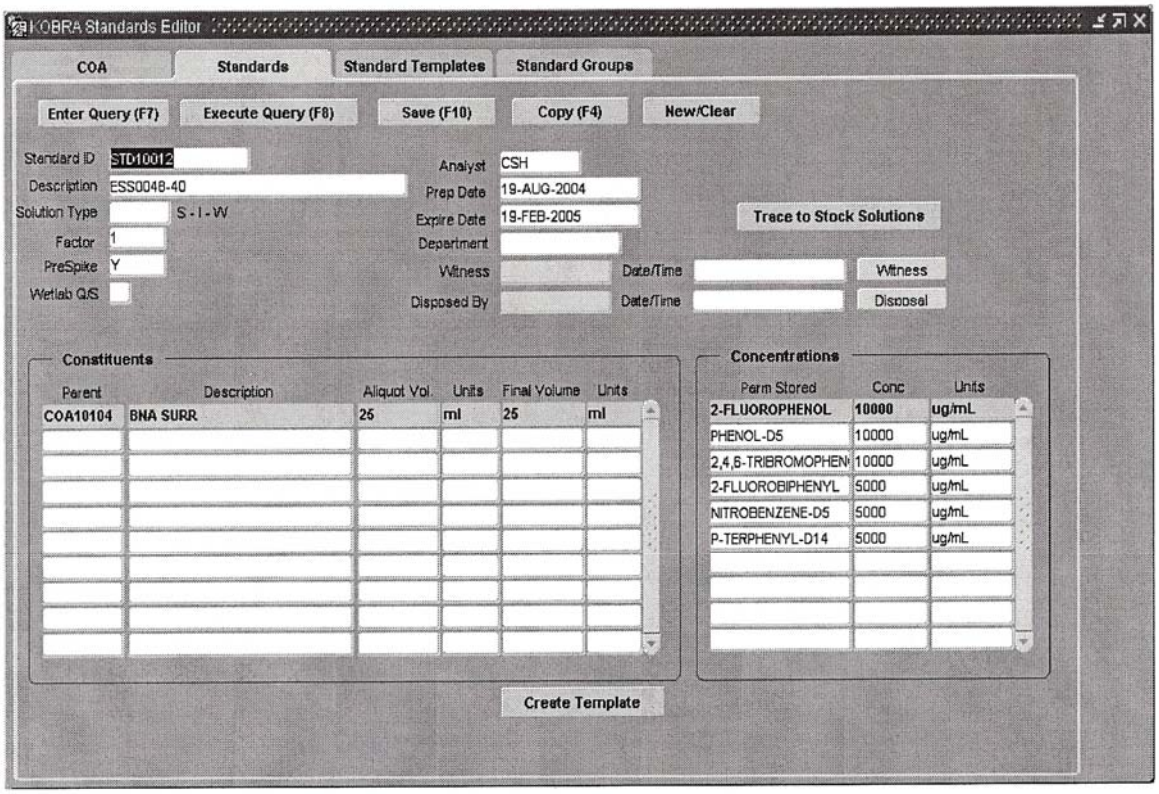


Figure 8-4
Example – KOBRA LIMS Standard Template

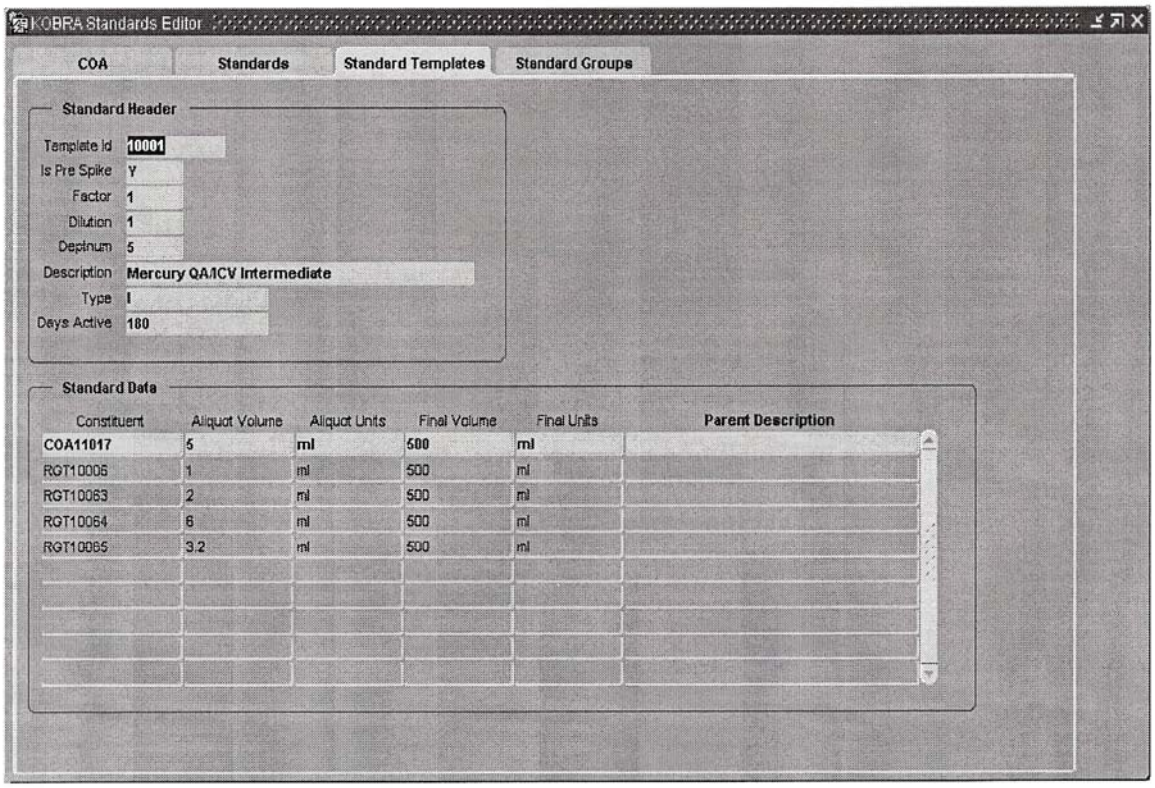
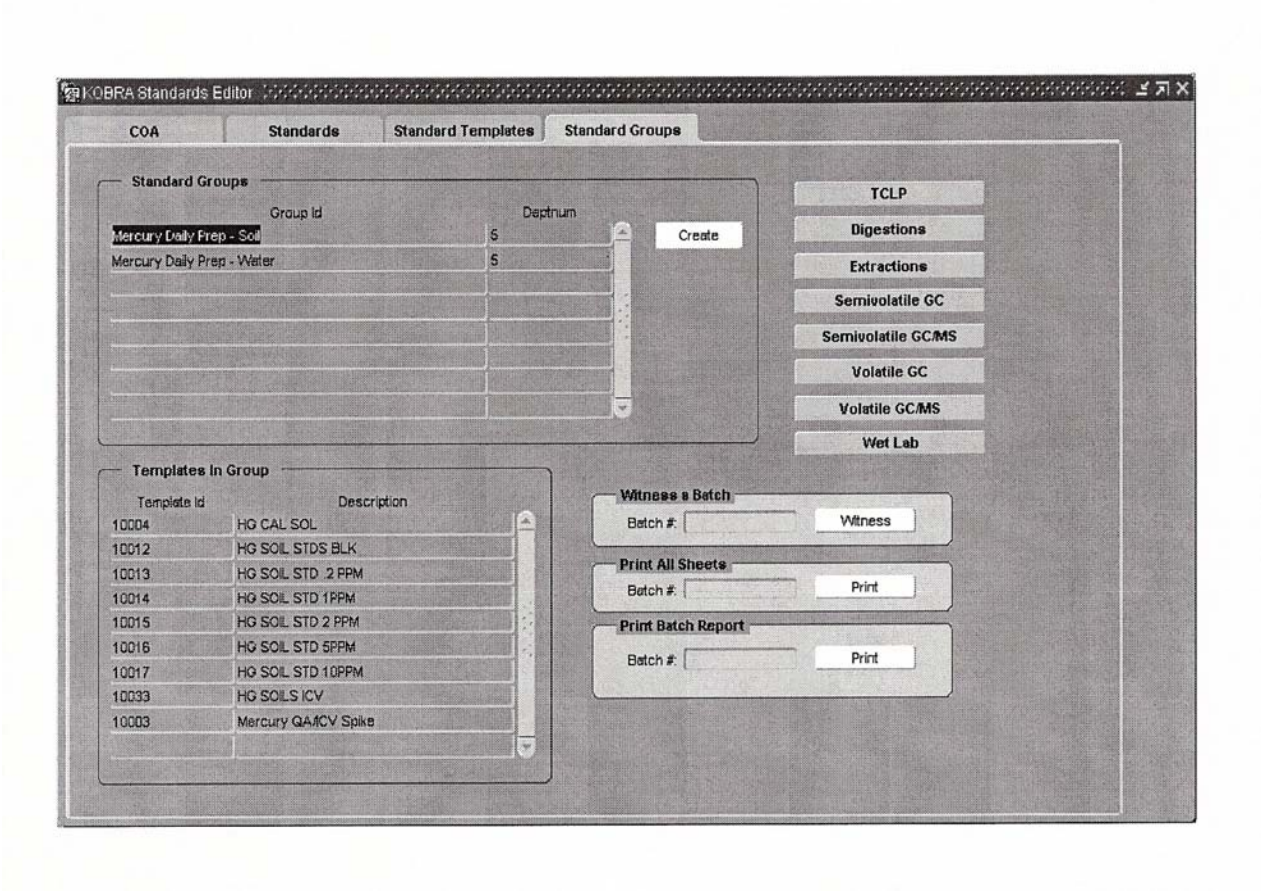


Figure 8-5
Example – KOBRA LIMS Standard Group



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9.0 CALIBRATION PROCEDURES AND FREQUENCY

9.1 Instrumentation

Since the modern analytical laboratory depends heavily upon instrumentation, their calibration, operation and maintenance must be a primary concern in the production of satisfactory data. Below is a list of the instruments commonly used by Microbac in the analysis of various sample matrices.

Table 9-1
Microbac Laboratories
Equipment List

Microbac Laboratories
Equipment List

Location	Instrument Name	Date Acquired	Condition At Purchase	Serial Number
Extractions	Puck Mill	9/09	New	217510007
Extractions	ASE200 Accelerated Solvent Extractor	5/99 1/03	New New	99040590 02110605
Extractions	TurboVap II Workstation	01/96	New	TV9602N6596
Extractions	TurboVap II Workstation	09/96	New	TV9633N7004
Extractions	TurboVap II Workstation	04/97	New	TV9715N7428
Extractions	TurboVap II Workstation	04/97	New	TV9715N7427
Extractions	TurboVap II Workstation	06/05	New	TV0156N12265
Extractions	TurboVap II Workstation	06/05	New	TV0516N12264
Extractions	Misonix XL 2020 Ultrasonicator	01/96	New	G2664
Extractions	Misonix XL 2020 Ultrasonicator	01/99	New	G4338
Extractions	Balance - OHAUS TS600	06/01	New	29515505
Extractions	Balance - AND FX1200i	08/09	New	15608655
Extractions TCLP	PE Spectrum RX 1 Infrared Spectrometer	07/05	New	73781
Volatile	HPMS 16 5973 - 6890 w Varian Archon Gas Chromatograph Mass Spec Tekmar Sample Concentrator	08/03	New	GC-CN1033019 MS-US30965929
Volatiles	HP16 - Gas Chromatograph/FID/TCD with RSK auto- sampler	11/04	New	GC-CN10429033 AS-IT00428012
Volatiles	HPMS 11 5973 - 6890 w Varian Archon Gas Chromatograph Mass Spec Tekmar Sample Concentrator	8/00	New	GC-US00036002 MS-US94260126
Volatiles	HPMS 8 5973 - 6890 w Varian Archon Gas Chromatograph Mass Spec Tekmar Sample Concentrator	1/98	New	GC-US0010116 MS-US82321660
Volatiles	HPMS 6 5973 - 6890 w Varian Archon Gas Chromatograph Mass Spec Tekmar Sample Concentrator	12/96	New	GC-Us00006300 MS-US63810266
Volatiles	HPMS 9 5973 - 6890 w Varian Archon Gas Chromatograph Mass Spec Tekmar Sample Concentrator	10/98	New	GC-US00022637 MS-US72821183
Volatiles	HPMS 10 5973 – 6890 w Varian Archon Gas Chromatograph Mass Spec Tekmar Sample Concentrator	8/99	New	GC-US00029166 MS-US91922575

Table 9-1 (continued)
Microbac Laboratories
Equipment List

Location	Instrument Name	Date Acquired	Condition At Purchase	Serial Number
Volatile	HP 19 7890 w Varian Archon Gas Chromatograph PID/FID, Tekmar Sample Concentrator	01/12	New	GC-CN10932057
Volatiles	HP 3 5890 w Varian Archon Gas Chromatograph PID/FID, Tekmar Sample Concentrator	9/90	New	2950A27655
Volatiles	HP 5 5890 w Varian Archon Gas Chromatograph PID/FID, Tekmar Sample Concentrator	7/92	New	3203A41712
Volatiles	Balance - AND EK-200i	5/07	New	P1845012
Volatiles	Balance - OHAUS N02120	6/03	New	1121242247
Semivolatile	LCMS1 API 4000 Applied Biosystems LC/MS/MS	7/09	New	J0200104
Semivolatile	HP18 FID Gas Chromatograph	01/11	New	CN10481154
Semivolatile	HP17 6890 Dual/ECD Gas Chromatograph	04/07	New	CN10704083
Semivolatile	HP15 AG 6890N Gas Chromatograph – ECD	9/04	New	CN10428037
Semivolatile	HPMS 7 5973 – 6890 Gas Chromatograph Mass Spec	4/97	New	GC-US00007949 MS-US70820650
Semivolatile	HPMS 5 5973 – 6890 Gas Chromatograph Mass Spec	9/96	New	GC-US00004989 MS-US62510073
Semivolatile	HP 9 6890 Gas Chromatograph – ECD	5/98	New	US00021274
Semivolatile	HP 4 5890 Gas Chromatograph- ECD	11/90	Used	2950A26244
Semivolatile	HP 14 AG 6890 Gas Chromatograph - FID	11/02	New	US10207074
Semivolatile	HPMS 12 AG 5973 – 6890 Gas Chromatograph/Mass Spec	5/03	New	US10249164
Semivolatile	HPMS 15 AG 5975 – 6890 Gas Chromatograph/Mass Spec	04/07	New	CN10710041
Semivolatile	VWR Ultrasonic Cleaner	10/03	New	01TS37915
Semivolatile	HP 8 5890 Gas Chromatograph – FID	5/94	New	2728A13203
Semivolatile	HP 18 Agilent 6890 Gas Chromatograph – FID	09/07	Used	DE00000787
Semivolatile HPLC	HPLC 3 1100 Liquid Chromatograph	12/97	New	US72102126
Semivolatile HPLC	HPLC 4 1100 Liquid Chromatograph	11/99	New	DE91605474
Semivolatile HPLC	HPLC 5 1200 Liquid Chromatograph	09/06	New	DEG0555260
Semivolatile HPLC	HPLC 6 Shimadzu Prominence XR Liquid Chromatograph	08/10	New	L20454600114
Semivolatile	IC1 Dionex 500 Ion Chromatograph	12/98	New	98080641
Semivolatile	IC2 Ion Chromatograph	8/01	New	01080138

Table 9-1 (continued)
Microbac Laboratories
Equipment List

Location	Instrument Name	Date Acquired	Condition At Purchase	Serial Number
Metals	ICP-MS 2 Nexion	12/11	New	81XN1110202
Metals	ES SC-8 DX FAST Autosampler	07/10	New	X8DX-HS-TSP-16-100602
Metals	ES SC-8 DX FAST Autosampler	02/10	New	X8DX-HS-TSP-16-100102
Metals	Thermo Scientific iCAP 6000	02/08	New	20080504
Metals	Thermo Scientific iCAP 6000	08/08	New	20083006
Metals	Perkin Elmer Sciex ELAN 6100 ICP-MS	1/00	New	1129909
Metals	Perkin Elmer Optima 4300 ICP-AES	1/04	New	930S4010403
Metals Mercury	Leeman Hydra AA CV_AAS	4/03	New	2054 112-0064-1
Metals Digest	CEM MARS XPRESS	08/10	New	MD3721
Metals Digest	CEM MARS XPRESS Microwave	09/08	New	MD1790
Metals Digest	CEM MARS XPRESS Microwave	07/05	New	MD7719
Metals Digest	Balance - OHAUS Explorer	03/06	New	E3121119410947
Metals Digest	Balance - AND600	09/06	New	14699618
Metals Digest	Balance - AND GR202	06/05	New	14221258
Metals Digest	Balance - AND300	07/08	New	14697360
Metals Digest	Balance - AND300	07/08	New	14697359
Metals Digest	Balance - ANDFX-1200iWP	10/08	New	15801769
Metals Digest	Balance - GF-300	05/06	New	14662980
Conventionals	Westco Easy Distillation	8/99	New	1061
Conventionals	CN – Easy Dist Universal Distallation System	12/02	New	483-W001-01
Conventionals	Orion pH/ISE 710A	1/98	New	B08320
Conventionals	Orion pH/ISE Model 710A pH Ion Meter	4/95	New	002576
Conventionals	Shimadzu UV-1201V Spectrophotometer	8/99	New	A108036800041
Conventionals	TOC Shimadzu	12/02	New	39624467
Conventionals	COD Reactor (HACH) I Block Digester	1987	New	930100008493
Conventionals	COD Reactor (HACH) II	3/09	Used	NA
Conventionals	YSI Model 32 Conductivity Meter	8/93	New	93G07466

Table 9-1 (continued)
Microbac Laboratories
Equipment List

Location	Instrument Name	Date Acquired	Condition At Purchase	Serial Number
Conventionals	VWR Turbidity Meter	3/01	New	800 1682
Conventionals	SmartChem Automated Chemistry Analyzer	04/04	New	W0402048
Conventionals	Horizon Oil & Grease Fully Automated Extractor System	09/05	New	05-123
Conventionals	Orion pH/ISE Model 4Star	08/08	New	B08320
Conventionals	Bante pH Model 922	06/10	New	20100517020
Conventionals	Horizon Controller Model 50-0412-02	06/09	New	09-1056
Conventionals	Balance - Explorer Pro ED2102	10/07	New	L291 1128353643P
Conventionals	Balance - AND GR202	01/06	New	14214584

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9.2 General Calibration Requirements

All laboratory instrumentation must be properly calibrated before it is put into official use. Some general policies and guidelines are provided in the following sections, but complete details are found in the Microbac SOP for the particular method. Specific program or project requirements may be provided in the project QAPP or the sampling and analysis plan (SAP) and may supercede the method and Microbac's SOP.

9.2.1 Initial Calibration

The initial calibration (ICAL) must meet the minimum requirements for the method in use. The calibration must contain the minimum number of points and the curve must pass the method criteria. If more than the minimum number of calibration points are analyzed for initial calibration, it is acceptable to eliminate points only at the top or bottom of the range, in order to get the curve to pass ICAL criteria. Points may not be eliminated from the middle portion of curve unless the entire ICAL is repeated.

9.2.2 Second Source Verification

It is the general policy of Microbac to verify the initial calibration with the analysis of a standard from a second source (different vendor). Acceptance criteria for the second source initial calibration verification (ICV) may be found in the specific SOP or the project QAPP or SAP. Any problems with the ICV that can not be resolved by corrective action must be noted in the report narrative and the data properly qualified.

9.2.3 Continuing Calibration Verification

Continuing calibration verification (CCV) must be performed at the method specified frequency and meet the method SOP, QAPP, or SAP requirements. When required by the method, all samples must be bracketed by passing CCVs. Samples not bracketed by passing CCVs must be reanalyzed. Any problems with the CCV that cannot be resolved by corrective action must be noted in the report narrative and the data properly qualified.

9.3 Gas Chromatography

- ECD (Pesticides/PCBs/Herbicides)
- FID (Polynuclear Aromatic)
- Hydrocarbons/DRO/8015/GRO
- PID (Aromatic Volatile Organics)
- ELCD (Halogenated Volatile Organics)

Initial calibration is at least a 5-point standard curve of all target compounds, (concentrations are in detector linear range) performed on failure of two continuing calibration standards. The lowest calibration standard has a concentration that is equal to or less than the Reporting Limit. Curves are checked by calculating the %RSD for all compounds.

Initial calibration and run sequence:

1. Initial calibration
2. ICV
3. Analyze 10 samples (includes reagent blanks, LCS, spikes and duplicates)
4. Run check standard
5. Continue with steps 3 and 4 for entire run

Daily continuing calibration and run sequence:

1. CCV
2. Analyze 10 samples (includes reagent blanks, LCS, spikes and duplicates)
3. Analyze check standard
4. Continue with analysis steps 2 and 3 for entire run

Samples must be bracketed by passing CCVs. If the CCV does not meet criteria, all affected samples must be rerun. Exceptions will be noted on corrective action forms and approved by management.

9.4 Gas Chromatography/Mass Spectrometry

- Volatile Organic Analysis
- Semivolatile Organic Analysis

Initial calibration is at least at a minimum 5 point standard curve of target compounds (concentrations are in detector linear range) performed on failure of two continuing calibration standards. The lowest calibration standard has a concentration that is equal to, or less than, the Reporting Limit. Method 624 requires a minimum of a 3 point standard curve.

Curves are checked by calculating the %RSD for the calibration check compounds (CCC). The system performance check compounds (SPCC) must meet method specific requirements.

Initial calibration and run sequence:

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1. Run BFB or DFTPP. Achieve acceptance criteria based on Key Ion and Abundance Tables 9-2 and 9-3.
2. Initial calibration
3. ICV
4. Analyze samples (including blanks, LCS, spikes and duplicates) within the specified tune time for BFB or DFTPP.

Daily continuing calibration and run sequence:

1. Run BFB or DFTPP. Achieve acceptance criteria based on Key Ion and Abundance Tables 9-2 and 9-3.
2. CCV
3. Check to see if CC meets criteria. If not, make necessary corrections in GC/MS system and run CCV again.
4. If standard passes, run samples (including blanks, LCS, spikes, and duplicates) for 12 hours from the time BFB or DFTPP was run.
5. At the end of the method specified tune time, repeat steps 1 - 5.

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TABLE 9-2
KEY IONS AND ABUNDANCE CRITERIA FOR BFB

Mass	Ion Abundance Criteria
40	15 to 40% of m/z 95
75	30 to 60% of m/z 95
95	base peak - 100% relative abundance
96	5 to 9% of m/z 95
173	less than 2% of m/z 174
174	greater than 50% of m/z 95
175	5 to 9% of m/z 174
176	greater than 95% but less than 101% of m/z 174
177	5 to 9% of m/z 176

TABLE 9-3
KEY IONS AND ABUNDANCE CRITERIA FOR DFTPP

Mass	Ion Abundance Criteria
51	30 to 60% of m/z 198
68	less than 2% of m/z 69
70	less than 2% of m/z 69
127	40 to 60% of m/z 198
197	less than 1% of m/z 198
198	base peak 100% relative abundance
199	5 to 9% of m/z 198
275	10 to 30% of m/z 198
365	greater than 1% of m/z 198
441	present, but less than m/z 443
442	greater than 40% of m/z 198
443	17 to 23% of m/z 442

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9.5 HPLC - VWD/FD (PNA and Explosives)

The initial calibration is a 6 point standard curve of all target analytes. The lowest calibration standard has a concentration equal to or less than the Reporting Limit. The curves are checked by calculating the %RSD for all analytes. The %RSD must be # 20%.

Initial Calibration and Run Sequence:

1. Initial Calibration
2. ICV
3. Analyze 10 samples
4. CCV
5. Continue steps 3 & 4 for entire run

Daily Continuing Calibration and Run Sequence:

1. CCV
2. Analyze 10 samples (includes reagent blanks, LCS, spikes and duplicates)
3. Analyze check standard
4. Continue with analysis steps 2 and 3 for entire run

Samples must be bracketed by passing CCVs. If the CCV does not meet criteria, all affected samples must be rerun. Exceptions will be noted on corrective action forms and approved by management.

9.6 IC - Conductivity Detector (Anions)

The initial calibration is a linear or quadratic regression based on six points for all seven analytes plus a blank. The initial calibration verification requires that the response not vary by more than ± 10%. Initial Calibration and Run Sequence:

1. Initial Calibration
2. ICV
3. Analyze 10 samples
4. Analyze one in every ten samples in duplicate
5. CCV
6. Continue steps 3, 4 & 5 for entire run

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Daily Continuing Calibration and Run Sequence:

1. CCV - response must not vary more than 10%
2. Analyze 10 samples
3. Analyze one in every 10 samples in duplicate
4. CCV – response must not vary more than 5%
5. Continue steps 2, 3 and 4 for entire run

Samples must be bracketed by passing CCVs. If the CCV does not meet criteria, an initial calibration must be run and all affected samples rerun. Exceptions will be noted on corrective action forms and approved by management.

9.7 Atomic Absorption – Cold Vapor

Initial calibration is a minimum of four standards and a blank and must be within the linear part of the calibration curve. The lowest calibration standard has a concentration that is equal to the Reporting Detection Limit. Calculation is by computer software using linear regression.

Initial Calibration and Run Sequence:

1. Initial Calibration
2. ICV
3. ICB
4. CCV
5. CCB
6. Analyze 10 or less samples, including all batch related QA/QC (LCS, Method Blank, MS/MSD).
7. CCV
8. CCB
9. Continue running samples in groups of 10 or less followed by the CCV and CCB.

Samples must be bracketed by passing CCVs. If the CCV does not meet criteria, an initial calibration must be run and all affected samples must be rerun. Exceptions will be noted on corrective action forms and approved by management.

9.8 ICP-AES, MS

Initial calibration is a minimum of 3 standards and a blank. Calculation is by computer software using linear regression.

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Initial Calibration and Run Sequence:

1. Initial calibration
2. ICV
3. ICB
4. Run Interference check samples
5. CCV
6. CCB
7. Analyze 10 or less samples, including all batch related QA/QC (LCS, Method Blank, MS/MSD)
8. CCV
9. CCB
10. Continue running samples in groups of 10 or less followed by the CCV and CCB

Samples must be bracketed by passing CCVs. If the CCV does not meet criteria, all affected samples must be rerun. Exceptions will be noted on corrective action forms and approved by management.

9.9 Support Equipment

9.9.1 pH Meter

The pH meter is recalibrated before each use or after 2 hours of use.

9.9.2 Turbidimeter

The Turbidimeter is calibrated before each use.

9.9.3 Thermometers

Each thermometer in use in the laboratory is identified with a unique I.D. number which is printed on an attached tag. When a thermometer is put into use, it is checked against an NIST certified thermometer and documented in the thermometer calibration logbook. Any variation from the certified thermometer is indicated on the I.D. tag. If no adjustment is necessary, it is indicated by writing “No Correction Necessary” or “NCN” in the book and “NCN” on the tag. If temperature correction is required, it is added to or subtracted from the actual thermometer reading. Microbac records only the corrected temperature. Each thermometer is rechecked annually against the certified thermometer using the procedures outlined in Microbac SOP K0002 and documented in the thermometer logbook.

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9.9.4 Mechanical Pipets and Syringes

The laboratory will verify mechanical pipets and syringes employing the procedures found in Microbac SOP K0002. Mechanical pipets are verified daily and gas tight syringes are checked quarterly. The laboratory maintains electronic or hardcopy records of all checks of these devices.

9.9.5 Balances

The most important piece of equipment in any laboratory is the analytical balance. The accuracy of data related to weight-prepared standards can be no better than that of the analytical balance. For this reason, proper care and use of the analytical balance should be of highest priority. The following section describes the standard operating requirements at Microbac for the calibration and care of analytical balances:

- Analytical balances are mounted on a heavy, shock-proof table, constructed of either marble or concrete, and placed in an area of low traffic. The balance level is checked daily and adjusted when necessary.
- Balances must be protected from extreme temperature and humidity change. A beaker of silica gel desiccant must be placed in the balance and changed frequently.
- All spills on the pan or inside the balance must be avoided, and the balance must be kept scrupulously clean at all times.
- Balances will be checked and adjusted at least twice a year under service contract with a professional balance specialist.
- Balances must be checked prior to each day's use applying the criteria specified in Table 9-4. The weights selected must bracket the range of use.

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Table 9-4
BALANCE CALIBRATION ACCEPTANCE CRITERIA

Balance Type	Weight (grams)	Criteria
Analytical (0.0001)	0.1	+/-0.0005
	0.2	+/-0.0005
	0.5	+/-0.0005
	1.0	+/-0.0005
	5.0	+/-0.001
	10.0	+/-0.001
	50.0	+/-0.005
	100.0	+/-0.005
Top Loading (0.001)	0.5	+/-0.02
	1.0	+/-0.02
	5.0	+/-0.05
	10.0	+/-0.05
	50.0	+/-0.05
	100.0	+/-0.1
	200.0	+/-0.1
Top Loading (0.01)	1.0	+/-0.05
	5.0	+/-0.05
	10.0	+/-0.05
	50.0	+/-0.05
	100.0	+/-0.1
	200.0	+/-0.1

9.10 Logbooks

Logbooks are kept for each analytical instruments, balances, refrigerators, and incubators in the laboratory. All logbooks are bound controlled documents with numbered pages.

9.10.1 Balances

Each balance has a logbook to record daily calibrations checks. Maintenance and service records must be entered in the logbook. The daily calibration records must include the date, time, the initials of the operator, and the weights for the standard checks using the procedure described earlier. Each balance is checked with weights which are at or near the weight of samples routinely weighed on each balance. Acceptance criteria is outlined in Table 9-4.

9.10.2 Refrigerators

Each refrigerator has a logbook to record its daily temperature checks. Temperatures must be maintained at ≤6° C. Each refrigerator has a calibrated thermometer inserted in a container of water. This thermometer is read daily

and more often if necessary. The temperature is recorded in the logbook to document the proper temperature and stability of each refrigerator.

9.10.3 Ovens and Incubators

Each oven and incubator has a logbook to record its daily operating temperatures. Each oven and incubator has a calibrated thermometer which is read during its operation. The operating temperatures are recorded in the logbook to document that the proper operating temperature has been utilized.

9.10.4 Instrument Logbooks

Each analytical instrument in the laboratory has a logbook. Daily operational notes, problems, routine maintenance procedures and repairs are kept in the instrument maintenance logbook. Calibrations, QC samples, and sample run information is documented in the instrument runlog.

10.0 PREVENTIVE MAINTENANCE

10.1 Routine Maintenance Activities

All of Microbac's instruments undergo routine maintenance, cleaning, and inspection on a daily, weekly, or monthly basis, according to the manufacturer's recommendation, and/or the requirements of the standard methods employed. Maintenance logs and instrument maintenance checklists are kept, noting problems and the steps taken to correct them. Records are kept on repairs requiring non-Microbac service repairmen. Table 10-1 provides a complete list of the preventive maintenance for all major laboratory instrumentation. Each instrument has an electronic log, which contains the records of any maintenance or repairs performed.

10.2 Contingency Plan

In the event of a major instrument failure, most of Microbac's instrumentation has a back-up. There are multiple volatile and semivolatile GC/MS's, as well as, multiple ECD's, ELCD's, FID's and PID's. In the inorganic laboratory there are multiple pH meters, spectrophotometers, an AAS and an ICP-MS (for low-level analyses) and ICP-AES's (3). This instrumentation is listed in Section 9.0, Table 9-1, pages 1-3 of 12. In the event that no backup is available and the sample has holding time left, the sample will be held until repairs have been completed. If the sample is getting close to the end of its holding time, the sample will be subcontracted out to another certified laboratory, or a new

sample will be requested from the client. This decision will be left up to the client. Microbac, under no circumstance, will analyze samples out of holding time or subcontract to another laboratory, without client notification.

TABLE 10-1
LABORATORY INSTRUMENTATION PREVENTIVE MAINTENANCE

EQUIPMENT	ACTIVITY
Gas Chromatographs Semivolatile Organics	change septum change liners check carrier gas change carrier gas change in-line filters remove first foot of capillary column replace ECD replenish Electrolytic Conductivity Detector Solvents change ion exchange resin replace nickel tubing bake out column at completion of sample batch run check system for gas leaks at each column change sylonize injection port liners every liner
Gas Chromatographs Volatile Organics	check gases change gases clip chromatographic column clean PID Lamp clean FID Lamp change Trap bake out column
Gas Chromatograph/ Mass Spectrometers Semivolatile Organics	clean mass spectrometer source change septum change liners check carrier gas change carrier gas change in-line filters remove first foot of capillary column replace nickel tubing bake out column check system for gas leaks sylonize injection port liners
Gas Chromatograph/ Mass Spectrometers Volatile Organics	clean mass spectrometer check helium change helium change trap clip column change Purge and Trap ferrules bake out column

TABLE 10-1 (continued)
LABORATORY INSTRUMENTATION PREVENTIVE MAINTENANCE

EQUIPMENT	ACTIVITY
HPLC - VWD/FD	monitor system pressure change guard cartridges reverse column filter samples at 0.45 microns filter eluents at 0.20 microns if needed monitor eluent reservoir content
IC - Conductivity Detector	monitor system pressure monitor baseline detector output change guard column filter samples at 0.45 microns filter eluents at 0.20 micron if needed degas eluent monitor eluent volume monitor waste volume
CV-AAS(mercury)	change tubing check optics check gases check rinse change drying tube
ICP	clean nebulizer check torch check gases change tubing check optics
pH Meters	clean probe
TOC Meter	clean detector
Specific Conductivity Meters	clean probe check cell constant replenish/replace probe redetermine cell constant
DO Meter	clean probe check membrane change membrane
Analytical Balance	check pans and compartment check alignment and balance cleaning/calibration/service
Ovens	temperature monitoring
Refrigerators	temperature monitoring
Incubators	temperature monitoring
LC/MS/MS	monitor system pressure change guard cartridges filter samples at 0.45 microns monitor eluent reservoir content check curtain plate for residue buildup

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11.0 QUALITY CONTROL CHECKS, ROUTINES TO ASSESS PRECISION, ACCURACY, AND CALCULATION OF METHOD DETECTION LIMIT

This section describes the basic techniques of laboratory quality control and quality assessment normally used to evaluate analytical proficiency. General concepts are defined and discussed as measurement tools for evaluation of data quality. Topics addressed include analytical methods, the concept of batch control, specific types of quality control samples, routines to assess accuracy and precision, statistical control, method detection limits and reporting limits, and internal and external performance evaluation samples. For additional information on related subjects, the reader is referred to Section 9.0 for instrument calibration procedures and to Section 13.0 for corrective action criteria.

11.1 Analytical Methods

An important element in Microbac's Quality Assurance/Quality Control (QA/QC) program is strict adherence to the referenced analytical methods. Whenever possible, Microbac will use only methods that are US-EPA approved and promulgated for analytical investigations. The quality control samples described in Section 11.4 are designed to meet requirements of SW-846, Chapter 1, as well as, the specific method QA/QC criteria. However if program or project A/QC requirements are more stringent, Microbac will comply with the specific project requirements or document the individual variances.

11.2 The Batch Concept

The basic unit for laboratory production and quality control is the **batch**. Samples are most effectively handled and processed in related groups. Examples of batches and their corresponding laboratory identifiers are discussed briefly below. The Sample Delivery Group (SDG) is a group of samples received in one shipment for a specific project and client and become a login batch. They are assigned a unique login number by the KOBRA LIMS at the time of login. The login number also is the unit for the **laboratory reporting batch.**

The **preparation batch** is a group of twenty or less samples of the same matrix type that are prepared for analysis by a unique analytical procedure (SOP). Examples include extraction batches for semivolatile organics and digestion of samples prior to analysis for metals. A preparation batch employs the same analysts, reagents, equipment, method (SOP), clean up, and concentration procedures. Each preparation batch has associated with it the appropriate quality control samples required by the method and usually includes the

preparation blank (method blank), the laboratory control sample, matrix spike, sample duplicate or matrix spike duplicate. Each preparation batch is assigned a unique KOBRA LIMS tracking number referred to as **workgroup**.

The **analytical batch** refers to a group of samples analyzed by a specific analytical method, technique, or instrument, and is the analysis prior to data reduction and reporting. The analytical batch can be identical in sample makeup to the preparation batch, but can include parts of preparation batches, or multiple preparation batches. They include samples that are analyzed together within the same time period by the same analyst and/or instrument. They are always associated with the required method instrument quality control samples such as GC/MS tunes, instrument blanks, initial calibrations and/or continuing calibration verifications. A separate workgroup number is assigned to the analytical batch for the purposes of scheduling and tracking.

The **data entry batch** refers to a group of client and laboratory QC samples for which the analytical results are entered and verified in the KOBRA LIMS. A unique identifier referred to as the run ID is assigned to this data entry batch.

11.3 Batch Quality Control Samples

Each preparation and analytical batch is assigned a unique number by the KOBRA LIMS called a workgroup. For analyses such as wet chemical procedures and purge and trap methods for volatile organics, the preparation batch and analytical batch are one and the same. Other methods require a separate extraction or digestion prior to analysis by the instrument and separate preparation workgroups are applicable. The following analytical quality control samples will be associated with each workgroup if the control procedure is applicable to the analysis. Data tabulation and control charting procedures for these quality control samples are described in more detail in Section 11.0. Acceptance criteria and corrective action measures are presented in the specific laboratory SOP.

11.3.1 Method blank

A method blank (MB), or preparation blank (PB), is analyzed with each preparation batch as a check on analytical system contamination. A sample consisting of laboratory reagent water or analyte free laboratory sand is processed through the entire analytical method including all sample preparation procedures such as extraction, digestion, and filtration. As a quality control sample, the results are used in conjunction with other control data to validate overall system performance and data quality. Client samples are associated with the method blank by sharing a common preparation workgroup number.

11.3.2 Laboratory Control Sample

The LCS is used to assess the general performance of the analytical procedure. The LCS is a quality control sample, similar in composition to the method blank, spiked with the analytes of concern at a known concentration, and is processed through the entire analytical procedure. The purpose of these samples is to monitor analysis control and to assess the accuracy of the procedure in the absence of matrix interference. The results of the LCS are charted or tabulated and must meet the criteria established by the project data quality objectives or the laboratory derived statistical control limits. The LCS is normally used to verify system control, but evaluation should take into consideration several factors including the number of spiked analytes, their performance characteristics, and the severity of the non-compliance. NELAC requires that all certified analytes be included in the LCS over a two year period, including all EPA Appendix IX organics, pesticides and Aroclors. When the spike list is extensive, there exists a high probability of having a few analytes outside the acceptance limits. If the spiking concentrations are not specified in the project QAPP, an attempt is made to spike a level near the mid-range for the method. Client samples are associated with a specific LCS by sharing a common preparation workgroup number.

11.3.3 Laboratory Control Sample Duplicate

An Laboratory Control Sample Duplicate (LCSD) is prepared with the LCS for those batches that do not have another measure of precision, such as a sample duplicate, or matrix spike/ matrix spike duplicate (MS/MSD).The LCSD must meet the same acceptance requirements for accuracy (% recovery) as the LCS and the same precision requirements (RPD) as the sample duplicate (or MS/MSD).

11.3.4 Matrix Spikes

MS are analyzed with each batch of samples of a similar matrix. They consist of a field sample that is spiked with the same analytes as the LCS and normally at the same concentration. The MS is used to assess the performance of the method in client's sample matrix. The percent recoveries are tabulated in a summary report and the results are used to assess bias or other matrix effects. The MS analyses are not used to establish laboratory control, but can be used to properly qualify data.

If sufficient sample quantity is available, the laboratory will select samples for matrix spiking based on the following approach:

- All client specified MS, MSD or duplicate samples are logged into the KOBRA LIMS and reported to the client.

- If no client specified samples have been submitted, the laboratory will randomly select a sample for the MS/MSD or duplicates based on sample availability and client approval requirements.

- If there is insufficient sample volume to perform MS/MSD or duplicate analysis the laboratory will perform an LCS and LCS duplicate in order to provide a measure of precision and accuracy for the analytical batch.

11.3.5 Duplicates and Matrix Spike Duplicates

Duplicate samples (DUP) or MSD may be with each batch of samples of a similar matrix to monitor the method precision. The results in relative percent difference (RPD) are tabulated as outlined in Section 11.7. This data may be used to evaluate the precision of the method in real sample matrices. For analytical methods for which spiking is inappropriate, sample duplicates are used to assess precision.

11.3.6 Selecting Samples for MS/MSD/DUP (Batch QC)

The laboratory will implement one of the following procedures for selecting samples for duplicate analysis (DUP), MS, and MSD.

a) If client samples are specified for batch QC in the KOBRA LIMS or in the project QAPP, the analyst must select these sample(s).

b) If there are no client-specified samples, but extra sample aliquots are available for batch QC, the analyst will randomly select sample(s) for the MS/MSD or DUP. This option must not be used if it depletes all remaining sample. There must be enough field sample volume remaining to allow for re-analysis if necessary.

c) If there is insufficient volume of field samples available for DUP/MS/MSD and re-analysis, the analyst will include an LCS duplicate in the batch in lieu of MS, MSD or DUP.

11.4 Quality Assurance Summary Reports

Quality assurance summary reports are prepared for each analytical workgroup. Whenever samples are analyzed, the batch quality control sample results described in Section 11.4 are entered into the laboratory database.

Reports are generated by workgroup for review by department supervisors, QA/QC personnel, and general management. Copies of the quality assurance summary reports are provided to the client upon request. They are included in all laboratory reports designated as Level 2, or higher, as described in Section 12.0.

11.5 Measuring Precision, Accuracy and Method Detection Limits

This section discusses method performance parameters and how they are related to data quality objectives (DQO). Definitions are given for precision, accuracy, representativeness, completeness, comparability (PARCC), MDL and RL. Tables which provide current statistics for methods including MDLs, RLs, precision and accuracy are updated annually and are available in the individual method SOPs (listed in Appendix B). The following definitions that are used establish baseline data quality objectives for all analytical projects. The PARCC parameters and MDL/RL data are a useful template for development of SAP and QAPP for a wide scope of programs.

11.5.1 Precision (% RPD)

The laboratory objective is to equal or exceed the precision data generated by the applicable method validation studies on similar matrices. Relative percent difference (% RPD) as derived from duplicate matrix spike results (or duplicate sample results for metals) will be used to evaluate precision. With each analysis of a duplicate sample, or matrix spike/matrix spike duplicate, the RPD is calculated from the following formula:

$$RPD = \left[\frac{|C_1 - C_2|}{(C_1 + C_2)/2} \right] 100$$

where:

C_1 = Concentration of the first sample
C_2 = Concentration of the second sample

Method precision can be evaluated through the analysis of duplicate samples or matrix spike duplicates. For most inorganic methods, the results of duplicate analyses are used to calculate advisory limits, but the upper limit for the RPD is usually set at 20%. Another measure of precision is the method standard deviation. The standard deviation determined from the analysis of laboratory control samples can also be used to estimate the upper control limit for the RPD. The later procedure, which is taken from Method 1020B (Standard

Methods – 18th Edition), is used for organic methods having long lists of analytes. However, for most projects the advisory upper limit for the RPD of organic analytes is set at 40%.

11.5.2 Accuracy (% recovery)

The laboratory objective is to equal or exceed the accuracy data generated by the applicable method validation studies on similar matrices. Percent recovery, as derived from the analysis of LCS will be used to evaluate accuracy. The LCS contains all of the analytes of interest at the concentration of interest, either at the midrange of the method, or as specifically defined in the QAPP.

Accuracy statements (ranges) are derived from statistical analysis of the percent recoveries for the LCS for the applicable media. Criteria are established at three standard deviations from the mean LCS recoveries. The ranges for accuracy are generally used as control limits, however, projects DQO's, laboratory policies, or performance method requirements may dictate exceptions. Recovery is defined mathematically as follows:

For a laboratory control samples:

$$\%R = \left(\frac{C_x}{C_t}\right)100$$

where:

C_x = the measured concentration of the analyte in the LCS
C_t = the theoretical spike concentration.
$\%R$ = percent recovery

Calculating recovery for matrix spikes (MS/MSD):

$$\%R = \left[\frac{(C_{spk} - C_x)}{C_t}\right]100$$

where:

C_{spk} = the concentration of the analyte in the spiked sample
C_x = the concentration of the analyte in the reference (parent) sample
C_t = the theoretical spike concentration.
$\%R$ = percent recovery

Representativeness

Representativeness ensures that a set of data accurately depicts the distinguishing characteristics of the sample source. This is usually achieved through sample collection in accordance with statistically defined bounds of the population mean and variance, and by following existing sampling protocols.

Comparability

To achieve a performance level in terms of accuracy and precision for sample parameters in similar matrices, so that one set of data is comparable to another in terms of quality of measurement on a consistent basis. This assures that all Microbac analyses fall within an acceptable range.

Completeness

Refers to the percentage of measurements made which are judged to be valid. The completeness goals for most methods are 95% on all water analyses and 90% on all soil analyses.

11.6 Statistical Evaluation of Data

11.6.1 Statistical Methods

Microbac has established its statistical approach to quality control based on the following standards:

Handbook for Analytical Quality Control in Water and Wastewater Laboratories, EPA-60014-79-019, March 1979.

Standard Methods for the Examination of Water and Wastewater, 18th Edition, APHA/AWWA/WEF, Methods 1010, 1020, 1030.

Test Methods for Evaluating Solid Waste - Physical/ Chemical Methods, SW-846, 3rd Edition, Chapter 1.

The KOBRA LIMS report is found in menu system: Reports, Others, LCS Limits

11.6.2 LCS Control Limits

The laboratory shall establish statistically derived control limits for laboratory control samples. The laboratory will evaluate the data from at least thirty (30) LCS data points to compute the mean and standard deviation(s).

The lower control limit (LCL) shall be established at the mean –3s

The upper control limit (UCL) shall be established at the mean +3s

11.6.3 MS/MSD Control Limits

Microbac will use the LCS control limits to evaluate MS/MSD data, unless the project QAPP specifies otherwise.

11.6.4 Annual Evaluation

The laboratory will also generate an annual LCS summary report from the KOBRA LIMS menu system. The summary report will display the individual LCS results in concentration and percent recovery, computing the mean, standard deviation, and limits at +/-3 sigma. This evaluation will occur concurrently with the annual SOP review. The supervisor and QAO will compare the statistics to the existing default control limits, to determine if these limits are supported by the new statistic. The laboratory will update the KOBRA LIMS QC tables and the appropriate SOP tables as necessary. The laboratory supervisory will review the data for method bias, trends, and shifts, and forward the data package to the QAO. The QAO will review, approve, and /or initiate investigations based on the data.

11.7 General Control Charting Procedure

The laboratory constructs control charts using percent recovery data from LCS. X-Charts are constructed for all inorganic analytes and a representative group of organic analytes from each method. In constructing an initial chart, twenty or more consecutive data points are necessary and the time required to generate such a chart will vary with the frequency of the analysis (daily, weekly, monthly, etc.). This data is charted against the control limits effective during the evaluation period. Control charts are used not only to monitor system control and to evaluate accuracy and precision, but also to check for general trends. Each analyst is trained to interpret and identify problems such as shifts, trends and biases. This method ensures continued evaluation of laboratory and personnel performance. An example Microbac X-Chart is presented in Figure 11-1 of this section.

11.8 Method Detection Limits

The MDL is defined as the minimum concentration of an analyte that can be determined with 99 percent confidence to be greater than zero. All MDL determinations provided by Microbac are made in accordance with Microbac SOP 45, which is derived from the US-EPA procedures outlined in 40 CFR part 136, Appendix B. MDL's are evaluated annually and/or verified quarterly. Verification consists of analyzing a detectability check standard (DCS), which is a fortified blank spiked at a concentration near the concentration of the laboratory MDL and must not exceed the standard reporting limit. This check confirms that the laboratory MDL, which is derived from multiple instruments and analysts, is routinely achievable on a specific instrument and method over the course of time. In order to be considered acceptable, the MDL verification must give a measurable response that also meets the method's qualitative criteria, or is at least distinguishable from the response in a blank sample. The laboratory will perform an MDL verification immediately after each (initial) MDL study and quarterly thereafter. The laboratory will perform a verification if MDLs must be lowered for any reason.

The laboratory shall evaluate the acceptability of MDLs at the time of the SOP review for the method. This review shall include the status and acceptability of the MDL data for water and soil in the initial (EPA) studies and quarterly verification data, if applicable. Based on these reviews, the laboratory may choose to revise current MDLs, or determine the need for additional studies.

11.9 Quantitation Limits and Reporting Limits

Practical Quantitation Limits (PQL) and Limits of Quantitation (LOQ) are defined as the smallest concentration of analyte that can be reported to a known level of accuracy. The PQL is often defined as 3-10 times the MDL, but Microbac normally estimates the PQL as the concentration of the lowest standard in the initial calibration curve for the method. Laboratory RLs are often used in place of the PQL, since they are generally accepted by the environmental industry. They can be adjusted for specific projects requirements but are independent of instrument variation and statistics. At Microbac, the RL/LOQ is usually at least two times the laboratory observed MDL for that analyte, and is normally equivalent to the concentration of the lowest standard on the calibration curve. For some programs such as DoD, it is necessary to report both the MDL and the RL. The standard laboratory reporting limits may be found in the applicable SOP and the KOBRA LIMS.

11.10 Proficiency Testing Studies (PT)

Microbac currently participates in several government administered and private sector single blind PT studies. For each of these programs, it is our internal policy to evaluate each department's performance and prepare corrective action plans for all unacceptable results. All performance summaries and our corrective action plans are made available to clients and state agencies upon request. See also Section 14.2.

For certified methods for which there are not commercially available proficiency testing samples, Microbac OVD will rely on quality control checks for assuring the quality of testing results. The quality control checks include (but are not limited to) alternate source check standards or comparison of new standard lots to previous standard lots prior to use. These quality control checks samples must be analyzed at least twice per year.

For those accrediting bodies that require the submission of proficiency testing results and, associated CAPAs if necessary, the laboratory will submit as per the stated requirement.

Figure 11-1
X-CHART
LABORATORY CONTROL SAMPLE

ID#	INSTRUMENT	METHODREF2	METHOD CLASS	MAT. CLASS	MATRIX	COLUMN	TYPE1	TYPE2	QAPP	LAST POINT
380	%	ALK-COLOR	300	WATER	1	F	LCS	LCS2	STD	08/31/2009

Analyte: ALKALINITY
Number of Points: 30

Mean: 103.591
Standard Deviation: 3.586
Upper Control Limit: 114.35
Lower Control Limit: 92.83

Sample #	Analysis Date	Numvalue	Recovery	Lower	Upper	SJ#	Q
WG308001-02	07/27/2009 10:53	201.814	100.907	85.0	115.0	SJ8150808	
WG308001-03	07/27/2009 10:54	207.652	103.826	85.0	115.0	SJ8150809	
WG308333-02	07/29/2009 14:35	201.272	100.636	85.0	115.0	SJ8159084	
WG308333-03	07/29/2009 14:36	213.24	106.62	85.0	115.0	SJ8159085	
WG308335-02	07/29/2009 14:51	201.475	100.738	85.0	115.0	SJ8159137	
WG308335-03	07/29/2009 14:52	210.059	105.03	85.0	115.0	SJ8159147	
WG308770-02	08/04/2009 14:07	203.719	101.86	85.0	115.0	SJ8172378	
WG308784-02	08/04/2009 14:23	208.341	104.17	85.0	115.0	SJ8172450	
WG308784-03	08/04/2009 14:24	210.616	105.308	85.0	115.0	SJ8172454	
WG308770-03	08/04/2009 14:40	206.542	103.271	85.0	115.0	SJ8172506	
WG308907-02	08/04/2009 15:48	204.922	102.461	85.0	115.0	SJ8172681	
WG308907-03	08/04/2009 15:49	218.434	109.217	85.0	115.0	SJ8172697	
WG309312-02	08/10/2009 11:20	201.445	100.723	85.0	115.0	SJ8185373	
WG309312-03	08/10/2009 11:20	214.549	107.274	85.0	115.0	SJ8185386	
WG309315-02	08/10/2009 11:35	208.036	104.018	85.0	115.0	SJ8185424	
WG309315-03	08/10/2009 11:36	218.717	109.359	85.0	115.0	SJ8185430	
WG309738-02	08/14/2009 14:09	204.406	102.203	85.0	115.0	SJ8200086	
WG309738-03	08/14/2009 14:10	210.105	105.052	85.0	115.0	SJ8200092	

Figure 11-1 (continued)
X-CHART
LABORATORY CONTROL SAMPLE

Sample #	Analysis Date	Numvalue	Recovery	Lower	Upper	SJ#	Q
WG309752-02	08/14/2009 15:20	201.277	100.638	85.0	115.0	SJ8200183	
WG309752-03	08/14/2009 15:21	201.899	100.949	85.0	115.0	SJ8200188	
WG310316-02	08/21/2009 15:01	210.902	105.451	85.0	115.0	SJ8220503	
WG310316-03	08/21/2009 15:02	220.044	110.022	85.0	115.0	SJ8220522	
WG310336-02	08/21/2009 16:08	205.945	102.972	85.0	115.0	SJ8220641	
WG310336-03	08/21/2009 16:09	209.788	104.894	85.0	115.0	SJ8220658	
WG310812-02	08/28/2009 12:02	191.84	95.9202	85.0	115.0	SJ8245978	
WG310812-03	08/28/2009 12:03	192.12	96.0598	85.0	115.0	SJ8245979	
WG310813-02	08/28/2009 12:18	210.343	105.171	85.0	115.0	SJ8246061	
WG310813-03	08/28/2009 12:18	195.055	97.5277	85.0	115.0	SJ8246073	
WG310832-02	08/28/2009 13:59	215.889	107.945	85.0	115.0	SJ8247650	
WG310832-03	08/28/2009 14:00	215.013	107.507	85.0	115.0	SJ8247666	

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12.0 DATA REDUCTION, REVIEW, VERIFICATION, AND REPORTING

This section describes the process of data reduction, data review, data validation, data entry, and editing that begins with the raw data generated at the bench level in the laboratory and culminates with a useful collection of information in the form of summary laboratory reports and data deliverables packages.

12.1 Data Reduction

12.1.1 Data reduction is the conversion of raw data from instrument readings to reportable results. The raw data is converted into reportable values by instrument hardware and software or by other manual procedures suggested in the required reference method.

12.1.2 Policy on Significant Figures

The following policies relate to the use of significant figures for reporting analytical data apply in general to all departments and methods except as noted in the individual method SOPs. All analytical results which are taken from bench sheets, instrument quantitation reports, or other raw data shall be rounded to three (3) significant figures as per Section 12.7 and entered without adjustment into the KOBRA LIMS. The KOBRA LIMS shall be programmed to generate the final analytical report with the appropriate number of significant figures based on the project requirements.

- All results for performance evaluation samples will be reported with three (3) significant figures using the rounding rules specified in Section 12.7.
- All quality control sample results will be reported with three (3) significant figures.
- All results for surrogate compound recovery will be reported with three (3) significant figures.
- All results for client (real world) samples will be reported with three (3) significant figures (except as noted below).
- Project specific requirements may override these general guidelines and the KOBRA LIMS products and data entry screens will be modified accordingly.

12.1.3 Rules for Rounding

For rounding off numbers to the appropriate level of precision (significant figures), the laboratory staff shall follow these rules:

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- If the figure following the digit to be retained is less than five (5), drop it (round down).
- If the figure following the digit to be rounded is greater or equal to five, round up.

Examples:

Three Significant Figures:	Two Significant Figures:	One Significant Figure:
6.014 rounds to 6.01	0.0511 rounds to 0.051	0.015 rounds to 0.02
6.016 rounds to 6.02	0.0519 rounds to 0.052	0.016 rounds to 0.02
6.015 rounds to 6.02	0.0515 rounds to 0.052	1.9 rounds to 2
		25 rounds to 30
		26 rounds to 30
		24 rounds to 20

12.2 Review of Data and Deliverables

The laboratory has established policies and procedures for internal review of data and deliverables (reports) to assure the quality of reported environmental/analytical data.

This is a multi-tiered process involving the sample receiving staff, a detailed analytical review by the primary analyst, a secondary technical review by the department supervisor, or a qualified peer analyst, and an administrative review for completeness by a member the client services staff. These reviews utilize a combination of manual and electronic tools. In addition, the quality manager, or qualified designee, shall perform reviews (audits) on 10 percent of the final laboratory (reports).

Detailed lrocedures for review of data and deliverables is presented in SOP GP-DATA-REVIEW.

12.3 Data Entry and Verification

The OVD LIMS has been programmed to retrieve data directly from instrumentation using a datafile uploading process. Other data must be manually entered by a data specialist or technician. Data verification is a check on the data that is entered into the KOBRA LIMS. Data is entered by the analyst or a clerical staff assistant and is checked for accuracy by the department supervisor or a designated peer reviewer. Incorrect entries are immediately corrected. EDDs are generated by either the client's representative or Information Technologies (IT) personnel. Electronic files are verified by either the IT staff or the client's representative before being sent to the client by mail, or electronically.

12.4 Report Content and Levels

Microbac provides four levels of laboratory reports in order to match the documentation level required by specific projects. A summary of the four levels of data reporting follows:

Level 1 - Standard Laboratory Report

- Cover page with signature
- Results of analysis
- Reporting units
- Reporting/detection limits
- Analysts and analysis dates
- Method references
- Chain-of-custody form
- Surrogate recovery

Level 2 - Standard Report with QA/QC Summary of method blanks, LCS, MS/MSD, and duplicate results.

Level 3 - A Level 2 report with additional summary forms and no raw data.

Level 4 – CLP - Like report with summary forms and raw data.

Reporting level requirements are logged into the KOBRA LIMS system with the sample set. Level 1 and 2 data packages are assembled upon printout of the final report by the data entry staff. Copies of the raw analytical data for level and data packages are turned in by the analysts upon completion of analysis. Data summary forms are printed from specialized software packages by the analysts in each laboratory. For a list of standard Microbac data qualifiers see Figure 12-1. Customized “Level – X” reports are available for special projects.

12.5 Data Integrity, Storage and Archive

Insuring data integrity is one of Microbac’s main objectives. QA controls, as well as, Good Laboratory Practice are instituted by Microbac to achieve this objective. In the daily flow of data, laboratory personnel initial and date any corrections introduced into the data. Unused areas of the daily bench sheets and instrument logs are crossed out, initialed and dated by the corresponding analyst or technician. Controlled benchsheets and log books are required to maintain data integrity. Each sample delivery group is assigned a unique login number when initially logged into the KOBRA LIMS system. The report master files are stored in order of the login number and can be easily retrieved using

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this system. Hardcopies of each login are maintained in filing cabinets in the filing room for six to eight months and then removed to CD-ROM archive storage for a period of five to ten years depending on contractual agreements. OVAP requires notification prior to disposal of any records.

Computer records from the Microbac KOBRA LIMS are maintained on the system for one year and are then archived on magnetic tape. Two backup copies of the system are maintained on magnetic tape at all times. The backup and archive tapes are stored in a fireproof safe at the laboratory indefinitely. Extraction lab logbooks and bench sheets are maintained chronologically and stored in the laboratory for five years. Inorganics raw data, including analyst notebooks, bench sheets, computer printouts and instrument logs, are stored by parameter in the individual laboratories or in the archive area for a period of five years. GC data is stored as hardcopy in the individual master files. GC/MS data is stored as hardcopy for three-five years in the workorder files and on magnetic tape for at least one year. GC/MS Data stored on magnetic tape can be retrieved by the file numbers assigned to them at the time of analysis.

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Figure 12-1

Microbac Laboratories, Inc.
List of Valid Qualifiers
August 5, 2002

Standard Qualifiers

These are Microbac's Standard Report Qualifiers

B	Present in the method blank
C	Confirmed by GC/MS
CG	Confluent growth
D	The analyte was quantified at a secondary dilution factor
DL	Surrogate or spike was diluted out
E	Estimated concentration due to sample matrix interference
FL	Free liquid
I	Semi-quantitative result, out of instrument calibration range
J	Present below nominal reporting limit
L	Sample reporting limits elevated due to matrix interference
N	Tentatively Identified Compound (TIC)
NA	Not applicable
ND	Not detected at or above the reporting limit (RL)
NF	Not found
NFL	No free liquid
NI	Non-ignitable
NS	Not spiked
P	Concentration >40% difference between The two GC columns
QNS	Quantity not sufficient to perform analysis
RA	Re analysis confirms reported results
RE	Re analysis confirms sample matrix interference
S	Analyzed by method of standard addition
SMI	Sample matrix interference on surrogate
SP	Reported results are for spike compounds only
TNTC	Too numerous to count
U	Analyzed for but not detected
W	Post-digestion spike for furnace AA out o f control limits
X	Exceeds regulatory limit
Z	Can not be resolved from isomer.***
+	Correlation coefficient for the MSA is less than 0.995
<	Less than
>	Greater than
*	Surrogate or spike compound out of range

***** Special Notes for Organic Analytes**

1. Acrolein and acrylonitrile by method 624 are semi-quantitative screens only
2. 1,2-Diphenylhydrazine is unstable and is reported as azobenzene
3. N-nitrosodiphenylamine cannot be separated from diphenylamine
4. 3-Methyphenol and 4-Methyphenol are unresolvable compounds
5. m-Xylene and p-Xylene are unresolvable compounds
6. The reporting limits for Appendix II/IX compounds by method 8270 are based on EPA estimated PQLs referenced in 40 CFR Part 264, Appendix IX. They are not always achievable for every compound and are matrix dependent.

AFCEE Qualifiers
These are Microbac's AFCEE Report Qualifiers

J	The analyte was positively identified, the quantitation is an estimation
U	The analyte was analyzed for, but not detected. The associated numerical value is at or below the MDL
F	The analyte was positively identified but the associated numerical value is below the RL
R	The data is unusable due to deficiencies in the ability to analyze the sample and meet QC criteria
B	The analyte was found in an associated blank, as well as in the sample
M	The matrix effect was present
S	To be applied to all field screening data
T	Tentatively identified compound (using GC/MS)

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13.0 CONTROL OF NONCONFORMING WORK

13.1 Nonconforming Work

The laboratory implements general procedures to be followed when departures from documented policies, procedures and quality control have occurred or when any aspect of testing, result generation or reporting does not conform to established procedures or contract requirements of the customer. The procedures detailed in Microbac SOP GP-RCA, "Root Cause Analysis" and Microbac SOP GP-CAPA, "Corrective Action and Preventive Action: Initiating, Tracking and Monitoring", are to be followed when such occurs. The department supervisor and/or the analyst has the ultimate authority and responsibility for the management of nonconforming work and the appropriate actions to be taken. The department supervisor, analyst and/or the QA department have the authority, under their scope of responsibilities, to initiate the necessary procedure; the procedure insures that:

- An evaluation of the significance of the nonconforming work is made.
- Corrective actions are taken immediately, as necessary
- When necessary, the customer is notified and the work is recalled.

Where there is doubt about the compliance of laboratory operations with policies or procedures, with the ISO17025:2005 standard or determination is made that nonconforming work could recur, the QA department will audit the appropriate areas of activity as discussed in Microbac SOP GP-INTAUDIT, Internal Audit Guidelines and the procedures described in Microbac SOP GP-CAPA, "Corrective Action and Preventive Action: Initiating, Tracking and Monitoring" are to be followed.

13.2 Corrective Action

Corrective action may be required as a result of both analytical and non-analytical events. The purpose of the corrective action is not only to provide documentation of the event, but also to correct and prevent recurrence of the nonconformance or departure from the policies and procedures.

The procedures in Microbac SOP GP-RCA, Root Cause Analysis and Microbac SOP GP-CAPA, Corrective Action and Preventative Action: Initiating, Tracking and Monitoring detail and insure the following:

- An investigation is made to determine the root cause(s) of the problem.
- Potential corrective actions are identified and subsequently the most appropriate are implemented.

- Corrective actions are chosen appropriate to the magnitude of the problem.
- The entire process is properly documented.
- Follow-up is made to monitor and determine the effectiveness.

13.3 Preventive Action

Preventive action is the proactive identification of potential problems or areas for improvement. No nonconforming event needs to take place in order to stimulate a preventive action. This practice applies to the quality management system. Needed improvements and potential sources of nonconformance, whether administrative, technical or quality related are identified, selected, implemented, monitored and documented following Microbac SOP GP-CAPA, "Corrective Action and Preventive Action: Initiating, Tracking and Monitoring". Effectiveness of these actions is evaluated during the management review process.

13.4 General Analytical Requirements

Analysts have the primary responsibility for assessing method compliance and evaluating the acceptability of the batch quality control samples. Laboratory criteria that must be met and the resultant corrections are addressed in detail in the individual SOPs. An example of the contents is outlined in Tables 13-1. Some methods have additional control criteria such as surrogates, ICVs, CCVs etc. A departure occurs if a blank, calibration standard, laboratory control sample, sample replicate, or spike recovery analyses fail to meet the quality control criteria outlined in the SOPs. An investigation to find the cause of the problem is undertaken by the analyst and department supervisor and a nonconforming work report (Figure 13-1) is initiated. This form is used to document the problem, its resolution and to provide the means to inform management (including the QAO) of chronic quality problems and non-compliant systems. Corrective action must be approved by the QAO who will ensure implementation and documentation of the corrective action. More specific discussion of the various laboratory corrections due to nonconformance are discussed in the sections that follow. The special requirements of the OVAP are presented in Section 16.1.

13.5 Calibration Requirements

Instrument calibration is fundamental to all quantitative chemical analysis. Each US-EPA or other reference analytical method has specified calibration criteria that must be met in order for the data to be fully useable. Proper initial calibration must be performed in accordance with the method specifications for number, source and level of calibration standards, as well as, meet the linearity requirements. Each initial calibration must be verified at the specified

frequencies and meet acceptance limits. Repeated failure of CCV standards necessitates that the analysis be stopped, the instrument evaluated, and the initial calibrations repeated. Data for problematic analytes that do not pass the method specification must be qualified appropriately in the final laboratory summary reports and narratives.

13.6 Method Blanks

Method blanks are used to evaluate the analytical system for contamination. For most analytes the upper limit for blank contamination is the reporting limit, however, it is our policy to evaluate the source of any contamination greater than two times the MDL.

The criteria used to determine the acceptability of method blanks varies with the particular analyte. Factors such as the level of analyte in the sample and the existence of established regulatory limits, or action limits, must be taken into consideration. No correction other than documentation is required when the levels of analyte in the samples are at least ten times the level in the blank. Laboratory action involving blank contamination would include an investigation documented by a nonconformance report and one of the following actions:

- re-preparation and re-analysis of the affected samples
- B-flagging of the data
- documentation of the problem in the report narrative along with the effects on data quality, if any

13.7 Laboratory Control Samples

The data from the LCS is crucial to assessing the usability of the data from samples in the same batch. Normally, the LCS is approached from the stand point of pass/fail. If the LCS is out-of-control, the samples in the associated batch are re-analyzed, starting from the preparation step. This is the standard laboratory policy for single analyte methods such as wet chemistry or metals. For multi-analyte methods such as volatile and semi-volatile organics, both the number and severity of LCS outliers must be evaluated. A certain amount of professional judgment is required of the laboratory management as to what constitutes an out-of-control LCS. If the number of failing analytes is excessive (i.e. > 10% the analytes spiked), indicating a general system failure, then correction shall include the re-preparation and re-analysis of the entire batch. When the outliers are out high, there is no correction required if the samples do not contain reportable levels of these analytes. Furthermore, if the analytes are out low, but only marginally, this also might not indicate a method problem. The results of the LCS are included in the QC Summary Report and all outliers are

appropriately identified. The report narrative will discuss any problems with non-compliant LCS data, and the proper flags used to qualify the analytical results.

13.8 Matrix Spikes and Duplicates

Evaluating the data from MS, MSD, and duplicate samples is more complex than for method blanks and LCSs. In general, Microbac does not base batch control on the results of these analyses due to matrix effects and the issues of heterogeneity and sampling. The control limits for the LCS will be used to assess the acceptability of the MS/MSD data for the purposes of data flagging only.

13.9 Nonconformance Reports

Nonconformance reports (NCR) are used to document out of control events which consists of but are not limited to the non-fulfillment of a requirement of a customer, quality management system or regulatory agency (Figure 13.1). This report can be generated by any employee when nonconformances are identified. The form describes the event, correction and signifies a return to control if achieved. Further action is required if there is not a return to control and/or the out of control event is recurring. Further actions include but are not limited to corrective action procedures.

13.10 Corrective Action/Preventive Action Reports

Corrective Action/Preventive Action Reports (CAPA's) are used to document nonconformances requiring corrective action, as well as, actions designed to prevent initial occurrences of a nonconformance (Figure 13-2). These reports are typically generated by the analyst or individual who has encountered the nonconforming or potential nonconforming situation. This individual would be responsible for generating the CAPA form by describing the nonconformance issue and recommending or describing the correction taken. After the correction is performed the root cause is determined and the solution(s) implemented, the CAPA form is reviewed and signed by the department supervisor, a member of the QA department and the laboratory managing director. Post closure monitoring is performed and recorded in the monthly corrective action spreadsheet.

Figure 13.1

Microbac Ohio Valley Division

NONCONFORMANCE REPORT

Date: _____ **Department:** _____ **Initiator:** _____

Prep WG# _____ **Preparation Date:** _____ **Parameter:** _____

I. Description of Nonconformance:

Sample ID(s) _____

_____

☐ Method Blank _____

☐ LCS Failures _____ analytes out _____

☐ Other _____

_____

_____

II. Correction:

☐ Reprep affected samples only _____

☐ Reprep entire workgroup _____

☐ Reanalyze affected samples only _____

☐ Report data with qualifiers _____

☐ Other _____

_____

III. Return to Control?: Not Applicable _____ Yes _____ No _____

Control Verification _____

IV. Further Action Required?: (required if No is checked in III.)

_____

_____

_____

Approvals:

Department Supervisor: _____ Date: _____

QA Department: _____ Date: _____

Document Control Form #454

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Figure 13.2

Microbac Ohio Valley Division

CORRECTIVE ACTION/PREVENTIVE ACTION REPORT

Date:_____ **Department:**_____ **Initiator:**_____

I. Description of Nonconformance:

II. Correction (CAR only):

III. Root Cause Analysis Results (optional for PAR):

IV. Action to be Taken:

V. Describe evidence of effectiveness:

Approvals:

Department Supervisor: _____ Date: _____

QA Department: _____ Date: _____

Director/Manager: _____ Date: _____

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14.0 PERFORMANCE AND SYSTEMS AUDITS

14.1 External Audits

Microbac actively participates in several Federal and State performance evaluation testing programs and system audits. External systems audits of the Microbac facility occur on a regular basis. These include audits by the West Virginia Department of Natural Resources (WVDNR), the OEPA, and the Florida Department of Health (FLDOH) (NELAC Primary Accreditor). Additionally, audits are conducted every 2 - 3 years by the California Department of Health Services, and the US Army Corps of Engineers.

14.2 Performance Audits and Proficiency Testing

Performance audits are required for numerous state and federal programs. These certifications include the submittal of single blind analytical proficiency testing (PT) samples from NIST certified providers. Microbac formally participates semiannually in the following performance evaluation programs:

- NELAC/WP/DMRQA
- NELAC Soil
- NELAC UST

If problems are identified in any of these programs, the QAO will submit internal PT samples to verify the effectiveness of our corrective actions.

14.3 Internal Audits

The QAO will perform an annual internal audit of the laboratory operations to assure continued adherence to the LQAP, including the referenced methods and SOPs. The QAO may conduct the audit over the course of the year, with assistance from other technical directors or supervisors. The results of the audit shall be documented using the checklist in Figure 14-1, or an equivalent form, and the results are presented in a report to the Managing Director. The QAO may perform additional internal audits based on results of internal and external performance feedback. If the laboratory receives a customer complaint, an audit will be used to investigate the appropriate areas. The laboratory will perform corrective actions and notify the client(s) within three business days if any data are affected by findings resulting from an internal or external audit. The laboratory shall have thirty (30) days to close out any internal audit finding.

The procedures for conducting the internal audit are presented in Microbac SOP GP-INTAUDIT

14.4 Management Review Procedures (Managing Director)

Senior Management annually conducts a Quality Systems Review. Each system is reviewed for client responsiveness, overall efficiency, value towards quality and economic value. Human resources and equipment needs are evaluated. With the summation of the review, changes are made (corrective action) as appropriate, equipment is purchased and overall business strategy is adjusted. The procedures for conducting the management reviews in accordance with ISO 17025:2005, Section 4.15.1 are presented in Microbac SOP GP-QMSR. This review includes but is not limited to:

- Laboratory Quality System
- Report Generation/Content (Hard Copy & EDD)
- Laboratory Data QA/QC
- KOBRA LIMS development and improvement
- Sales/Marketing Function/System
- Proposal/Quotation generation
- Project Management/Technical Service
- Production efficiencies
- Volume of work
- Internal audit reports
- Performance evaluation studies
- Client satisfaction
- Client feedback

Figure 14-1
MICROBAC INTERNAL SYSTEM AUDIT FORM

Microbac Laboratories, Inc.
Interal Audit Checklist

Auditor Name: _____
Date: _____

I. Sample Receipt and Storage Area

ITEM	YES	NO	COMMENTS
Are written Standard Operating Procedures (SOP) developed for receipt and storage of samples?			
Is the appropriate portion of the SOP available to the analyst at the sample receipt/storage area?			
Has SOP been reviewed in the last 12 months?			
Are samples that require preservation stored in such a way as to maintain their preservation?			
Are volatile samples stored separately from semi-volatile samples?			
Are refrigerator blanks used for volatile storage?			
Are adequate facilities provided for storage of samples, including cold storage?			
Is the temperature of the cold storage recorded daily in a logbook?			
Does the cold storage temperature logbook contain acceptance criteria?			
Are the sample receipt/storage and temperature logbooks maintained in a manner consistent with GLP?			
Is the sample pH measured and recorded by the sample custodian?			
Does the supervisor periodically examine and review all notebooks, logbooks, etc. and sign his/her name therein, together with the date and appropriate comments as to whether or not the notebook is being maintained in an appropriate manner?			
Are proper records kept of standards preparation?			
Are materials properly labeled with concentrations, date of preparation, and the identity of the person preparing the sample?			

Additional Comments:

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Figure 14-1 (continued)
MICROBAC INTERNAL SYSTEM AUDIT FORM

II. Inorganics Sample Preparation Area

Item	Yes	No	Comments
Is the laboratory maintained in a clean and organized manner?			
Are contamination-free areas provided for trace level analytical work?			
Are exhaust hoods provided to allow contamination-free work with volatile materials?			
Is the air flow of the hoods periodically checked and recorded?			
Does the laboratory have a source of distilled/demineralized water?			
Can the laboratory supervisor document that trace-free water is available for preparation of standards and blanks?			
Is the analytical balance away from draft and area subject to rapid temperature changes?			
Has the balance been calibrated within one year by a certified technician?			
Is the balance routinely checked with class 1 weights before each use and the results recorded in a logbook?			
Does the balance logbook contain acceptance criteria?			
Is the appropriate portion of the SOP available to the analyst at the sample preparation area?			
Are reagent grade or higher purity chemicals used to prepare standards?			
Are fresh analytical standards prepared at a frequency consistent with good QA?			
Are reference materials properly labeled with identity of materials, concentrations, date of preparation, and the identity of the person preparing the sample?			
Is a standards preparation and tracking logbook maintained?			
Do the analysts record bench data in a neat and accurate manner?			
Are standards stored separately from sample extracts?			
Is the temperature of the refrigerator/freezer recorded daily?			
Does the temperature logbook contain acceptance criteria?			

Additional Comments:

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Figure 14-1 (continued)
MICROBAC INTERNAL SYSTEM AUDIT FORM

III. Organics Sample Preparation Area

Item	Yes	No	Comments
Is the laboratory maintained in a clean and organized manner?			
Are contamination-free areas provided for trace level analytical work?			
Are exhaust hoods provided to allow contamination-free work with volatile materials?			
Is the air flow of the hoods periodically checked and recorded?			
Does the laboratory have a source of distilled/demineralized water?			
Can the laboratory supervisor document that trace-free water is available for preparation of standards and blanks?			
Is the analytical balance away from draft and area subject to rapid temperature changes?			
Has the balance been calibrated within one year by a certified technician?			
Is the balance routinely checked with class 1 weights before each use and the results recorded in a logbook?			
Does the balance logbook contain acceptance criteria?			
Is the appropriate portion of the SOP available to the analyst at the sample preparation area?			
Are reagent grade or higher purity chemicals used to prepare standards?			
Are fresh analytical standards prepared at a frequency consistent with good QA?			
Are reference materials properly labeled with identity of materials, concentrations, date of preparation, and the identity of the person preparing the sample?			
Is a standards preparation and tracking logbook maintained?			
Do the analysts record bench data in a neat and accurate manner?			
Are standards stored separately from sample extracts?			
Is the temperature of the refrigerator/freezer recorded daily?			
Does the temperature logbook contain acceptance criteria?			

Additional Comments:

Figure 14-1 (continued)
MICROBAC INTERNAL SYSTEM AUDIT FORM

IV. VOA GC Instrumentation

ITEM	YES	NO	COMMENTS
Are written Standard Operating Procedures (SOP) developed for all methods used in this area?			
Is the appropriate portion of the SOP available to the analyst at the various instruments?			
Is the laboratory maintained in a clean and organized manner?			
Are contamination-free areas provided for trace level analytical work?			
Are exhaust hoods provided to allow contamination-free work with volatile materials?			
Is the air flow of the hoods periodically checked and recorded?			
Does the laboratory have a source of distilled/demineralized water?			
Can the laboratory supervisor document that trace-free water is available for preparation of standards and blanks?			
Are fresh analytical standards prepared at a frequency consistent with good QA?			
Are reference materials properly labeled with identity of materials, concentrations, date of preparation, and the identity of the person preparing the sample?			
Is a standards preparation and tracking logbook maintained?			
Are standards stored separately from sample extracts?			
Is the temperature of the refrigerator/freezer recorded daily?			
Is there a calibration protocol in use by the operator?			
Are calibration results kept in a permanent record?			
Do the analysts record bench data in a neat and accurate manner?			
Is preventive maintenance applied?			
Is a permanent service record maintained in a logbook?			
Is an electronic data storage service available?			
Is there evidence that at least one GC or GC/MS system can be reasonably expected to be operating acceptably at any given time?			
Are refrigerator blanks analyzed to monitor contamination free sample storage?			
Is a balance logbook maintained?			
Is the balance routinely checked with Class 1 weights before each use and results recorded in the balance logbook?			
Have expired standards been disposed of?			
Are instrument run logbooks maintained?			
Are system blanks analyzed to check for carryover contamination?			
Are solvent bottles (e.g. methanol for VOA) labeled with receipt date, open date, and initials?			
Do the analysts maintain statistical process control charts for each method?			
Do the analysts use control charts to monitor method performance?			
Are analysts familiar with applicable QA/QC method requirements?			
Is positive pressure maintained in rooms where volatile organic samples are analyzed?			

Figure 14-1 (continued)
MICROBAC INTERNAL SYSTEM AUDIT FORM

V. VOA GCMS Instrumentation

ITEM	YES	NO	COMMENTS
Are written Standard Operating Procedures (SOP) developed for all methods used in this area?			
Is the appropriate portion of the SOP available to the analyst at the various instruments?			
Is the laboratory maintained in a clean and organized manner?			
Are contamination-free areas provided for trace level analytical work?			
Are exhaust hoods provided to allow contamination-free work with volatile materials?			
Is the air flow of the hoods periodically checked and recorded?			
Does the laboratory have a source of distilled/demineralized water?			
Can the laboratory supervisor document that trace-free water is available for preparation of standards and blanks?			
Are fresh analytical standards prepared at a frequency consistent with good QA?			
Are reference materials properly labeled with identity of materials, concentrations, date of preparation, and the identity of the person preparing the sample?			
Is a standards preparation and tracking logbook maintained?			
Are standards stored separately from sample extracts?			
Is the temperature of the refrigerator/freezer recorded daily?			
Is there a calibration protocol in use by the operator?			
Are calibration results kept in a permanent record?			
Do the analysts record bench data in a neat and accurate manner?			
Is preventive maintenance applied?			
Is a permanent service record maintained in a logbook?			
Is an electronic data storage service available?			
Is there evidence that at least one GC or GC/MS system can be reasonably expected to be operating acceptably at any given time?			
Are refrigerator blanks analyzed to monitor contamination free sample storage?			
Is a balance logbook maintained?			
Is the balance routinely checked with Class 1 weights before each use and results recorded in the balance logbook?			
Have expired standards been disposed of?			
Are instrument run logbooks maintained?			
Are system blanks analyzed to check for carryover contamination?			
Are solvent bottles (e.g. methanol for VOA) labeled with receipt date, open date, and initials?			
Do the analysts maintain statistical process control charts for each method and matrix?			
Do the analysts use control charts to monitor method performance?			
Are analysts familiar with applicable QA/QC method requirements?			
Is positive pressure maintained in rooms where volatile organic samples are analyzed?			

Figure 14-1 (continued)
MICROBAC INTERNAL SYSTEM AUDIT FORM

VI. SEMI-VOA GC Instrumentation

ITEM	YES	NO	COMMENTS
Are written Standard Operating Procedures (SOP) developed for all methods used in this area?			
Is the appropriate portion of the SOP available to the analyst at the various instruments?			
Is the laboratory maintained in a clean and organized manner?			
Are contamination-free areas provided for trace level analytical work?			
Are exhaust hoods provided to allow contamination-free work with volatile materials?			
Is the air flow of the hoods periodically checked and recorded?			
Does the laboratory have a source of distilled/demineralized water?			
Can the laboratory supervisor document that trace-free water is available for preparation of standards and blanks?			
Are fresh analytical standards prepared at a frequency consistent with good QA?			
Are reference materials properly labeled with identity of materials, concentrations, date of preparation, and the identity of the person preparing the sample?			
Is a standards preparation and tracking logbook maintained?			
Are standards stored separately from sample extracts?			
Is the temperature of the refrigerator/freezer recorded daily?			
Is there a calibration protocol in use by the operator?			
Are calibration results kept in a permanent record?			
Do the analysts record bench data in a neat and accurate manner?			
Is preventive maintenance applied?			
Is a permanent service record maintained in a logbook?			
Is an electronic data storage service available?			
Is there evidence that at least one GC or GC/MS system can be reasonably expected to be operating acceptably at any given time?			
Have expired standards been disposed of?			
Are instrument run logbooks maintained?			
Are system blanks analyzed to check for carryover contamination?			
Are solvent bottles (e.g. methanol for VOA) labeled with receipt date, open date, and initials?			
Do the analysts maintain statistical process control charts for each method?			
Do the analysts use control charts to monitor method performance?			
Are analysts familiar with applicable QA/QC method requirements?			
Is positive pressure maintained in rooms where volatile organic samples are analyzed?			

Figure 14-1 (continued)
MICROBAC INTERNAL SYSTEM AUDIT FORM

VII. SEMI-VOA GCMS Instrumentation

ITEM	YES	NO	COMMENTS
Are written Standard Operating Procedures (SOP) developed for all methods used in this area?			
Is the appropriate portion of the SOP available to the analyst at the various instruments?			
Is the laboratory maintained in a clean and organized manner?			
Are contamination-free areas provided for trace level analytical work?			
Are exhaust hoods provided to allow contamination-free work with volatile materials?			
Is the air flow of the hoods periodically checked and recorded?			
Does the laboratory have a source of distilled/demineralized water?			
Can the laboratory supervisor document that trace-free water is available for preparation of standards and blanks?			
Are fresh analytical standards prepared at a frequency consistent with good QA?			
Are reference materials properly labeled with identity of materials, concentrations, date of preparation, and the identity of the person preparing the sample?			
Is a standards preparation and tracking logbook maintained?			
Are standards stored separately from sample extracts?			
Is the temperature of the refrigerator/freezer recorded daily?			
Is there a calibration protocol in use by the operator?			
Are calibration results kept in a permanent record?			
Do the analysts record bench data in a neat and accurate manner?			
Is preventive maintenance applied?			
Is a permanent service record maintained in a logbook?			
Is an electronic data storage service available?			
Is there evidence that at least one GC or GC/MS system can be reasonably expected to be operating acceptably at any given time?			
Have expired standards been disposed of?			
Are instrument run logbooks maintained?			
Are system blanks analyzed to check for carryover contamination?			
Are solvent bottles (e.g. methanol for VOA) labeled with receipt date, open date, and initials?			
Do the analysts maintain statistical process control charts for each method?			
Do the analysts use control charts to monitor method performance?			
Are analysts familiar with applicable QA/QC method requirements?			
Is positive pressure maintained in rooms where volatile organic samples are analyzed?			

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Figure 14-1 (continued)
MICROBAC INTERNAL SYSTEM AUDIT FORM

VIII. AA/ICP Instrumentation

ITEM	YES	NO	COMMENTS
Are written Standard Operating Procedures (SOP) developed for all methods used in this area?			
Is the appropriate portion of the SOP available to the analyst at the various instruments?			
Are contamination-free areas provided for trace level analytical work?			
Are exhaust hoods provided to allow contamination-free work with corrosive materials?			
Is the air flow of the hoods periodically checked and recorded?			
Does the laboratory have a source of distilled/ demineralized water?			
Can the laboratory supervisor document that trace-free water is available for preparation of standards and blanks?			
Are fresh analytical standards prepared at a frequency consistent with good QA?			
Are reference materials properly labeled with concentrations, date of preparation, and the identity of the person preparing the sample?			
Is the standards preparation and tracking logbook maintained?			
Are standards stored separately from sample extracts?			
Is the laboratory maintained in a clean and organized manner?			
Is there a calibration protocol in use by the operator?			
Are calibration results kept in a permanent record?			
Is preventive maintenance applied?			
Is a permanent service record maintained in a logbook?			
Is there evidence that at least one AA/ICP system can be reasonably expected to be operating acceptably at any given time?			

Additional Comments:

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Figure 14-1 (continued)
MICROBAC INTERNAL SYSTEM AUDIT FORM

IX. Data Handling and Review/QC

ITEM	YES	NO	COMMENTS
Are written Standard Operating Procedures (SOP) developed for data review?			
Is the appropriate portion of the SOP available to data review personnel?			
Are data calculations spot-checked by a second person?			
Do records indicate corrective action that has been taken on rejected data?			
Have standard curves been adequately documented?			
Are in-house quality control charts maintained for analysis (i.e. internal standard control charts)?			
Do QC records show corrective action when analytical results fail to meet QC criteria?			
Do supervisory personnel review the data and QC results?			

Additional Comments:

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Figure 14-1 (continued)
MICROBAC INTERNAL SYSTEM AUDIT FORM

X. Purchasing

ITEM	YES	NO	COMMENTS
Does the laboratory have a formal purchase or requisition system for purchasing equipment, supplies and chemicals?			
Do purchases have to be approved by management?			
Are the proper grades of chemicals purchased for the intended use?			
Are only ACS grade or better chemicals used n the laboratory?			
Does the laboratory have a system to track lots for the following categories of supplies:			
a) Acids for preservation?			
b) Acids for metal digestion?			
c) Solvents for extraction?			
d) Sample bottles?			
Does the laboratory maintain certificates for standards, reagents, and sample bottles?			
Is an inventory system used to reserve specific lot numbers of extraction solvents and other critical reagents?			

Additional Comments:

Figure 14-1 (continued)
MICROBAC INTERNAL SYSTEM AUDIT FORM

XI. Training

ITEM	YES	NO	COMMENTS
Does the laboratory have a formal training program and documentation files?			
Are the files current in the following departments?			
a) Wet Chemistry?			
b) Metals?			
c) Extraction?			
d) Volatile Organics?			
e) Semivolatile Organics?			
Does documentation exist that each analyst has performed a proficiency demonstration for each method for which they are certified in the following departments?			
a) Wet Chemistry?			
b) Metals?			
c) Extraction?			
d) Volatile Organics?			
e) Semivolatile Organics?			
Are the analyst's certificates up to date?			

Additional Comments:

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Figure 14-1 (continued)
MICROBAC INTERNAL SYSTEM AUDIT FORM

XII. Document Control

ITEM	YES	NO	COMMENTS
Is the document control system outlined in SOP 46 of the LQAP in use in each department?			
Are controlled copies of the laboratory SOPs available in each department?			
Have "unofficial" or uncontrolled copies of SOPs been removed from the laboratory?			
Does the document control system provide a means to identify out-of-date SOPs and documents?			
Does the system requiring acknowledgment of receipt of control copies appear to be working?			

Additional Comments:

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Figure 14-1 (continued)
MICROBAC INTERNAL SYSTEM AUDIT FORM

XIII. Project Management and Reporting

ITEM	YES	NO	COMMENTS
Are "kick-off" meeting for new projects used effectively to communicate specifications to the laboratory staff?			
Are written work orders being used?			
Are the TSRs performing a review of 100% of each project or sample delivery group (login number)?			
Are data in the LIMS being checked at each of the following stages:			
a) Analyst review?			
b) Peer review?			
c) Supervisory/QC review?			
d) Data entry?			
e) Data verification and editing?			
f) Final report review?			
Does each report have a certification and signature by the laboratory manager or appropriate designee?			

Additional Comments:

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15.0 QUALITY ASSURANCE REPORTS

The QAO and other laboratory technical directors perform an annual review of the quality system. This review includes all of the following elements:

- Results of internal audits
- Results of external audits
- Results of Proficiency Testing (PT) studies
- Summary of review of Corrective Action Reports
- Reports and deliverables
- Electronic Data Deliverables (EDD)
- Annual revision of the Quality Assurance Manual

15.1 Laboratory Quality Assurance Reports

The QAO prepares a monthly report for the Managing Director and to Microbac's corporate Director of Quality Improvement. The report summarizes laboratory activities for audits, PT studies, corrective action closure, certification changes, training, customer feedback, and other significant events.

The QAO also presents a written annual report to the Managing Director that summarizes the annual system review activities. Any significant quality assurance or quality control problems along with the recommended solutions for the problems will be listed.

15.2 Quality System Review Report

The Quality System Review is conducted annually (see Section 14.3) and a report of this review is issued to the president of the company. This report is included in the Annual Business Plan with the recommendations, observations, and adjustments incorporated in the business plan/strategy for the following year.

15.3 Special Reports

The QAO shall prepare special quality assurance reports as necessary to document special concerns and problems. These reports may indicate the discussion of chronic PT performance problems, evaluation of Corrective Action Reports, results of storage blanks, follow-up from internal and external audits, customer complaints, and any trends determined from periodic evaluation of statistical data.

16.0 SPECIAL PROGRAM REQUIREMENTS

This section identifies the specific requirements of various state and federal programs that have requirements that go beyond what is outlined in this quality manual and the laboratory policies and procedures (SOPs) referenced in Appendix B. It is not the intent to list all of the QA/QC requirements of these programs, since these documents are incorporated by reference. Only the specifications that more stringent than our standard protocols will be identified.

16.1 Department of Defense

Microbac performs analyses for projects that must comply with the DoD's Quality Systems Manual (QSM). The QSM is based on the NELAC standards, but has special requirements that are identified in the DoD "gray boxes". The appendices to the QSM summarize the QA/QC requirements for several common methods and list special surrogate and LCS control limits. To assure compliance with the DoD's QSM, Microbac has implemented the following special procedures.

16.1.1 QAPP and Control Limits

The DoD QSM has special QA/QC acceptance limits for the LCS, MS/MSD, and surrogates. The KOBRA project set up specifications shall identify the QAPP and QC-Key i.e. DOD3. The KOBRA QC Table is populated with the correct LCS/surrogate acceptance limits for DoD3. These steps will assure that the correct control limits are used for all QSM projects.

16.1.2 Internal Standards

Methods 8260 and 8270 must compare the internal standard (IS) area to the mid-point of the ICAL curve. Use KOBRA project set-up to indicate this requirement.

16.1.3 Soil Sub-sampling – Method 8330B

Microbac will follow these procedures for drying, sieving, grinding, and multi-increment sub-sampling of soil samples in preparation for SW-846 method 8330B. The laboratory obtained additional guidance for these procedures from "DoD" Guide for Implementing EPA SW-846 Method 8330B", July 7, 2008.
Sample Drying

Remove the entire contents of the 8330 sample container and spread the soil evenly in a shallow pan lined with aluminum foil. Remove all large pebbles, sticks, and other solids too large to pass through a 2 mm screen. Air-dry the

soil at room temperature in the soil drying room or other low traffic area of the laboratory.

Sieving Procedure

Gently crush the air-dry soil using a large spoon or glass rod and transfer to a clean 2 mm sieve. Stir, shake, and mix the sample and allow it to pass through the sieve, and collect in a foil-lined pan. Do not use excessive force in this step, as this may damage the screens. The sample is now the portion that passes the 2 mm screen.

Grinding Procedure

Transfer the sieved sample to a mill grinder or a mortar and pestle. Grind entire sample reducing the particle size to 75 micron, or less.

Sub-sampling

Transfer the entire ground sample to a clean shallow pan, spreading the soil to thickness of 1 – 2 cm. Using a small spatula, randomly remove at least thirty increments of approximately 0.33 g each, giving a representative sub-sample of 10 g. Record the weight of the subsample to the nearest 0.01 g. This is the sample aliquot to be taken for extraction via ultrasonic bath.

Triplicate Analysis and MS/MSD (Optional)

For each sample delivery batch of 1-20 samples, process the client-specified sample(s) in triplicate by processing three discrete 10 g sub-samples as per Section 7.4. Individual projects may vary the rate of samples processed in triplicate. Repeat the sub-sampling procedure two more times for each sample specified for MS/MSD.

Grinding Blanks

A grinding blank with each batch of samples will be used to verify the effectiveness of the cleaning procedures. Some projects may require grinding blanks after each sample. The project QAPP will specify the frequency of these blanks, and they will be logged into the LIMS accordingly. The grinding blank(s) must meet the same criteria as the 8330B method blank (no target analytes > one-half the RL).

Grinder Cleaning Procedures

Use the following procedures to clean the mortar and pestle and coffee grinder(s) between samples:

1. Remove bowl/blade from base of grinder
2. Immerse bowl/blade in soapy water and remove all visible soil residue
3. Rinse w/ tap water
4. Rinse w/ DI Water
5. Wipe with paper towel and air dry

16.1.4 Soil Sub-sampling – Metals

Microbac will use the following procedures for the drying, sieving, grinding, and sub-sampling of soil samples in preparation for metals digestion by SW-846 methods 3050 or 3051. This procedure may be extended to other methods if specified in the project QAPP.

Sample Drying

Remove the entire contents of the metals sample container and spread the soil evenly in a shallow pan lined with wax paper. Remove all large pebbles, sticks, and other solids too large to pass through a 2 mm screen. Air-dry the soil room temperature in a secure, low traffic area of the laboratory.

Sieving Procedure

Gently crush the air-dry soil using a large plastic, wood or glass rod and transfer to a clean 2 mm sieve. Stir, shake, and mix the sample and allow it to pass through the sieve, and collect in a foil-lined pan. Do not use excessive force in this step, as this may damage the screens. The sample is now the portion that passes the 2 mm screen.

Grinding Procedure

Transfer the sieved sample to a mortar and pestle. Grind entire sample reducing the particle size to 75 micron, or less.

Sub-sampling

Transfer the entire sample to a clean shallow pan, spreading the soil to thickness of 0.3-0.5 cm. Using a rectangular micro-spatula, remove representative cross-section(s) of the soil giving a sample in the range of 1.0-2.0 g. Record the weight of the sub-sample to the nearest 0.01 g. This is the aliquot to be taken for microwave digestion using SW-846 method 3051A.

16.2 Air Force Center for Environmental Excellence (AFCEE)

Microbac performs project work that must meet the requirements of various documents prepared by the AFCEE. We have provided analytical support to prime contractors under QAPP versions 1.0 – 4.0.02. Each version has special QA/QC requirements, the details of which are identified in the specific QAPP reference. To assure compliance with the AFCEE QAPPs, Microbac has implemented the following special procedures.

16.2.1 QAPP and Control Limits

The AFCEE QAPPs have special QA/QC acceptance limits for the LCS, MS/MSD, and surrogates. The KOBRA project set up specifications shall identify the QAPP and QC-Key, i.e AF40, AF31, etc.. The KOBRA QC Table is populated with the correct LCS/surrogate acceptance limits for each AFCEE QAPP These steps will assure that the correct control limits are used for all AFCEE projects.

16.2.2 AFCEE Reporting Limits

AFCEE QAPPs specifies that the MDL must be no greater than one-half the project's RL. The KOBRA project review system shall assure use of the special reporting lists created just for AFCEE projects (pkeys). Microbac has/will adjust the RLs accordingly to comply with the projects requirement, but in some cases it may be necessary to repeat MDL studies, if a lower RL is required. Microbac will get client approval of all reporting limits before proceeding with an AFCEE project.

17.0 REFERENCES

17.1 NELAC Standards, June 2003.

17.2 Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans, QAMS-005/80, December 29, 1980, Office of Monitoring Systems and Quality Assurance, ORD, U.S. EPA, Washington, DC 20460.

17.3 RCRA QAPP Instructions, U.S. EPA Region 5, Revision: April 1998.

17.4 ASTM D-5283-92. Generation of Environmental Data Related to Waste Management Activities: Quality Assurance and Quality Control Planning and Implementation.

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17.5 "American National Standards Specification and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs (ANSI/ASQC E-4)", 1994.

17.6 EPA 2185 – Good Automated Laboratory Practices, 1995.

17.7 ANSI/ISO/IEC 17025 - 2005 General requirements for the competence of calibration and testing laboratories.

17.8 QA/R-2: EPA Requirements for Quality Management Plans, August 1994.

17.9 QA/G-4: Guidance for the Data Quality Objectives Process EPA/600/R-96/055, September, 1994.

17.10 QA/R-5: EPA Requirements for Quality Assurance Project Plans Draft – November 1997.

17.11 QA/G-5: Guidance on Quality Assurance Project Plans EPA/600/R-98/018, February, 1998.

17.12 QA/G-6: Guidance for the Preparation of Standard Operating Procedures for Quality-Related Operations EPA/600/R-96/027, November, 1995.

17.13 QA/G-9: Guidance for the Data Quality Assessment: Practical Methods for Data Analysis EPA/600/R-96/084, January, 1998.

17.14 Manual for the Certification of Laboratories Analyzing Drinking Water EPA/570/9-90/008.

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APPENDIX A
DEFINITIONS

The following definitions are used in the production of this Comprehensive Quality Assurance Plan.

Analytical Batch:

The basic unit for analytical quality control. The analytical batch is defined as samples which are analyzed (or sampled together) with the same method sequence, the same lots of reagents, and with the same treatment common to all samples. The samples should have been analyzed (or collected) within the same specified time period or in continuous sequential time periods. Samples in each batch should be of similar composition.

Audits:

A systematic check to determine the quality of operation of some function or activity.

1. **Performance Audits:** Quantitative data are independently obtained for comparison with routinely obtained data in a measurement system. Examples of these audits are EPA performance evaluation programs, commercial performance evaluation programs, split sampling programs involving at least two laboratories, and blind spike samples.

2. **Systems Audit:** These are qualitative in nature and consist of an on-site review and evaluation of a laboratory or field operation quality assurance system and physical facilities for sampling, calibration and measurements.

Calibration:

Process by which the correlation between instrument response and actual value of a measured parameter is determined.

1. **Calibration Curve:** A curve which plots the concentration of known analyte standards against the instrument response to the analyte. Also known as a Standard Curve or the ICAL.

2. **Calibration Standard:** Solutions or dilutions of a substance or material with a verifiable accuracy which are used to evaluate the sample property of an unknown sample. In analytical terms, these standards are used to establish a calibration curve or standard instrument response factors.

3. **Continuing Calibration Verification:** Standards that are analyzed during an analytical set to verify the accuracy of the calibration curve.

4. **Internal Standard:** A compound having similar chemical characteristics to the compounds of interest, but which is not normally found in the environment or does not interfere with the compounds of interest. A known and specified concentration of the standard is added to each sample prior to analysis. The concentration in the sample is based on the response of the internal standard relative to that of the calibration standard and the compound in the standard.

Confidence Level:

The statistical probability associated with an interval of precision (or accuracy) values in a QC chart. The values of confidence intervals are generally expressed as percent probability. It is a commonly accepted convention that the result being tested is significant if the calculated probability is greater than 99 percent.

Data Quality Objectives:

A set of specifications that the environmental data should meet in order to be acceptable for its intended use in a program area. DQO's are commonly established for limits of detection and quality of data (precision, accuracy, representativeness and comparability).

1. **Accuracy:** The degree of agreement of a measurement X (or an average of measurements of the same thing), with an accepted reference or true value, T, usually expressed as the difference between the two values, X-T, or the difference as a percentage of the percentage of the reference or true value, 100 (X/T)/T, and sometimes expressed as a ratio, X/T. Accuracy is a measure of the bias in a system.

2. **Precision:** A measure of mutual agreement among individual measurements of the same property, usually prescribed similar conditions. Precision is best expressed in terms of the standard deviation. Various measures of precision exist, depending upon the "prescribed similar conditions."

3. **Representativeness:** Expresses the degree to which data accurately and precisely represents, a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.

4. **Comparability:** Expresses the confidence with which one data set can be compared to another.

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5. **Completeness:** Completeness refers to the percentage of measurements made which are judged to be valid. The completeness goal is the same for all data uses: that we achieve 95% completeness on our first analysis. Subsequently our goal is to achieve 100% completeness by resampling or doing additional analysis.

Detection Limits:

The smallest concentration/amount of an analyte of interest that can be measured with a stated probability of significance.

1. **Method Detection Limit (MDL):** The smallest concentration of an analyte of interest that can be measured and reported with 99 percent confidence that the concentration is greater than zero. The MDL's are determined from the analysis of a sample in a given matrix containing the analyte at a specified level. Determination of MDL's should be done by procedures determined in Appendix B of 40 CFR, Part 136. Equivalent procedures to determine MDL's may be used.

2. **Detection Limit (DL):** The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration at the 99% level of confidence. At the DL, the false positive rate (Type I error) is 1%.

3. **Limit of Detection (LOD):** The smallest amount or concentration of a substance that must be present in a sample in order to be detected at a high level of confidence (99%). At the LOD, the false negative rate (Type II error) is 1%.

4. **Limit of Quantitation (LOQ):** The lowest concentration that produces a quantitative result within specified limits of precision and bias. For DoD projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard.

5. **Practical Quantitation Limit (PQL):** The smallest concentration of an analyte of interest that can be reported with a specific degree of confidence. PQL's shall be determined in the same way as MDL's by using the procedures outlined in Appendix B of 40 CFR, Part 136. The standard deviation (sd) derived from the procedure will be used to calculate the PQL: PQL = 10sd, which corresponds to an uncertainty of $\pm$ 30 percent in the measures value at the 99 percent confidence level.

6. **Instrument Detection Limit (IDL):** The smallest amount of an analyte of interest that generates an instrument response (signal) under prescribed conditions, so that the magnitude of the signal is larger than the absolute uncertainty (error) associated with it.

Environmental Sample:

Means any sample from a natural source or source that reasonably may be expected to contribute pollution to or receive pollution from groundwaters or surface waters of the State. This includes, but is not limited to: receiving waters; waters used to define natural background conditions; soils; sediments; industrial, domestic or municipal discharge effluents; chemical storage or handling facilities; waste disposal facilities or areas; industrial or agricultural chemical handling or application areas; surface water run-off; and facilities for the handling or applying of chemicals for weed or insect control.

Holding Time:

Sample hold time is defined as time elapsed from sample collection date and time to sample analysis date and time.

Parameter Group:

Is defined as a group of samples that have been preserved in the same manner, prepared by similar protocols and analyzed using instruments of similar technology (also known as analyte group). Examples of parameter groups are:

- Volatiles (EPA methods 601, 602, and 624)
- Pesticides (EPA methods 608, 614, and 622)
- Trace Metals (All metals except mercury)
- Nutrients (Total Kjeldahl Nitrogen, Nitrate-Nitrite, Total Phosphorus)

Performance Evaluation Samples:

A sample submitted for analysis whose composition and concentration are known to the submitter but unknown to the analyst. Also known as a Blind Sample.

Quality Assurance:

A system of activities whose purpose is to provide the producer or user of environmental data the assurance that it meets defined standards of quality with a stated level of confidence.

Quality Assurance Plans (QAP):

An orderly assembly of detailed and specific procedures which delineates how data of a known and accepted quality is produced.

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Quality Assurance Project Plans (QAPP):

A QA plan that is written for a specific project outlining specific QA targets and data quality objectives as well as protocols and QC measures needed to meet the project specific objectives.

Quality Control Measures:

1. Blanks:

An artificial sample of an analytical matrix designed to monitor the introduction of artifact into the system.

a) Field Quality Control Blanks

- Field Blanks: Blanks of analyte-free water prepared on-site by filling the pre-preserved sample containers with the water, sealing the containers, and completing the documentation. These blanks should be prepared during the middle to end of a sampling event by filling sample containers with water from the equipment decontamination water transport containers. They are to be treated, stored, transported, and analyzed in the same manner as the sample group for which it was intended. These blanks may be submitted for all water parameter groups.

- Equipment Blanks: Blanks of analyte-free water that are prepared on-site by pouring the equipment decontamination water through decontaminated field equipment. Appropriate pre-preserved sample containers for each analyte group should be used, and documentation should be completed. These blanks are to be stored, transported and analyzed with the intended parameter groups. At least one equipment blank is required for each water and solid matrix analytical group, and should be collected at the beginning of the sampling episode. If field decontamination is performed on-site, additional equipment blanks should be submitted for all water and solid matrix analytical groups.

- Trip Blanks: These blanks are required for volatile organic compound (VOC) water samples only. Blanks of volatile organic-free water are prepared by the organization providing the sample containers. These are transported to the site with the empty VOC sample containers, and shipped to the analyzing laboratory in the same containers. They remain unopened for the entire trip. Proper labeling and documentation should be completed. One trip blank for VOC sent per project unless client requests more.

b) Laboratory

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- Method Blank: A blank of an analyte-free matrix that is processed (digested, extracted, etc.) and analyzed with a specified sample set.

- Reagent Blank: An aliquot of analyte-free water or solvent that is analyzed with a sample set.

2. Spiked Samples:

   These are samples fortified to a known and validated concentration of analyte. Percent recoveries are calculated for each compound in the spike.

   a) Field

   - An environmental sample fortified to a known and validated concentration in the field. These may be submitted as blind spike (laboratory does not know they are spiked) or as identified field spikes.

   b) Laboratory

   - LCS (Laboratory Control Sample): Samples of an analyte-free matrix (deionized water, sand, soil, etc.) that are fortified to a known and validated concentration of analyte(s) before sample preparation.

   - Sample (Matrix Spikes): Environmental sample selected from a set (not blanks) that is fortified to a known and validated concentration of analyte(s) before sample preparation. The concentration of each analyte in the spiking solution should be approximately 3-5 times the level expected in the sample.

   - Surrogate Spikes: A compound having similar chemical characteristics to the compounds of interest, but which is not normally found in environmental samples. Known concentrations of these compounds are added to all samples in the set before sample preparation.

3. Replicate Sample:

   Samples that have been collected at the same time from the same source (field replicates) or aliquots of the sample that are prepared and analyzed at the same time (laboratory replicates).

   a) Duplicate samples: Samples that are one type of a replicate sample. The analytical results from replicates are used to determine the precision of a system. If the concentration of analytes in the sample is below detectable limits, Duplicate Spike Samples may be used to determine precision.

b) Blind Replicates (Duplicates): Samples that are replicates that have been collected (field replicate) or prepared (laboratory replicate) and are submitted and analyzed as separate samples (analyst does not know they are replicates).

4) Quality Control Checks:

Standards or samples from an independent source that are analyzed at a specific frequency.

a) Quality Control Check Standards: Standard solutions from a source other than normal calibration standards that are certified and traceable. These standards are used to check the accuracy of a calibration curve.

b) Quality Control Check Samples: (also known as Reference Materials): Samples obtained from an independent source for which the level(s) of analytes have been validated. These samples are prepared and analyzed with a sample set of similar matrix. If these samples have been obtained from the National Institute of Standards and testing (formerly National Bureau of Standards), they are referred to as Standard Reference Materials.

5) Split Samples:

Replicate of the same sample that is given to two independent laboratories for analysis.

Sample Custody:

All record and documentation required to trace a sample from point of origin to disposal after analysis. These records should include, but are not limited to:

a) Field notebooks;
b) Field sample ID tags
c) Laboratory transmittal forms (if applicable);
d) Laboratory sample receipt logs;
e) Sample extraction/preparation logs or worksheets;
f) Analytical (instrument) logs or worksheets;
g) Calibration and quality control data associated with a sample set;
h) Instrument maintenance logs;
i) Sample disposition logs; and
j) Final reports.

Legal Chain of Custody is a special type of sample custody in which all events associated with a specific sample should be documented in writing. In addition to the records described above, chain of custody records should include the following:

a) Sample transmittal forms or tags that have adequate spaces for the dated, original signatures of all individuals who handle the sample (or cleaned sample containers if obtained for a contracted laboratory) from time of collection (or container receipt) to laboratory delivery.

b) Laboratory sample storage logs that identify date, time, and individuals who remove samples from storage.

c) Secure, limited access storage areas.

Sample Matrix:

This means that characteristic of an environmental laboratory sample, associated with its physical and chemical properties, which defines how such a sample is handled when subjected to the intended analytical process. The following samples matrices (major matrix groups), defined below should be used in QA plans whenever specifying data quality objectives:

1. **Reagent Water:** A sample of water which conforms to ASTM TYPE II, III, IV.

2. **Drinking Water:** Includes finished (treated) or raw source water designated as potable water. Such resources may be from surface or ground water.

3. **Surface Water:** Includes fresh or saline waters from streams, canals, rivers, lakes, ponds, bays and estuaries (natural or manmade).

4. **Groundwater:** Includes all waters found below ground in confined or unconfined aquifers.

5. **Wastewater:** Includes any influent or effluent associated with domestic or industrial waste treatment facilities.
6. **Chemical Waste:** Includes sludges and residuals from domestic or industrial wastewater processing, and liquid or solid chemicals no longer used for their intended purpose.

7. **Soil/Sediment:** Surface or subsurface soils and sediments of fresh or salt water origin.

8. **Biological Tissue:** Includes tissue of plant or animal origin. The most common of these are shellfish, finfish, and aquatic plants.

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APPENDIX B

STANDARD OPERATING PROCEDURES (SOP)
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SOP By Department Listing

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Conventionals	13	Deanna Hesson	Leslie Bucina	02-15-2012	15	K0100	Fecal Coliform (Membrane Filtration) - SM 9222D
Conventionals	16	Deanna Hesson	Leslie Bucina	11-15-2011	15	K0002	Calibration Techniques
Conventionals	10	Deanna Hesson	Leslie Bucina	01-15-2012	8	K0005	Extraction of Soils and Sludges
Conventionals	10	Deanna Hesson	Leslie Bucina	09-15-2011	11	K4829	ASH - ASTM D482-07/D2974-87
Conventionals	14	Deanna Hesson	Leslie Bucina	09-15-2011	15	K3761	Sulfide (Titrimetric, Iodine) - EPA 376.1/SM 4500-S F
Conventionals	13	Deanna Hesson	Leslie Bucina	04-15-2011	15	K1501	pH (Electrometric) - SW846 9040C, 9045D/EPA 150.1, SM4500H+B
Conventionals	3	Deanna Hesson	Leslie Bucina	09-15-2011	4	K0001	Glassware Washing
Conventionals	17	Deanna Hesson	Leslie Bucina	03-15-2011	22	K3512	Total Kjeldahl Nitrogen (Semi-Automated Block Digester) EPA 351.2
Conventionals	10	Deanna Hesson	Leslie Bucina	04-15-2011	20	K7332	Reactivity (Cyanide and Sulfide) - SW846 Section 7.3
Conventionals	9	Deanna Hesson	Leslie Bucina	04-15-2011	11	K2710	Specific Gravity - SM 2710F
Conventionals	14	Deanna Hesson	Leslie Bucina	09-15-2011	20	K3252	Chloride (Automated, Ferric Nitrate) EPA 325.2, SM4500Cl-E
Conventionals	8	Deanna Hesson	Leslie Bucina	01-15-2012	19	K5310	TOC in Soil - Lloyd Kahn Method
Conventionals	13	Deanna Hesson	Leslie Bucina	09-15-2011	15	K3101	Alkalinity (Titrimetric, pH 4.5) - EPA 310.1/SM 2320B
Conventionals	12	Deanna Hesson	Leslie Bucina	01-15-2012	18	K4251	Methylene Blue Active Substances (MBAS, Surfactants) - SM 5540C
Conventionals	8	Deanna Hesson	Leslie Bucina	09-15-2011	14	K3758	Total Sulfur - SW846 5050/EPA 375.4
Conventionals	13	Deanna Hesson	Leslie Bucina	01-15-2012	17	K1302	Hardness, Total (Titrimetric, EDTA) Method 130.2/SM 2340C
Conventionals	12	Deanna Hesson	Leslie Bucina	05-15-2011	15	K1601	Residue, Filterable (TDS, Gravametric, 180 degrees C) EPA Method 160.1, SM2540C
Conventionals	13	Deanna Hesson	Leslie Bucina	01-15-2012	15	K1201	Conductance (UMHOS at 25 Degrees Celcius - EPA 120.1, SM2510B
Conventionals	14	Deanna Hesson	Leslie Bucina	04-15-2011	31	K3354	Cyanide, All Forms (Spectrophotometric) - EPA 335.2/335.4/9010C/9014/SM 4500 CN-C,E (Total), EPA 335.1 SM/9010C/9014/ 4500 CN-C,G (Amenable to Chlorination)/SM 4500CN-I (Weak-Dissociable)
Conventionals	16	Deanna Hesson	Leslie Bucina	03-15-2011	22	K3654	Total Phosphorus: (Semi-Automated Block Digestor/Automated) - EPA Method 365.4
Conventionals	11	Deanna Hesson	Leslie Bucina	05-15-2011	16	K1801	Turbidity (Nephelometric)-EPA 180.1, SM2130 B
Conventionals	15	Deanna Hesson	Leslie Bucina	02-15-2012	15	K0101	Total Coliform (Membrane Filtration) - SM 9222-B
Conventionals	17	Deanna Hesson	Leslie Bucina	04-15-2011	21	K2186	Chromium,Hexavalent (Colorimetric) Standard Method 3500-Cr B
Conventionals	11	Deanna Hesson	Leslie Bucina	09-15-2011	15	K3771	Sulfite (Titrimetric) - Method SM 4500-S03 B, EPA 377.1
Conventionals	17	Deanna Hesson	Leslie Bucina	03-15-2011	19	K4051	Biochemical Oxygen Demand - SM 5210 B
Conventionals	14	Deanna Hesson	Leslie Bucina	01-15-2012	20	K4105	Chemical Oxygen Demand (COD) - EPA 410.4 (mod)/SM 5220D/Hach 8000
Conventionals	17	Deanna Hesson	Leslie Bucina	03-15-2011	26	K3501	Nitrogen, Ammonia (Automated Phenate) - EPA 350.1 / SM 4500-NH3
Conventionals	11	Deanna Hesson	Leslie Bucina	09-15-2011	15	K3052	Acidity (Titrametric) EPA Method 305.2/SM2310B(4d)

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Conventionals	5	Deanna Hesson	Leslie Bucina	01-15-2012	17	K3500	Ferrous Iron - SM3500 Fe-B
Conventionals	2	Deanna Hesson	Leslie Bucina	04-15-2011	17	K5468	Gross Calorific Value of Waste Materials (BTU) - ASTM D5468
Conventionals	11	Deanna Hesson	Leslie Bucina	09-15-2011	15	K3051	Acidity (Titrimetric, H2O2) EPA Method 305.1/SM2310B(4a)
Conventionals	14	Deanna Hesson	Leslie Bucina	09-15-2011	22	K4151	Organic Carbon, Total (Oxidation) - EPA 415.1/SW846 9060A/SM5310C
Conventionals	12	Deanna Hesson	Leslie Bucina	04-15-2011	19	K5050	Halides, Total (TX) - SW 846 Method 5050
Conventionals	10	Deanna Hesson	Leslie Bucina	12-15-2011	10	K9095	Paint Filter Liquids Test - SW846 Method 9095B
Conventionals	8	Deanna Hesson	Leslie Bucina	09-15-2011	13	K3601	Dissolved Oxygen and Winkler Calibration, EPA method 360.1, SM 4500-O C,G
Conventionals	13	Deanna Hesson	Leslie Bucina	05-15-2011	14	K1603	Residue, Total (TS, Gravemetric, 103 - 105 Degrees C) EPA Method 160.3, SM2540B
Conventionals	12	Deanna Hesson	Leslie Bucina	02-15-2012	13	K0103	Most Probable Number of Fecal Coliforms - SM 9221 B,C,E
Conventionals	14	Deanna Hesson	Leslie Bucina	01-15-2012	17	K3541	Nitrogen, Nitrite (Spectrophotometric) EPA 354.1/SM 4500-NO2B
Conventionals	12	Deanna Hesson	Leslie Bucina	01-15-2012	21	K9030	Sulfide (Acid Soluble/Acid Insoluble) - Method SW846 9030B/9034
Conventionals	6	Deanna Hesson	Leslie Bucina	11-15-2011	20	K1664	n-Hexane Extractable Material and (Silica Gel Treated n-Hexane Extractable Material) (Automated Solid Phase) Method 1664A
Conventionals	18	Deanna Hesson	Leslie Bucina	01-15-2012	22	K3532	Nitrogen, Nitrate-Nitrite (Automated, Cadmium Reduction) - EPA 353.2/SM4500NO3 F
Conventionals	13	Deanna Hesson	Leslie Bucina	03-15-2011	18	K3402	Fluoride (Potentiometric, Ion Selective Electrode) - SM 4500-F C
Conventionals	10	Deanna Hesson	Leslie Bucina	03-15-2011	21	K3401	Fluoride (Preliminary Distillation) - SM 4500-F B
Conventionals	10	Deanna Hesson	Leslie Bucina	05-15-2011	10	K1605	Settleable Solids (Volumetric, IMHOFF Cone) - EPA Method 160.5/SM 2540F
Conventionals	15	Deanna Hesson	Leslie Bucina	01-15-2012	17	K1010	Flash Point (Pensky-Martens Closed Cup Method) - SW846 1010A
Conventionals	13	Deanna Hesson	Leslie Bucina	05-15-2011	15	K1602	Residue, Non-Filterable (TSS, Gravemetric, 103 degrees C) EPA Method 160.2/SM2540D
Conventionals	17	Deanna Hesson	Leslie Bucina	09-15-2011	21	K4201	Phenolics, Total Recoverable (Spectrophotometric, manual 4-AAP/Easy-Distillation) EPA Method 420.1
Conventionals	14	Deanna Hesson	Leslie Bucina	11-15-2011	20	K3102	Alkalinity (Automated Methyl Orange) EPA Method 310.2
Conventionals	14	Deanna Hesson	Leslie Bucina	09-15-2011	17	K9075	Total Residual Chlorine - SM 4500-Cl, G
Conventionals	12	Deanna Hesson	Leslie Bucina	01-15-2012	10	K0003	Percent Solids(Percent Moisture) - ASTM D2216-90
Conventionals	16	Deanna Hesson	Leslie Bucina	11-15-2011	20	K3754	Sulfate, Total (Turbidimetric) - EPA Method 375.4, SM 426 C (15th ed)
Conventionals	13	Deanna Hesson	Leslie Bucina	01-15-2012	17	K3653	Orthophosphate (Colorimetric, Ascorbic Acid, Single Reagent) EPA 365.2/SM 4500-P E
Conventionals	12	Deanna Hesson	Leslie Bucina	01-15-2012	14	K1102	Color (Colorimetric-Platinum-Cobalt) - SM 2120 B
Conventionals	12	Mike Cochran	Leslie Bucina	11-15-2011	24	IC01	Determination of Inorganic Anions By Ion Chromatography - Method 9056/300.0

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Digestions	13	Maren Beery	Leslie Bucina	11-16-2011	31	ME404	Mercury (7470A, 245.1)
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Extractions	16	Chad Barnes	Leslie Bucina	02-15-2012	14	EXB01	Continuous Liquid-Liquid Extraction Semivolatiles (BNA) - Method 3520C
Extractions	17	Chad Barnes	Leslie Bucina	03-15-2011	17	EXD01	Extraction of Diesel Range Organics
Extractions	14	Chad Barnes	Leslie Bucina	02-15-2012	10	EXB03	Waste Dilution for Semivolatiles - Method 3580A
Extractions	13	Chad Barnes	Leslie Bucina	04-15-2011	15	EXP01	Separatory Funnel Liquid-Liquid Extractions for Pesticides and PCBs - SW846 Method 3510, 3500, and CFR Method 608
Extractions	11	Chad Barnes	Leslie Bucina	06-28-2011	12	EXTNT01	Liquid Extraction of Nitroaromatics and Nitroamines - SW846 Method 8330
Extractions	15	Chad Barnes	Leslie Bucina	02-15-2012	13	EXA01	Separatory Funnel Liquid-Liquid Extraction for Polynuclear Aromatic Hydrocarbons and Organophosphorus Pesticides - Method 3510C/3520C
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Extractions	7	Chad Barnes	Leslie Bucina	03-15-2011	15	EXPRO	Extraction of Petroleum Range Organics
Extractions	13	Chad Barnes	Leslie Bucina	02-15-2012	12	EXA02	Sonication Extractions for Polyaromatic Hydrocarbons - Method 3550
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General	3	Stephanie Mossburg	Leslie Bucina	12-15-2011	5	CRC01	Ensuring Confidentiality of Results
General	13	Jane Thompson	Leslie Bucina	08-15-2011	37	SOP33	Laboratory Waste Management
General	00	Matt Wilson	Leslie Bucina	10-15-2011	8	MISBUR	Backup and Recovery
General	3	Mike Albertson/Mike Cochran	Leslie Bucina	09-15-2011	20	SOP41	Manual Integration of Chromatographic Peak
General	4	David Bumgarner	Leslie Bucina	01-15-2012	9	ETH01	Ethics Policy
General	1	David Bumgarner	David Vandenberg	11-18-2011	7	GP-QMSR	Quality Management System Review

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SOP By Department Listing

Department	Rev.	Author	Approved By	Approval Date	# Pages	Name	Title
General	1	David Bumgarner	Leslie Bucina	10-15-2011	6	GP-UNCERTAINTY	Estimation of Uncertainty of Measurement
General	1	Stephanie Mossburg	Leslie Bucina	01-15-2012	9	GP-CONTRACTS	Review of Contracts
General	00	Leslie Bucina	David Vandenberg	09-15-2011	6	GP-RCA	Root Cause Analysis
General	1	David Bumgarner	Leslie Bucina	09-15-2011	10	GP-PURCHASING	Purchasing Services and Supplies
General	1	Dianna Rauch	Leslie Bucina	10-15-2011	10	GP-DOC-CONTROL	Document Control
General	1	Leslie Bucina	David Vandenberg	11-15-2011	8	GP-CAPA	Corrective Action and Preventive Action: Initiating, Tracking, and Monitoring
General	1	Leslie Bucina	David Vandenberg	09-15-2011	9	GP-RECORDS	Managing Records
General	1	David Bumgarner	David Vandenberg	11-15-2011	8	GP-INTAUDIT	Internal Audit Guidelines
General	13	David Bumgarner	David Vandenberg	02-15-2011	199	LQAP	Laboratory Quality Assurance Plan
General	00	Will Beasley	Leslie Bucina	01-19-2012	11	GP-IT-Software	Software Version Control
General	00	David Bumgarner	Leslie Bucina	Pending		GP-TEMP-SSU	Temperature Control Systems for Sample Storage Units
General	00	Will Beasley	Leslie Bucina	Pending		IT-Hardware	LIMS Hardware Design and Maintenance
General	00	Wade DeLong	Leslie Bucina	Pending		GP-Review of Analytical Data	Review of Analytical Data
Metals	11	Maren Beery	Leslie Bucina	11-15-2011	47	ME600E	Perkin Elmer Optima 4300 Inductively Coupled Plasma Atomic Emission Spectroscopy (SW-6010) SW-846 Method 6010/200.7
Metals	2	Maren Beery	Leslie Bucina	11-15-2011	47	ME600G	Thermo iCAP 6000 Series Inductively Coupled Plasma Atomic Emission Spectroscopy SW-846 Method 6010/EPA 200.7
Metals	7	Maren Beery	Leslie Bucina	04-15-2011	46	ME700	Perkin Elmer ELAN 6100 Inductively Coupled Plasma/Mass Spectrometer - SW846 6020/EPA 200.8
Metals	00	Maren Beery	Leslie Bucina	Pending		ME700A	Perkin Elmer NexION 300X Inductively Coupled Plasma/Mass Spectrometer (SW-846 6020/EPA Method 200.8)
OVAP	00	Maren Beery	Leslie Bucina	11-15-2010	14	OVAP ME401	OVAP Acid Digesting of Waters for Total Recoverable or Dissolved ICP Spectroscopy - Method 3005A
OVAP	00	Chad Barnes	Leslie Bucina	11-15-2010	13	OVAP EXA01	OVAP Separatory Funnel Liquid-Liquid Extraction for PAH's - Method 3510C/3520C
OVAP	00	Deanna Hesson	Leslie Bucina	12-15-2010	19	OVAP K2186	OVAP Chromium, Hexavalent - Standard Method 3500-Cr D
OVAP	00	Mike Albertson	Leslie Bucina	11-15-2010	20	OVAP SOP41	OVAP Manual Integration of Chromatographic Peaks
OVAP	00	Maren Beery	Leslie Bucina	11-15-2010	16	OVAP ME407	OVAP Microwave Digestion - Aqueous - SW846 Method 3015
OVAP	00	Maren Beery	Leslie Bucina	11-15-2010	16	OVAP ME406	OVAP Microwave Digestion of Sediments and Soils - Method 3051
OVAP	00	Maren Beery	Leslie Bucina	12-15-2010	28	OVAP ME405	OVAP Mercury SE-846 Method 7471A

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Microbac

SOP By Department Listing

Department	Rev.	Author	Approved By	Approval Date	# Pages	Name	Title
OVAP	00	Chad Barnes	Leslie Bucina	12-15-2010	15	OVAP EXB02	OVAP Sonication Extractions for Semivolatiles - Method 3550B
OVAP	00	Chad Barnes	Leslie Bucina	12-15-2010	15	OVAP EXP02	OVAP Sonication Extractions for Pesticides and PCB's - SW846 Method 3550B
OVAP	00	Chad Barnes	Leslie Bucina	12-15-2010	13	OVAP EXA02	OVAP Sonication Extrations for Polyaromatic Hydrocarbons - Method 3550B
OVAP	00	Maren Beery	Leslie Bucina	12-15-2010	28	OVAP ME404	OVAP Mercury (7470A)
OVAP	00	Maren Beery	Leslie Bucina	12-15-2010	37	OVAP ME600G	OVAP Thermo iCap Series ICP Atomic Emission Spectroscopy - SW-846 Method 6010B
OVAP	00	Maren Berry	Leslie Bucina	01-15-2011	41	OVAP ME600E	OVAP PE Optima 4300 ICP Atomic Emission Spectroscopy SW-846 - Method 6010B
OVAP	00	Chad Barnes	Leslie Bucina	12-15-2010	15	OVAP EXB01	OVAP Extraction Semivolatiles (BNA) - Method 3520C
OVAP	00	Mike Albertson	Leslie Bucina	12-15-2010	16	OVAP PAT01	OVAP Purge and Trap for Volatile Organics - SW846 Methods 5030B and 5035A
OVAP	00	Chad Barnes	Leslie Bucina	12-15-2010	15	OVAP EXB08	OVAP Separatory Funnel Liquid-Liquid Extractions for Semivolatiles (BNA) - Method 3510C (OVAP)
OVAP	00	Chad Barnes	Leslie Bucina	01-15-2011	18	OVAP EXH01	OVAP Extraction of Chlorinated Herbicides - SW-846 Method 8151A
OVAP	00	Chad Barnes	Leslie Bucina	01-15-2011	00	OVAP ASE01	OVAP Accelerated Solvent Extractor - SW-846 Method 3545
OVAP	00	Maren Beery	Leslie Bucina	01-15-2011	40	OVAP ME700	OVAP PE ELAN 6100 ICP Mass Spectrometer - SW-846 Method 6020
OVAP	00	Mike Cochran	Leslie Bucina	02-15-2011	24	OVAP GCS02	OVAP Analysis of Middle and Heavy Distillates - Method 8015B
OVAP	00	Mike Albertson	Leslie Bucina	02-15-2011	29	OVAP GCV05	OVAP Light Distillates - Method SW846 8015B
OVAP	00	Chad Barnes	Leslie Bucina	02-05-2011	15	OVAP EXP01	OVAP Extractions for Pesticides and PCB's SW-846 Method 3510C and 3500C
OVAP	00	Chad Barnes	Leslie Bucina	02-15-2011	17	OVAP EXD01	OVAP Extraction of Middle and Heavy Distillates - Method 3550B and 3510
OVAP	00	Deanna Hesson	Leslie Bucina	03-15-2011	26	OVAP K3354	OVAP Total Cyanide (Spectrophotometric - EPA 335.2 (CLP-M)
OVAP	00	Mike Cochran	Leslie Bucina	03-15-2011	26	OVAP GCS10	OVAP Organic Analysis of PCB's - Method 8082
OVAP	00	Mike Albertson	Leslie Bucina	03-15-2011	47	OVAP MSV01	OVAP Analysis of Volatile Organic Compounds - Method 8260A and 8260B
OVAP	00	Mike Cochran	Leslie Bucina	03-15-2011	25	OVAP GCS04	OVAP Organic Analysis of Chlorinated Herbicides - Method 8151A
OVAP	00	Mike Cochran	Leslie Bucina	03-15-2011	28	OVAP GCS09	OVAP Organic Analysis of Pesticides - Method 8081A
OVAP	00	Mike Cochran	Leslie Bucina	03-15-2011	39	OVAP MSS01	OVAP Organic Analytes - Method 8270C
OVAP	00	Mike Cochran	Leslie Bucina	04-15-2011	31	OVAP MSS03	OVAP Low Level PAH's - Method 8270
Semivolatiles	11	Mike Cochran	Leslie Bucina	04-25-2011	24	GCS07	1,2 Dibromoethane (EDB) and 1,2 Dibromo-3-chloropropane (DBCP) Method SW-846 Method 8011
Semivolatiles	13	Mike Cochran	Leslie Bucina	08-15-2011	30	GCS09	Organic Analysis of Pesticides - Method 8081A/8081B
Semivolatiles	7	Mike Cochran	Leslie Bucina	06-15-2011	31	GCS05	Analysis of TNRCC Method for Total Petroleum Hydrocarbons - Methods T1005/T1006
Semivolatiles	10	Mike Cochran	Leslie Bucina	07-15-2011	25	GCS03	Analysis of Petroleum Range Organics - SW846 8015 Modified
Semivolatiles	2	Mike Cochran	Leslie Bucina	02-15-2011	25	HPLC04	Formaldehyde - Method 8315A

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SOP By Department Listing

Department	Rev.	Author	Approved By	Approval Date	# Pages	Name	Title
Semivolatiles	13	Mike Cochran	Leslie Bucina	06-15-2011	26	GCS02	Analysis of Diesel Range Organics - Method 8015
Semivolatiles	9	Mike Cochran	Leslie Bucina	04-15-2010	30	GCS08	Organic Analysis of Pesticides and PCBs - Method 608
Semivolatiles	3	Mike Cochran	Leslie Bucina	04-15-2011	30	HPLC06	Perchlorate - Method 6850/331.0
Semivolatiles	1	Mike Cochran	Leslie Bucina	02-15-2012	22	HPLC05	Nitroguanidine by High Performance Liquid Chromatography - Method 8330-NG
Semivolatiles	15	Mike Cochran	Leslie Bucina	06-15-2011	28	HPLC02	Nitroaromatics and Nitramines by High Performance Liquid Chromatography - Method 8330
Semivolatiles	5	Mike Cochran	Leslie Bucina	09-15-2011	22	HPLC03	Organic Analysis of Metabolic Acids - Method 830MBA
Semivolatiles	18	Mike Cochran	Leslie Bucina	08-15-2011	64	MSS01	Organic Analytes - Method 8270
Semivolatiles	10	Mike Cochran	Leslie Bucina	04-25-2011	32	MSS03	Low Level PAHs - Method 8270
Semivolatiles	7	Mike Cochran	Leslie Bucina	10-15-2011	23	GCS12	Alcohol - Method 8015B
Semivolatiles	12	Mike Cochran	Leslie Bucina	06-15-2011	28	GCS10	Organic Analysis of PCBs - Method 8082
Semivolatiles	13	Mike Cochran	Leslie Bucina	09-15-2011	26	GCS04	Organic Analysis of Chlorinated Herbicides - Method 8151A
Semivolatiles	2	Mike Cochran	Leslie Bucina	10-15-2010	21	HPLC07	Hexamethylphosphoramide and Daughter Products - Method XMPA-LCMS
Semivolatiles	00	Mike Cochran	Leslie Bucina	09-15-2011	22	HPLC08	Thiodiglycol
Semivolatiles	00	Mike Cochran	Leslie Bucina	02-15-2011	31	GCS13	Determination of Extractable Petroleum Hydrocarbons (EPH) Fractions
Semivolatiles	00	Mike Cochran	Leslie Bucina	08-15-2011	23	HPLC09	Benzotriazole and Tolyltrizole Method TTA-LCMS
Semivolatiles	00	Mike Cochran	Leslie Bucina	Pending		MSS05	Measurement of Triclosan in Extracts Prepared form Swabs
Semivolatiles	2	Mike Cochran	Leslie Bucina	02-24-2012	25	GCSAK	Diesel Range Organics and Residual Range Organics Method AK102/AK103
Volatiles	13	Mike Albertson	Leslie Bucina	06-15-2011	17	PAT01	Purge and Trap for Volatile Organics - SW-846 Methods 5030 and 5035
Volatiles	5	Mike Albertson	Leslie Bucina	06-15-2011	7	VGW01	Cleaning Glassware Used in Organic Analyses
Volatiles	14	Mike Albertson	Leslie Bucina	11-15-2011	59	MSV01	Volatile Organic Analytes by Methods 8260A and 8260B
Volatiles	16	Mike Albertson	Leslie Bucina	12-16-2011	25	RSK01	Dissolved Gases in Ground Water - EPA RSKSOP-175
Volatiles	12	Mike Albertson	Leslie Bucina	03-15-2011	33	GCV05	Gasoline Range Organics - SW846 8015
Volatiles	8	Mike Albertson	Leslie Bucina	08-01-2011	37	MSV10	Volatile Organic Analytes by Method 624
Volatiles	00	Mike Albertson	Leslie Bucina	12-15-2011	32	GCV08	Determination of Volatile Petroleum Hydrocarbon (VPH)
Volatiles	2	Mike Albertson	Leslie Bucina	02-24-2012	33	GCVAK	Gasoline Range Organics SW846 8015B (Alaska)

APPENDIX C

NELAP ACCREDITED ANALYTES

FLORIDA DEPARTMENT OF HEALTH

State of Florida
Department of Health, Bureau of Laboratories
This is to certify that

E87551

MICROBAC LABORATORIES, INC., OHIO VALLEY DIVISION
158 STARLITE DRIVE
MARIETTA, OH 45750

has complied with Florida Administrative Code 64E-1,
for the examination of Environmental samples in the following categories

NON-POTABLE WATER - EXTRACTABLE ORGANICS, NON-POTABLE WATER - GENERAL CHEMISTRY, NON-POTABLE WATER - METALS, NON-POTABLE WATER - PESTICIDES-HERBICIDES-PCB'S, NON-POTABLE WATER - VOLATILE ORGANICS, SOLID AND CHEMICAL MATERIALS - EXTRACTABLE ORGANICS, SOLID AND CHEMICAL MATERIALS - PESTICIDES-HERBICIDES-PCB'S, SOLID AND CHEMICAL MATERIALS - GENERAL CHEMISTRY, SOLID AND CHEMICAL MATERIALS - METALS, SOLID AND CHEMICAL MATERIALS - VOLATILE ORGANICS

Continued certification is contingent upon successful on-going compliance with the NELAC Standards and FAC Rule 64E-1 regulations. Specific methods and analytes certified are cited on the Laboratory Scope of Accreditation for this laboratory and are on file at the Bureau of Laboratories, P. O. Box 210, Jacksonville, Florida 32231. Clients and customers are urged to verify with this agency the laboratory's certification status in Florida for particular methods and analytes.

Date Issued: July 01, 2011 Expiration Date: June 30, 2012

Max Salfinger, M.D.
Chief, Bureau of Laboratories
Florida Department of Health
DH Form 1697, 7/04
NON-TRANSFERABLE E87551-22-07/01/2011
Supersedes all previously issued certificates

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FLORIDA DEPARTMENT OF HEALTH

Rick Scott
Governor

H. Frank Farmer, Jr., M.D., Ph.D.
State Surgeon General

Laboratory Scope of Accreditation

Attachment to Certificate #: E87551-22, expiration date June 30, 2012. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87551 **EPA Lab Code: OH00218** **(740) 373-4071**

E87551
Microbac Laboratories, Inc., Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,1,1,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,1,1-Trichloroethane	EPA 624	Volatile Organics	NELAP	5/16/2003
1,1,1-Trichloroethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,1,2,2-Tetrachloroethane	EPA 624	Volatile Organics	NELAP	5/16/2003
1,1,2,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,1,2-Trichloro-1,2,2-trifluoroethane	OVL MSV01/GC-MS	Volatile Organics	NELAP	5/7/2008
1,1,2-Trichloroethane	EPA 624	Volatile Organics	NELAP	5/16/2003
1,1,2-Trichloroethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,1-Dichloroethane	EPA 624	Volatile Organics	NELAP	5/16/2003
1,1-Dichloroethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,1-Dichloroethylene	EPA 624	Volatile Organics	NELAP	5/16/2003
1,1-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,1-Dichloropropene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2,3-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2,3-Trichloropropane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2,4,5-Tetrachlorobenzene	EPA 8270	Extractable Organics	NELAP	3/30/2006
1,2,4-Trichlorobenzene	EPA 625	Extractable Organics	NELAP	5/16/2003
1,2,4-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2,4-Trichlorobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,2,4-Trimethylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8011	Volatile Organics	NELAP	5/7/2008
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8011	Volatile Organics	NELAP	5/7/2008
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2-Dichlorobenzene	EPA 624	Volatile Organics	NELAP	5/16/2003
1,2-Dichlorobenzene	EPA 625	Extractable Organics	NELAP	5/16/2003
1,2-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,2-Dichloroethane	EPA 624	Volatile Organics	NELAP	5/16/2003
1,2-Dichloroethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2-Dichloropropane	EPA 624	Volatile Organics	NELAP	5/16/2003
1,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2-Diphenylhydrazine	EPA 8270	Extractable Organics	NELAP	3/30/2006
1,3,5-Trimethylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8270	Extractable Organics	NELAP	3/1/2011
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8330	Extractable Organics	NELAP	3/30/2006

Clients and Customers are urged to verify the laboratory's current certification status with the Environmental Laboratory Certification Program. **Issue Date: 7/1/2011** **Expiration Date: 6/30/2012**

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FLORIDA DEPARTMENT OF HEALTH

Rick Scott
Governor

H. Frank Farmer, Jr., M.D.,Ph.D.
State Surgeon General

Laboratory Scope of Accreditation

Attachment to Certificate #: E87551-22, expiration date June 30, 2012. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87551 **EPA Lab Code: OH00218** **(740) 373-4071**

E87551
Microbac Laboratories, Inc., Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,3-Butadiene	OVL MSV01/GC-MS	Volatile Organics	NELAP	5/7/2008
1,3-Dichlorobenzene	EPA 624	Volatile Organics	NELAP	5/16/2003
1,3-Dichlorobenzene	EPA 625	Extractable Organics	NELAP	5/16/2003
1,3-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,3-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,3-Dichloropropane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,3-Dinitrobenzene (1,3-DNB)	EPA 8270	Extractable Organics	NELAP	3/1/2011
1,3-Dinitrobenzene (1,3-DNB)	EPA 8330	Extractable Organics	NELAP	3/30/2006
1,4-Dichlorobenzene	EPA 624	Volatile Organics	NELAP	5/16/2003
1,4-Dichlorobenzene	EPA 625	Extractable Organics	NELAP	5/16/2003
1,4-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,4-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,4-Dioxane (1,4-Diethyleneoxide)	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,4-Dioxane (1,4-Diethyleneoxide)	OVL MSS01/GC-MS	Extractable Organics	NELAP	7/30/2010
1,4-Naphthoquinone	EPA 8270	Extractable Organics	NELAP	3/30/2006
1,4-Phenylenediamine	EPA 8270	Extractable Organics	NELAP	3/30/2006
1-Chlorohexane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1-Methylnaphthalene	OVL MSS01/GC-MS	Extractable Organics	NELAP	5/7/2008
1-Naphthylamine	EPA 8270	Extractable Organics	NELAP	3/30/2006
2,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	7/1/2003
2,3,4,6-Tetrachlorophenol	EPA 8270	Extractable Organics	NELAP	3/30/2006
2,4,5-T	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,4,5-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,4,6-Trichlorophenol	EPA 625	Extractable Organics	NELAP	5/16/2003
2,4,6-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,4,6-Trinitrotoluene (2,4,6-TNT)	EPA 8330	Extractable Organics	NELAP	3/30/2006
2,4-D	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,4-DB	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,4-Dichlorophenol	EPA 625	Extractable Organics	NELAP	5/16/2003
2,4-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,4-Dimethylphenol	EPA 625	Extractable Organics	NELAP	5/16/2003
2,4-Dimethylphenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,4-Dinitrophenol	EPA 625	Extractable Organics	NELAP	5/16/2003
2,4-Dinitrophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,4-Dinitrotoluene (2,4-DNT)	EPA 625	Extractable Organics	NELAP	5/16/2003
2,4-Dinitrotoluene (2,4-DNT)	EPA 8270	Extractable Organics	NELAP	7/1/2003

Clients and Customers are urged to verify the laboratory's current certification status with the Environmental Laboratory Certification Program. **Issue Date: 7/1/2011** **Expiration Date: 6/30/2012**

FLORIDA DEPARTMENT OF HEALTH

Rick Scott
Governor

H. Frank Farmer, Jr., M.D., Ph.D.
State Surgeon General

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Laboratory Scope of Accreditation

Attachment to Certificate #: E87551-22, expiration date June 30, 2012. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87551 **EPA Lab Code: OH00218** **(740) 373-4071**

E87551
Microbac Laboratories, Inc., Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,4-Dinitrotoluene (2,4-DNT)	EPA 8330	Extractable Organics	NELAP	3/30/2006
2,6-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	3/30/2006
2,6-Dinitrotoluene (2,6-DNT)	EPA 625	Extractable Organics	NELAP	5/16/2003
2,6-Dinitrotoluene (2,6-DNT)	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,6-Dinitrotoluene (2,6-DNT)	EPA 8330	Extractable Organics	NELAP	3/30/2006
2-Acetylaminofluorene	EPA 8270	Extractable Organics	NELAP	3/30/2006
2-Amino-4,6-dinitrotoluene (2-am-dnt)	EPA 8330	Extractable Organics	NELAP	3/30/2006
2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260	Volatile Organics	NELAP	7/1/2003
2-Chloroethyl vinyl ether	EPA 624	Volatile Organics	NELAP	5/16/2003
2-Chloroethyl vinyl ether	EPA 8260	Volatile Organics	NELAP	7/1/2003
2-Chloronaphthalene	EPA 625	Extractable Organics	NELAP	5/16/2003
2-Chloronaphthalene	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Chlorophenol	EPA 625	Extractable Organics	NELAP	5/16/2003
2-Chlorophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Chlorotoluene	EPA 8260	Volatile Organics	NELAP	7/1/2003
2-Hexanone	EPA 8260	Volatile Organics	NELAP	7/1/2003
2-Methyl-4,6-dinitrophenol	EPA 625	Extractable Organics	NELAP	5/16/2003
2-Methyl-4,6-dinitrophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Methylnaphthalene	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Methylphenol (o-Cresol)	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Naphthylamine	EPA 8270	Extractable Organics	NELAP	3/30/2006
2-Nitroaniline	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Nitrophenol	EPA 625	Extractable Organics	NELAP	5/16/2003
2-Nitrophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Nitropropane	EPA 8260	Volatile Organics	NELAP	7/1/2003
2-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	3/30/2006
2-Picoline (2-Methylpyridine)	EPA 8270	Extractable Organics	NELAP	3/30/2006
3,3'-Dichlorobenzidine	EPA 625	Extractable Organics	NELAP	5/16/2003
3,3'-Dichlorobenzidine	EPA 8270	Extractable Organics	NELAP	7/1/2003
3,3'-Dimethylbenzidine	EPA 8270	Extractable Organics	NELAP	3/30/2006
3/4-Methylphenols (m/p-Cresols)	EPA 8270	Extractable Organics	NELAP	7/30/2010
3-Methylcholanthrene	EPA 8270	Extractable Organics	NELAP	3/30/2006
3-Nitroaniline	EPA 8270	Extractable Organics	NELAP	7/1/2003
3-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	3/30/2006
4,4'-DDD	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
4,4'-DDD	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003

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H. Frank Farmer, Jr., M.D.,Ph.D.
State Surgeon General

Laboratory Scope of Accreditation

Attachment to Certificate #: E87551-22, expiration date June 30, 2012. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87551 **EPA Lab Code: OH00218** **(740) 373-4071**

E87551
Microbac Laboratories, Inc., Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
4,4'-DDE	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
4,4'-DDE	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
4,4'-DDT	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
4,4'-DDT	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
4-Amino-2,6-dinitrotoluene (4-am-dnt)	EPA 8330	Extractable Organics	NELAP	3/30/2006
4-Aminobiphenyl	EPA 8270	Extractable Organics	NELAP	3/30/2006
4-Bromophenyl phenyl ether	EPA 625	Extractable Organics	NELAP	5/16/2003
4-Bromophenyl phenyl ether	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Chloro-3-methylphenol	EPA 625	Extractable Organics	NELAP	5/16/2003
4-Chloro-3-methylphenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Chloroaniline	EPA 8270	Extractable Organics	NELAP	3/30/2006
4-Chlorophenyl phenylether	EPA 625	Extractable Organics	NELAP	5/16/2003
4-Chlorophenyl phenylether	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Chlorotoluene	EPA 8260	Volatile Organics	NELAP	7/1/2003
4-Dimethyl aminoazobenzene	EPA 8270	Extractable Organics	NELAP	3/30/2006
4-Methyl-2-pentanone (MIBK)	EPA 8260	Volatile Organics	NELAP	7/1/2003
4-Nitroaniline	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Nitrophenol	EPA 625	Extractable Organics	NELAP	5/16/2003
4-Nitrophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	3/30/2006
5-Nitro-o-toluidine	EPA 8270	Extractable Organics	NELAP	3/30/2006
7,12-Dimethylbenz(a) anthracene	EPA 8270	Extractable Organics	NELAP	3/30/2006
a-a-Dimethylphenethylamine	EPA 8270	Extractable Organics	NELAP	3/30/2006
Acenaphthene	EPA 625	Extractable Organics	NELAP	5/16/2003
Acenaphthene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Acenaphthylene	EPA 625	Extractable Organics	NELAP	5/16/2003
Acenaphthylene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Acetic acid	OVL HPLC03/HPLC-UV	Extractable Organics	NELAP	5/7/2008
Acetone	EPA 8260	Volatile Organics	NELAP	7/1/2003
Acetonitrile	EPA 8260	Volatile Organics	NELAP	7/1/2003
Acetophenone	EPA 8270	Extractable Organics	NELAP	3/30/2006
Acetylene	OVL RSK01/GC-FID	Volatile Organics	NELAP	5/7/2008
Acidity, as CaCO3	EPA 305.1	General Chemistry	NELAP	5/16/2003
Acidity, as CaCO3	SM 2310 B (4a)	General Chemistry	NELAP	4/17/2007
Acrolein (Propenal)	EPA 624	Volatile Organics	NELAP	5/16/2003
Acrolein (Propenal)	EPA 8260	Volatile Organics	NELAP	7/1/2003

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State Surgeon General

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State Laboratory ID: E87551 **EPA Lab Code: OH00218** **(740) 373-4071**

E87551
Microbac Laboratories, Inc., Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Acrylonitrile	EPA 624	Volatile Organics	NELAP	5/16/2003
Acrylonitrile	EPA 8260	Volatile Organics	NELAP	7/1/2003
Aldrin	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Aldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Alkalinity as CaCO3	EPA 310.2	General Chemistry	NELAP	5/16/2003
Alkalinity as CaCO3	SM 2320 B	General Chemistry	NELAP	5/16/2003
Allyl chloride (3-Chloropropene)	EPA 8260	Volatile Organics	NELAP	3/30/2006
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
alpha-Chlordane	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	3/30/2006
Aluminum	EPA 200.7	Metals	NELAP	5/16/2003
Aluminum	EPA 6010	Metals	NELAP	7/1/2003
Amenable cyanide	EPA 335.1	General Chemistry	NELAP	5/16/2003
Amenable cyanide	EPA 9010/9014	General Chemistry	NELAP	5/7/2008
Amenable cyanide	SM 4500-CN G	General Chemistry	NELAP	4/17/2007
Ammonia as N	EPA 350.1	General Chemistry	NELAP	5/16/2003
Aniline	EPA 8270	Extractable Organics	NELAP	7/1/2003
Anthracene	EPA 625	Extractable Organics	NELAP	5/16/2003
Anthracene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Antimony	EPA 200.7	Metals	NELAP	5/16/2003
Antimony	EPA 200.8	Metals	NELAP	5/16/2003
Antimony	EPA 6010	Metals	NELAP	7/1/2003
Antimony	EPA 6020	Metals	NELAP	7/1/2003
Aramite	EPA 8270	Extractable Organics	NELAP	3/30/2006
Aroclor-1016 (PCB-1016)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Aroclor-1016 (PCB-1016)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Aroclor-1221 (PCB-1221)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Aroclor-1221 (PCB-1221)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Aroclor-1232 (PCB-1232)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Aroclor-1232 (PCB-1232)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Aroclor-1242 (PCB-1242)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Aroclor-1242 (PCB-1242)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Aroclor-1248 (PCB-1248)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Aroclor-1248 (PCB-1248)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Aroclor-1254 (PCB-1254)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Aroclor-1254 (PCB-1254)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003

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State Laboratory ID: E87551 **EPA Lab Code: OH00218** **(740) 373-4071**

E87551
Microbac Laboratories, Inc., Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Aroclor-1260 (PCB-1260)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Aroclor-1260 (PCB-1260)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Arsenic	EPA 200.7	Metals	NELAP	5/16/2003
Arsenic	EPA 200.8	Metals	NELAP	5/16/2003
Arsenic	EPA 6010	Metals	NELAP	7/1/2003
Arsenic	EPA 6020	Metals	NELAP	7/1/2003
Atrazine	OVL MSS01/GC-MS	Extractable Organics	NELAP	7/30/2010
Barium	EPA 200.7	Metals	NELAP	5/16/2003
Barium	EPA 200.8	Metals	NELAP	3/30/2006
Barium	EPA 6010	Metals	NELAP	7/1/2003
Barium	EPA 6020	Metals	NELAP	3/30/2006
Benzaldehyde	OVL MSS01/GC-MS	Extractable Organics	NELAP	5/7/2008
Benzene	EPA 624	Volatile Organics	NELAP	5/16/2003
Benzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Benzidine	EPA 625	Extractable Organics	NELAP	5/16/2003
Benzidine	EPA 8270	Extractable Organics	NELAP	3/30/2006
Benzo(a)anthracene	EPA 625	Extractable Organics	NELAP	5/16/2003
Benzo(a)anthracene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Benzo(a)pyrene	EPA 625	Extractable Organics	NELAP	5/16/2003
Benzo(a)pyrene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Benzo(b)fluoranthene	EPA 625	Extractable Organics	NELAP	5/16/2003
Benzo(b)fluoranthene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Benzo(g,h,i)perylene	EPA 625	Extractable Organics	NELAP	5/16/2003
Benzo(g,h,i)perylene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Benzo(k)fluoranthene	EPA 625	Extractable Organics	NELAP	5/16/2003
Benzo(k)fluoranthene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Benzoic acid	EPA 8270	Extractable Organics	NELAP	7/1/2003
Benzyl alcohol	EPA 8270	Extractable Organics	NELAP	7/1/2003
Beryllium	EPA 200.7	Metals	NELAP	5/16/2003
Beryllium	EPA 6010	Metals	NELAP	7/1/2003
beta-BHC (beta-Hexachlorocyclohexane)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
beta-BHC (beta-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Biochemical oxygen demand	EPA 405.1	General Chemistry	NELAP	5/16/2003
Biochemical oxygen demand	SM 5210 B	General Chemistry	NELAP	5/16/2003
Biphenyl	OVL MSS01/GC-MS	Extractable Organics	NELAP	5/7/2008
bis(2-Chloroethoxy)methane	EPA 625	Extractable Organics	NELAP	5/16/2003

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State Laboratory ID: E87551 **EPA Lab Code: OH00218** **(740) 373-4071**

E87551
Microbac Laboratories, Inc., Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
bis(2-Chloroethoxy)methane	EPA 8270	Extractable Organics	NELAP	7/1/2003
bis(2-Chloroethyl) ether	EPA 625	Extractable Organics	NELAP	5/16/2003
bis(2-Chloroethyl) ether	EPA 8270	Extractable Organics	NELAP	7/1/2003
bis(2-Chloroisopropyl) ether (2,2'-Oxybis(1-chloropropane))	EPA 625	Extractable Organics	NELAP	5/16/2003
bis(2-Chloroisopropyl) ether (2,2'-Oxybis(1-chloropropane))	EPA 8270	Extractable Organics	NELAP	7/1/2003
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 625	Extractable Organics	NELAP	5/16/2003
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 8270	Extractable Organics	NELAP	7/1/2003
Boron	EPA 200.7	Metals	NELAP	5/16/2003
Boron	EPA 6010	Metals	NELAP	7/1/2003
Bromide	EPA 300.0	General Chemistry	NELAP	5/16/2003
Bromide	EPA 9056	General Chemistry	NELAP	5/7/2008
Bromobenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Bromochloromethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
Bromodichloromethane	EPA 624	Volatile Organics	NELAP	5/16/2003
Bromodichloromethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
Bromoform	EPA 624	Volatile Organics	NELAP	5/16/2003
Bromoform	EPA 8260	Volatile Organics	NELAP	7/1/2003
Butyl benzyl phthalate	EPA 625	Extractable Organics	NELAP	5/16/2003
Butyl benzyl phthalate	EPA 8270	Extractable Organics	NELAP	7/1/2003
Butyric acid (Butanoic acid)	OVL HPLC03/HPLC-UV	Extractable Organics	NELAP	5/7/2008
Cadmium	EPA 200.7	Metals	NELAP	5/16/2003
Cadmium	EPA 200.8	Metals	NELAP	3/30/2006
Cadmium	EPA 6010	Metals	NELAP	7/1/2003
Cadmium	EPA 6020	Metals	NELAP	3/30/2006
Calcium	EPA 200.7	Metals	NELAP	5/16/2003
Calcium	EPA 6010	Metals	NELAP	7/1/2003
Caprolactam	OVL MSS01/GC-MS	Extractable Organics	NELAP	5/7/2008
Carbazole	EPA 8270	Extractable Organics	NELAP	3/30/2006
Carbon dioxide	RSK-175	Volatile Organics	NELAP	3/30/2006
Carbon disulfide	EPA 8260	Volatile Organics	NELAP	7/1/2003
Carbon tetrachloride	EPA 624	Volatile Organics	NELAP	5/16/2003
Carbon tetrachloride	EPA 8260	Volatile Organics	NELAP	7/1/2003
Carbonaceous BOD (CBOD)	SM 5210 B	General Chemistry	NELAP	5/16/2003
Chemical oxygen demand	EPA 410.4	General Chemistry	NELAP	5/16/2003
Chemical oxygen demand	HACH 8000	General Chemistry	NELAP	5/16/2003

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158 Starlite Drive
Marietta, OH 45750

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Chlordane (tech.)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Chlordane (tech.)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Chloride	EPA 300.0	General Chemistry	NELAP	5/16/2003
Chloride	EPA 325.2	General Chemistry	NELAP	5/16/2003
Chloride	EPA 9056	General Chemistry	NELAP	5/7/2008
Chloride	SM 4500 Cl- E	General Chemistry	NELAP	7/30/2010
Chlorobenzene	EPA 624	Volatile Organics	NELAP	5/16/2003
Chlorobenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Chlorobenzilate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/30/2006
Chloroethane	EPA 624	Volatile Organics	NELAP	5/16/2003
Chloroethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
Chloroform	EPA 624	Volatile Organics	NELAP	5/16/2003
Chloroform	EPA 8260	Volatile Organics	NELAP	7/1/2003
Chloroprene	EPA 8260	Volatile Organics	NELAP	3/30/2006
Chromium	EPA 200.7	Metals	NELAP	5/16/2003
Chromium	EPA 200.8	Metals	NELAP	3/30/2006
Chromium	EPA 6010	Metals	NELAP	7/1/2003
Chromium	EPA 6020	Metals	NELAP	3/30/2006
Chromium VI	EPA 7196	General Chemistry	NELAP	3/30/2006
Chromium VI	SM 3500-Cr B (20th/21st Ed.)/UV-VIS	General Chemistry	NELAP	5/7/2008
Chromium VI	SM 3500-Cr D (18th/19th Ed.)/UV-VIS	Metals	NELAP	5/16/2003
Chrysene	EPA 625	Extractable Organics	NELAP	5/16/2003
Chrysene	EPA 8270	Extractable Organics	NELAP	3/30/2006
cis-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	7/1/2003
cis-1,3-Dichloropropene	EPA 624	Volatile Organics	NELAP	5/16/2003
cis-1,3-Dichloropropene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Cobalt	EPA 200.7	Metals	NELAP	5/16/2003
Cobalt	EPA 200.8	Metals	NELAP	3/30/2006
Cobalt	EPA 6010	Metals	NELAP	7/1/2003
Cobalt	EPA 6020	Metals	NELAP	3/30/2006
Color	EPA 110.2	General Chemistry	NELAP	5/16/2003
Color	SM 2120 B	General Chemistry	NELAP	4/17/2007
Conductivity	EPA 120.1	General Chemistry	NELAP	5/16/2003
Copper	EPA 200.7	Metals	NELAP	5/16/2003
Copper	EPA 200.8	Metals	NELAP	3/30/2006

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Marietta, OH 45750

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Copper	EPA 6010	Metals	NELAP	7/1/2003
Copper	EPA 6020	Metals	NELAP	3/30/2006
Cyanide	EPA 335.2	General Chemistry	NELAP	5/16/2003
Cyanide	SM 4500-CN E	General Chemistry	NELAP	4/17/2007
Cyclohexane	OVL MSV01/GC-MS	Volatile Organics	NELAP	5/7/2008
Cyclohexanone	OVL MSV01/GC-MS	Volatile Organics	NELAP	5/7/2008
Dalapon	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
delta-BHC	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
delta-BHC	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Diallate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/30/2006
Dibenz(a,h)anthracene	EPA 625	Extractable Organics	NELAP	5/16/2003
Dibenz(a,h)anthracene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Dibenzofuran	EPA 8270	Extractable Organics	NELAP	7/1/2003
Dibromochloromethane	EPA 624	Volatile Organics	NELAP	5/16/2003
Dibromochloromethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
Dibromofluoromethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
Dibromomethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
Dicamba	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Dichlorodifluoromethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
Dichloroprop (Dichlorprop)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Dieldrin	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Dieldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Diesel range organics (DRO)	EPA 8015	Extractable Organics	NELAP	3/30/2006
Diesel range organics (DRO)	TX1005	Extractable Organics	NELAP	3/30/2006
Diethyl ether	EPA 8260	Volatile Organics	NELAP	3/30/2006
Diethyl phthalate	EPA 625	Extractable Organics	NELAP	5/16/2003
Diethyl phthalate	EPA 8270	Extractable Organics	NELAP	7/1/2003
Di-isopropylether (DIPE)	OVL MSV01/GC-MS	Volatile Organics	NELAP	5/7/2008
Dimethoate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/30/2006
Dimethyl phthalate	EPA 625	Extractable Organics	NELAP	5/16/2003
Dimethyl phthalate	EPA 8270	Extractable Organics	NELAP	7/1/2003
Dimethyl sulfide	OVL MSV01/GC-MS	Volatile Organics	NELAP	5/7/2008
Dimethyldisulfide	OVL MSV01/GC-MS	Volatile Organics	NELAP	5/7/2008
Di-n-butyl phthalate	EPA 625	Extractable Organics	NELAP	5/16/2003
Di-n-butyl phthalate	EPA 8270	Extractable Organics	NELAP	7/1/2003
Di-n-octyl phthalate	EPA 625	Extractable Organics	NELAP	5/16/2003

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E87551
Microbac Laboratories, Inc., Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Di-n-octyl phthalate	EPA 8270	Extractable Organics	NELAP	7/1/2003
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8270	Extractable Organics	NELAP	3/30/2006
Diphenylamine	EPA 8270	Extractable Organics	NELAP	3/30/2006
Disulfoton	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/1/2011
Endosulfan I	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Endosulfan I	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Endosulfan II	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Endosulfan II	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Endosulfan sulfate	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Endosulfan sulfate	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Endrin	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Endrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Endrin aldehyde	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Endrin aldehyde	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Endrin ketone	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Ethane	RSK-175	Volatile Organics	NELAP	3/30/2006
Ethanol	EPA 8015	Volatile Organics	NELAP	5/7/2008
Ethyl acetate	EPA 8260	Volatile Organics	NELAP	3/30/2006
Ethyl methacrylate	EPA 8260	Volatile Organics	NELAP	3/30/2006
Ethyl methanesulfonate	EPA 8270	Extractable Organics	NELAP	3/30/2006
Ethylbenzene	EPA 624	Volatile Organics	NELAP	5/16/2003
Ethylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Ethylene	RSK-175	Volatile Organics	NELAP	3/30/2006
Ethyl-t-butylether (ETBE)	OVL MSV01/GC-MS	Volatile Organics	NELAP	5/7/2008
Famphur	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/30/2006
Ferrous iron	SM 3500-Fe B (20th/21st Ed.)/UV-VIS	Metals	NELAP	7/30/2010
Fluoranthene	EPA 625	Extractable Organics	NELAP	5/16/2003
Fluoranthene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Fluorene	EPA 625	Extractable Organics	NELAP	5/16/2003
Fluorene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Fluoride	EPA 300.0	General Chemistry	NELAP	5/16/2003
Fluoride	EPA 340.2	General Chemistry	NELAP	5/16/2003
Fluoride	EPA 9056	General Chemistry	NELAP	5/7/2008
Fluoride	SM 4500 F-C	General Chemistry	NELAP	5/16/2003
Formaldehyde	EPA 8315	Extractable Organics	NELAP	5/7/2008

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Rick Scott
Governor

H. Frank Farmer, Jr., M.D.,Ph.D.
State Surgeon General

Laboratory Scope of Accreditation

Attachment to Certificate #: E87551-22, expiration date June 30, 2012. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87551 **EPA Lab Code: OH00218** **(740) 373-4071**

E87551
Microbac Laboratories, Inc., Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
gamma-Chlordane	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	3/30/2006
Gasoline range organics (GRO)	EPA 8015	Volatile Organics	NELAP	3/30/2006
Hardness	EPA 130.2	General Chemistry	NELAP	5/16/2003
Hardness	SM 2340 B	General Chemistry	NELAP	5/16/2003
Hardness	SM 2340 C	General Chemistry	NELAP	4/17/2007
Hardness (calc.)	EPA 200.7	Metals	NELAP	7/30/2010
Heptachlor	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Heptachlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Heptachlor epoxide	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Heptachlor epoxide	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Hexachlorobenzene	EPA 625	Extractable Organics	NELAP	5/16/2003
Hexachlorobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Hexachlorobutadiene	EPA 625	Extractable Organics	NELAP	5/16/2003
Hexachlorobutadiene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Hexachlorobutadiene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Hexachlorocyclopentadiene	EPA 625	Extractable Organics	NELAP	5/16/2003
Hexachlorocyclopentadiene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Hexachloroethane	EPA 625	Extractable Organics	NELAP	5/16/2003
Hexachloroethane	EPA 8270	Extractable Organics	NELAP	7/1/2003
Hexachlorophene	EPA 8270	Extractable Organics	NELAP	3/30/2006
Hexachloropropene	EPA 8270	Extractable Organics	NELAP	3/30/2006
Hexamethylphosphoramide (HMPA)	OVL HPLC07/HPLC-MS-MS	Extractable Organics	NELAP	7/30/2010
Hexamethylphosphoramide (HMPA)	OVL MSS01/GC-MS	Extractable Organics	NELAP	5/7/2008
Ignitability	EPA 1010	General Chemistry	NELAP	7/1/2003
Indeno(1,2,3-cd)pyrene	EPA 625	Extractable Organics	NELAP	5/16/2003
Indeno(1,2,3-cd)pyrene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Iodomethane (Methyl iodide)	EPA 8260	Volatile Organics	NELAP	3/30/2006
Iron	EPA 200.7	Metals	NELAP	5/16/2003
Iron	EPA 6010	Metals	NELAP	7/1/2003
Isobutane	OVL RSK01/GC-FID	Volatile Organics	NELAP	5/7/2008
Isobutyl alcohol (2-Methyl-1-propanol)	EPA 8260	Volatile Organics	NELAP	3/30/2006
Isodrin	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/30/2006
Isophorone	EPA 625	Extractable Organics	NELAP	5/16/2003

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State Laboratory ID: E87551 **EPA Lab Code: OH00218** **(740) 373-4071**

E87551
Microbac Laboratories, Inc., Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Isophorone	EPA 8270	Extractable Organics	NELAP	7/1/2003
Isoprene	OVL MSV01/GC-MS	Volatile Organics	NELAP	5/7/2008
Isopropyl alcohol (2-Propanol)	EPA 8015	Volatile Organics	NELAP	5/7/2008
Isopropylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Isosafrole	EPA 8270	Extractable Organics	NELAP	3/30/2006
Kepone	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/30/2006
Kjeldahl nitrogen - total	EPA 351.2	General Chemistry	NELAP	5/16/2003
Lactic acid	OVL HPLC03/HPLC-UV	Extractable Organics	NELAP	5/7/2008
Lead	EPA 200.7	Metals	NELAP	5/16/2003
Lead	EPA 200.8	Metals	NELAP	5/16/2003
Lead	EPA 6010	Metals	NELAP	7/1/2003
Lead	EPA 6020	Metals	NELAP	7/1/2003
Lithium	EPA 200.7	Metals	NELAP	3/30/2006
Lithium	EPA 6010	Metals	NELAP	7/1/2003
m/p-Xylenes	EPA 8260	Volatile Organics	NELAP	7/30/2010
Magnesium	EPA 200.7	Metals	NELAP	5/16/2003
Magnesium	EPA 6010	Metals	NELAP	7/1/2003
Malathion	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/1/2011
Manganese	EPA 200.7	Metals	NELAP	5/16/2003
Manganese	EPA 200.8	Metals	NELAP	3/30/2006
Manganese	EPA 6010	Metals	NELAP	7/1/2003
Manganese	EPA 6020	Metals	NELAP	3/30/2006
MCPA	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
MCPP	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Mercury	EPA 245.1	Metals	NELAP	5/16/2003
Mercury	EPA 7470	Metals	NELAP	5/16/2003
Methacrylonitrile	EPA 8260	Volatile Organics	NELAP	3/30/2006
Methane	RSK-175	Volatile Organics	NELAP	3/30/2006
Methanol	EPA 8015	Volatile Organics	NELAP	5/7/2008
Methapyrilene	EPA 8270	Extractable Organics	NELAP	3/30/2006
Methoxychlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Methyl acetate	OVL MSV01/GC-MS	Volatile Organics	NELAP	5/7/2008
Methyl bromide (Bromomethane)	EPA 624	Volatile Organics	NELAP	5/16/2003
Methyl bromide (Bromomethane)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Methyl chloride (Chloromethane)	EPA 624	Volatile Organics	NELAP	5/16/2003
Methyl chloride (Chloromethane)	EPA 8260	Volatile Organics	NELAP	7/1/2003

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E87551
Microbac Laboratories, Inc., Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Methyl methacrylate	EPA 8260	Volatile Organics	NELAP	3/30/2006
Methyl methanesulfonate	EPA 8270	Extractable Organics	NELAP	3/30/2006
Methyl parathion (Parathion, methyl)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/30/2006
Methyl tert-butyl ether (MTBE)	EPA 8260	Volatile Organics	NELAP	3/30/2006
Methyl tert-butyl ether (MTBE)	OVL MSV10/GC-MS	Volatile Organics	NELAP	7/30/2010
Methylcyclohexane	OVL MSV01/GC-MS	Volatile Organics	NELAP	5/7/2008
Methylene chloride	EPA 624	Volatile Organics	NELAP	5/16/2003
Methylene chloride	EPA 8260	Volatile Organics	NELAP	7/1/2003
Molybdenum	EPA 200.7	Metals	NELAP	5/16/2003
Molybdenum	EPA 6010	Metals	NELAP	7/1/2003
Naphthalene	EPA 625	Extractable Organics	NELAP	5/16/2003
Naphthalene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Naphthalene	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Butane	OVL RSK01/GC-FID	Volatile Organics	NELAP	5/7/2008
n-Butyl alcohol	EPA 8260	Volatile Organics	NELAP	3/30/2006
n-Butylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Nickel	EPA 200.7	Metals	NELAP	5/16/2003
Nickel	EPA 200.8	Metals	NELAP	3/30/2006
Nickel	EPA 6010	Metals	NELAP	7/1/2003
Nickel	EPA 6020	Metals	NELAP	3/30/2006
Nitrate	EPA 9056	General Chemistry	NELAP	5/7/2008
Nitrate	SM 4500-NO3 F	General Chemistry	NELAP	7/30/2010
Nitrate as N	EPA 300.0	General Chemistry	NELAP	5/16/2003
Nitrate as N	EPA 353.2	General Chemistry	NELAP	5/16/2003
Nitrate-nitrite	EPA 353.2	General Chemistry	NELAP	5/16/2003
Nitrite	EPA 9056	General Chemistry	NELAP	5/7/2008
Nitrite	SM 4500-NO2 B	General Chemistry	NELAP	4/17/2007
Nitrite as N	EPA 300.0	General Chemistry	NELAP	5/16/2003
Nitrite as N	EPA 354.1	General Chemistry	NELAP	5/16/2003
Nitrobenzene	EPA 625	Extractable Organics	NELAP	5/16/2003
Nitrobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Nitrobenzene	EPA 8330	Extractable Organics	NELAP	3/30/2006
Nitrocellulose	OVL KNITRO-C-W/UV-VIS	General Chemistry	NELAP	5/7/2008
Nitroglycerin	EPA 8330	Extractable Organics	NELAP	6/13/2007
Nitroglycerin	OVL HPLC02/HPLC-UV	Extractable Organics	NELAP	5/7/2008
Nitroguanidine	OVL HPLC05/HPLC-UV	Extractable Organics	NELAP	5/7/2008

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State Laboratory ID: E87551 **EPA Lab Code: OH00218** **(740) 373-4071**

E87551
Microbac Laboratories, Inc., Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Nitroquinoline-1-oxide	EPA 8270	Extractable Organics	NELAP	3/30/2006
n-Nitrosodiethylamine	EPA 8270	Extractable Organics	NELAP	3/30/2006
n-Nitrosodimethylamine	EPA 625	Extractable Organics	NELAP	5/16/2003
n-Nitrosodimethylamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Nitroso-di-n-butylamine	EPA 8270	Extractable Organics	NELAP	3/30/2006
n-Nitrosodi-n-propylamine	EPA 625	Extractable Organics	NELAP	5/16/2003
n-Nitrosodi-n-propylamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Nitrosodiphenylamine	EPA 625	Extractable Organics	NELAP	5/16/2003
n-Nitrosodiphenylamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Nitrosomethylethylamine	EPA 8270	Extractable Organics	NELAP	7/30/2010
n-Nitrosomorpholine	EPA 8270	Extractable Organics	NELAP	3/30/2006
n-Nitrosopiperidine	EPA 8270	Extractable Organics	NELAP	3/30/2006
n-Nitrosopyrrolidine	EPA 8270	Extractable Organics	NELAP	3/30/2006
n-Propylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
o,o,o-Triethyl phosphorothioate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/30/2006
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	EPA 8330	Extractable Organics	NELAP	3/30/2006
Oil & Grease	EPA 1664A	General Chemistry	NELAP	5/16/2003
Organic nitrogen	TKN minus AMMONIA	General Chemistry	NELAP	5/16/2003
Orthophosphate as P	EPA 365.2	General Chemistry	NELAP	5/16/2003
Orthophosphate as P	SM 4500-P E	General Chemistry	NELAP	4/17/2007
o-Toluidine	EPA 8270	Extractable Organics	NELAP	3/30/2006
o-Xylene	EPA 8260	Volatile Organics	NELAP	3/30/2006
Parathion, ethyl	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/1/2011
Pentachlorobenzene	OVL MSS01/GC-MS	Extractable Organics	NELAP	5/7/2008
Pentachloroethane	OVL MSS01/GC-MS	Extractable Organics	NELAP	5/7/2008
Pentachloronitrobenzene (Quintozene)	EPA 8270	Extractable Organics	NELAP	3/30/2006
Pentachlorophenol	EPA 625	Extractable Organics	NELAP	5/16/2003
Pentachlorophenol	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Pentachlorophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
Pentaerythritoltetranitrate (PETN)	EPA 8330	Extractable Organics	NELAP	6/13/2007
Pentamethylphosphoramide (PMPA)	OVL HPLC07/HPLC-MS-MS	Extractable Organics	NELAP	7/30/2010
Perchlorate	EPA 6850	General Chemistry	NELAP	7/30/2010
pH	EPA 150.1	General Chemistry	NELAP	5/16/2003
pH	SM 4500-H+-B	General Chemistry	NELAP	4/17/2007
Phenacetin	EPA 8270	Extractable Organics	NELAP	3/30/2006

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State Laboratory ID: E87551 **EPA Lab Code: OH00218** **(740) 373-4071**

E87551
Microbac Laboratories, Inc., Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Phenanthrene	EPA 625	Extractable Organics	NELAP	5/16/2003
Phenanthrene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Phenol	EPA 625	Extractable Organics	NELAP	5/16/2003
Phenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
Phorate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/30/2006
Phosphorus, total	EPA 200.7	Metals	NELAP	7/30/2010
Phosphorus, total	EPA 365.4	General Chemistry	NELAP	5/16/2003
Phosphorus, total	EPA 6010	Metals	NELAP	7/30/2010
p-Isopropyltoluene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Potassium	EPA 200.7	Metals	NELAP	5/16/2003
Potassium	EPA 6010	Metals	NELAP	7/1/2003
Pronamide (Kerb)	EPA 8270	Extractable Organics	NELAP	3/30/2006
Propane	OVL RSK01/GC-FID	Volatile Organics	NELAP	5/7/2008
Propionic acid (Propanoic acid)	OVL HPLC03/HPLC-UV	Extractable Organics	NELAP	5/7/2008
Propionitrile (Ethyl cyanide)	EPA 8260	Volatile Organics	NELAP	3/30/2006
Propylene	OVL RSK01/GC-FID	Volatile Organics	NELAP	5/7/2008
Propyne	OVL RSK01/GC-FID	Volatile Organics	NELAP	5/7/2008
Pyrene	EPA 625	Extractable Organics	NELAP	5/16/2003
Pyrene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Pyridine	EPA 8270	Extractable Organics	NELAP	7/1/2003
Pyruvic acid	OVL HPLC03/HPLC-UV	Extractable Organics	NELAP	5/7/2008
RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)	EPA 8330	Extractable Organics	NELAP	3/30/2006
Residue-filterable (TDS)	EPA 160.1	General Chemistry	NELAP	5/16/2003
Residue-filterable (TDS)	SM 2540 C	General Chemistry	NELAP	4/17/2007
Residue-nonfilterable (TSS)	EPA 160.2	General Chemistry	NELAP	5/16/2003
Residue-nonfilterable (TSS)	SM 2540 D	General Chemistry	NELAP	4/17/2007
Residue-settleable	EPA 160.5	General Chemistry	NELAP	5/16/2003
Residue-settleable	SM 2540 F	General Chemistry	NELAP	4/17/2007
Residue-total	EPA 160.3	General Chemistry	NELAP	5/16/2003
Residue-total	SM 2540 B	General Chemistry	NELAP	4/17/2007
Residue-volatile	EPA 160.4	General Chemistry	NELAP	5/16/2003
Safrole	EPA 8270	Extractable Organics	NELAP	3/30/2006
sec-Butylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Selenium	EPA 200.7	Metals	NELAP	5/16/2003
Selenium	EPA 200.8	Metals	NELAP	5/16/2003
Selenium	EPA 6010	Metals	NELAP	7/1/2003

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E87551
Microbac Laboratories, Inc., Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Selenium	EPA 6020	Metals	NELAP	5/16/2003
Silica as SiO2	EPA 6010	Metals	NELAP	7/1/2003
Silica-dissolved	EPA 200.7	General Chemistry	NELAP	5/16/2003
Silicon	EPA 200.7	Metals	NELAP	5/16/2003
Silicon	EPA 6010	Metals	NELAP	7/1/2003
Silver	EPA 200.7	Metals	NELAP	5/16/2003
Silver	EPA 200.8	Metals	NELAP	3/30/2006
Silver	EPA 6010	Metals	NELAP	7/1/2003
Silver	EPA 6020	Metals	NELAP	3/30/2006
Silvex (2,4,5-TP)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Sodium	EPA 200.7	Metals	NELAP	5/16/2003
Sodium	EPA 6010	Metals	NELAP	7/1/2003
Strontium	EPA 200.7	Metals	NELAP	3/30/2006
Strontium	EPA 6010	Metals	NELAP	7/1/2003
Styrene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Sulfate	EPA 300.0	General Chemistry	NELAP	5/16/2003
Sulfate	EPA 375.4	General Chemistry	NELAP	5/16/2003
Sulfate	EPA 9056	General Chemistry	NELAP	5/7/2008
Sulfide	EPA 376.1	General Chemistry	NELAP	5/16/2003
Sulfide	SM 4500-S F	General Chemistry	NELAP	4/17/2007
Sulfotepp	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/30/2006
Surfactants - MBAS	SM 5540 C	General Chemistry	NELAP	4/17/2007
T-amylmethylether (TAME)	OVL MSV01/GC-MS	Volatile Organics	NELAP	5/7/2008
tert-Butyl alcohol	EPA 8260	Volatile Organics	NELAP	7/1/2003
tert-Butylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Tetrachloroethylene (Perchloroethylene)	EPA 624	Volatile Organics	NELAP	5/16/2003
Tetrachloroethylene (Perchloroethylene)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Tetrachlorvinphos (Stirophos, Gardona)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/30/2006
Tetraethyl pyrophosphate (TEPP)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/30/2006
Tetrahydrofuran (THF)	OVL MSV01/GC-MS	Volatile Organics	NELAP	5/7/2008
Tetramethylphosphoramide (TMPA)	OVL HPLC07/HPLC-MS-MS	Extractable Organics	NELAP	7/30/2010
Tetryl (methyl-2,4,6-trinitrophenylnitramine)	EPA 8330	Extractable Organics	NELAP	3/30/2006
Thallium	EPA 200.7	Metals	NELAP	5/16/2003
Thallium	EPA 200.8	Metals	NELAP	5/16/2003
Thallium	EPA 6010	Metals	NELAP	7/1/2003
Thallium	EPA 6020	Metals	NELAP	7/1/2003

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Governor

H. Frank Farmer, Jr., M.D.,Ph.D.
State Surgeon General

Laboratory Scope of Accreditation

Attachment to Certificate #: E87551-22, expiration date June 30, 2012. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87551 **EPA Lab Code: OH00218** **(740) 373-4071**

E87551
Microbac Laboratories, Inc., Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Thionazin (Zinophos)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/30/2006
Tin	EPA 200.7	Metals	NELAP	5/16/2003
Tin	EPA 6010	Metals	NELAP	7/1/2003
Titanium	EPA 200.7	Metals	NELAP	5/16/2003
Titanium	EPA 6010	Metals	NELAP	3/30/2006
Toluene	EPA 624	Volatile Organics	NELAP	5/16/2003
Toluene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Total cyanide	EPA 9010/9014	General Chemistry	NELAP	5/7/2008
Total organic carbon	EPA 415.1	General Chemistry	NELAP	5/16/2003
Total organic carbon	EPA 9060	General Chemistry	NELAP	5/7/2008
Total organic carbon	SM 5310 C	General Chemistry	NELAP	4/17/2007
Total Petroleum Hydrocarbons (TPH)	EPA 1664A	General Chemistry	NELAP	3/22/2011
Total Petroleum Hydrocarbons (TPH)	FL-PRO	General Chemistry	NELAP	7/30/2010
Total Petroleum Hydrocarbons (TPH)	TX1006	Extractable Organics	NELAP	5/7/2008
Total phenolics	EPA 420.1	General Chemistry	NELAP	5/16/2003
Toxaphene (Chlorinated camphene)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Toxaphene (Chlorinated camphene)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
trans-1,2-Dichloroethylene	EPA 624	Volatile Organics	NELAP	5/16/2003
trans-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	7/1/2003
trans-1,3-Dichloropropylene	EPA 624	Volatile Organics	NELAP	5/16/2003
trans-1,3-Dichloropropylene	EPA 8260	Volatile Organics	NELAP	7/1/2003
trans-1,4-Dichloro-2-butene	EPA 8260	Volatile Organics	NELAP	3/30/2006
Trichloroethene (Trichloroethylene)	EPA 624	Volatile Organics	NELAP	5/16/2003
Trichloroethene (Trichloroethylene)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Trichlorofluoromethane	EPA 624	Volatile Organics	NELAP	5/16/2003
Trichlorofluoromethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
Trimethylphosphoramide (TriMPA)	OVL HPLC07/HPLC-MS-MS	Extractable Organics	NELAP	7/30/2010
Turbidity	EPA 180.1	General Chemistry	NELAP	5/16/2003
Uranium	EPA 200.8	Metals	NELAP	7/30/2010
Uranium	EPA 6020	Metals	NELAP	7/30/2010
Vanadium	EPA 200.7	Metals	NELAP	5/16/2003
Vanadium	EPA 200.8	Metals	NELAP	3/30/2006
Vanadium	EPA 6010	Metals	NELAP	7/1/2003
Vanadium	EPA 6020	Metals	NELAP	3/30/2006
Vinyl acetate	EPA 8260	Volatile Organics	NELAP	7/1/2003
Vinyl chloride	EPA 624	Volatile Organics	NELAP	5/16/2003

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State Laboratory ID: E87551 **EPA Lab Code: OH00218** **(740) 373-4071**

E87551
Microbac Laboratories, Inc., Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Vinyl chloride	EPA 8260	Volatile Organics	NELAP	7/1/2003
Weak acid dissociable cyanide	SM 4500 CN-I	General Chemistry	NELAP	5/7/2008
Xylene (total)	EPA 624	Volatile Organics	NELAP	5/16/2003
Xylene (total)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Zinc	EPA 200.7	Metals	NELAP	5/16/2003
Zinc	EPA 200.8	Metals	NELAP	3/30/2006
Zinc	EPA 6010	Metals	NELAP	7/1/2003
Zinc	EPA 6020	Metals	NELAP	3/30/2006
Zirconium	OVL ME600/ICP-AES	Metals	NELAP	7/30/2010

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State Laboratory ID: E87551 **EPA Lab Code: OH00218** **(740) 373-4071**

E87551
Microbac Laboratories, Inc., Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,1,1,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	5/16/2003
1,1,1-Trichloroethane	EPA 8260	Volatile Organics	NELAP	5/16/2003
1,1,2,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	5/16/2003
1,1,2-Trichloro-1,2,2-trifluoroethane	OVL MSV01/GC-MS	Volatile Organics	NELAP	5/7/2008
1,1,2-Trichloroethane	EPA 8260	Volatile Organics	NELAP	5/16/2003
1,1-Dichloroethane	EPA 8260	Volatile Organics	NELAP	5/16/2003
1,1-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	5/16/2003
1,1-Dichloropropene	EPA 8260	Volatile Organics	NELAP	5/16/2003
1,2,3-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	5/16/2003
1,2,3-Trichloropropane	EPA 8260	Volatile Organics	NELAP	5/16/2003
1,2,4,5-Tetrachlorobenzene	EPA 8270	Extractable Organics	NELAP	5/16/2003
1,2,4-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	5/16/2003
1,2,4-Trichlorobenzene	EPA 8270	Extractable Organics	NELAP	5/16/2003
1,2,4-Trimethylbenzene	EPA 8260	Volatile Organics	NELAP	5/16/2003
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8260	Volatile Organics	NELAP	5/16/2003
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8260	Volatile Organics	NELAP	5/16/2003
1,2-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	5/16/2003
1,2-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	5/16/2003
1,2-Dichloroethane	EPA 8260	Volatile Organics	NELAP	5/16/2003
1,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	5/16/2003
1,2-Diphenylhydrazine	EPA 8270	Extractable Organics	NELAP	5/16/2003
1,3,5-Trimethylbenzene	EPA 8260	Volatile Organics	NELAP	5/16/2003
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8270	Extractable Organics	NELAP	3/1/2011
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8330	Extractable Organics	NELAP	5/16/2003
1,3-Butadiene	OVL MSV01/GC-MS	Volatile Organics	NELAP	5/7/2008
1,3-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	5/16/2003
1,3-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	5/16/2003
1,3-Dichloropropane	EPA 8260	Volatile Organics	NELAP	5/16/2003
1,3-Dinitrobenzene (1,3-DNB)	EPA 8270	Extractable Organics	NELAP	3/1/2011
1,3-Dinitrobenzene (1,3-DNB)	EPA 8330	Extractable Organics	NELAP	5/16/2003
1,4-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	5/16/2003
1,4-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	5/16/2003
1,4-Dioxane (1,4-Diethyleneoxide)	EPA 8260	Volatile Organics	NELAP	5/16/2003
1,4-Dioxane (1,4-Diethyleneoxide)	OVL MSS01/GC-MS	Extractable Organics	NELAP	7/30/2010
1,4-Naphthoquinone	EPA 8270	Extractable Organics	NELAP	5/16/2003
1,4-Phenylenediamine	EPA 8270	Extractable Organics	NELAP	5/16/2003

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State Surgeon General

Laboratory Scope of Accreditation

Attachment to Certificate #: E87551-22, expiration date June 30, 2012. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87551 **EPA Lab Code: OH00218** **(740) 373-4071**

E87551
Microbac Laboratories, Inc., Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
1-Chlorohexane	EPA 8260	Volatile Organics	NELAP	5/16/2003
1-Methylnaphthalene	OVL MSS01/GC-MS	Extractable Organics	NELAP	5/7/2008
1-Naphthylamine	EPA 8270	Extractable Organics	NELAP	5/16/2003
2,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	5/16/2003
2,3,4,6-Tetrachlorophenol	EPA 8270	Extractable Organics	NELAP	5/16/2003
2,4,5-T	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
2,4,5-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	5/16/2003
2,4,6-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	5/16/2003
2,4,6-Trinitrotoluene (2,4,6-TNT)	EPA 8330	Extractable Organics	NELAP	5/16/2003
2,4-D	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
2,4-DB	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
2,4-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	5/16/2003
2,4-Dimethylphenol	EPA 8270	Extractable Organics	NELAP	5/16/2003
2,4-Dinitrophenol	EPA 8270	Extractable Organics	NELAP	5/16/2003
2,4-Dinitrotoluene (2,4-DNT)	EPA 8270	Extractable Organics	NELAP	5/16/2003
2,4-Dinitrotoluene (2,4-DNT)	EPA 8330	Extractable Organics	NELAP	5/16/2003
2,6-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	5/16/2003
2,6-Dinitrotoluene (2,6-DNT)	EPA 8270	Extractable Organics	NELAP	5/16/2003
2,6-Dinitrotoluene (2,6-DNT)	EPA 8330	Extractable Organics	NELAP	5/16/2003
2-Acetylaminofluorene	EPA 8270	Extractable Organics	NELAP	5/16/2003
2-Amino-4,6-dinitrotoluene (2-am-dnt)	EPA 8330	Extractable Organics	NELAP	5/16/2003
2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260	Volatile Organics	NELAP	5/16/2003
2-Chloroethyl vinyl ether	EPA 8260	Volatile Organics	NELAP	5/16/2003
2-Chloronaphthalene	EPA 8270	Extractable Organics	NELAP	5/16/2003
2-Chlorophenol	EPA 8270	Extractable Organics	NELAP	5/16/2003
2-Chlorotoluene	EPA 8260	Volatile Organics	NELAP	5/16/2003
2-Hexanone	EPA 8260	Volatile Organics	NELAP	5/16/2003
2-Methyl-4,6-dinitrophenol	EPA 8270	Extractable Organics	NELAP	5/16/2003
2-Methylnaphthalene	EPA 8270	Extractable Organics	NELAP	5/16/2003
2-Methylphenol (o-Cresol)	EPA 8270	Extractable Organics	NELAP	5/16/2003
2-Naphthylamine	EPA 8270	Extractable Organics	NELAP	5/16/2003
2-Nitroaniline	EPA 8270	Extractable Organics	NELAP	5/16/2003
2-Nitrophenol	EPA 8270	Extractable Organics	NELAP	5/16/2003
2-Nitropropane	EPA 8260	Volatile Organics	NELAP	5/16/2003
2-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	5/16/2003
2-Picoline (2-Methylpyridine)	EPA 8270	Extractable Organics	NELAP	5/16/2003

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State Surgeon General

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State Laboratory ID: E87551 **EPA Lab Code: OH00218** **(740) 373-4071**

E87551
Microbac Laboratories, Inc., Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
3,3'-Dichlorobenzidine	EPA 8270	Extractable Organics	NELAP	5/16/2003
3,3'-Dimethylbenzidine	EPA 8270	Extractable Organics	NELAP	5/16/2003
3/4-Methylphenols (m/p-Cresols)	EPA 8270	Extractable Organics	NELAP	7/30/2010
3-Methylcholanthrene	EPA 8270	Extractable Organics	NELAP	5/16/2003
3-Nitroaniline	EPA 8270	Extractable Organics	NELAP	5/16/2003
3-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	5/16/2003
4,4'-DDD	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
4,4'-DDE	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
4,4'-DDT	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
4-Amino-2,6-dinitrotoluene (4-am-dnt)	EPA 8330	Extractable Organics	NELAP	5/16/2003
4-Aminobiphenyl	EPA 8270	Extractable Organics	NELAP	5/16/2003
4-Bromophenyl phenyl ether	EPA 8270	Extractable Organics	NELAP	5/16/2003
4-Chloro-3-methylphenol	EPA 8270	Extractable Organics	NELAP	5/16/2003
4-Chloroaniline	EPA 8270	Extractable Organics	NELAP	5/16/2003
4-Chlorophenyl phenylether	EPA 8270	Extractable Organics	NELAP	5/16/2003
4-Chlorotoluene	EPA 8260	Volatile Organics	NELAP	5/16/2003
4-Dimethyl aminoazobenzene	EPA 8270	Extractable Organics	NELAP	3/30/2006
4-Methyl-2-pentanone (MIBK)	EPA 8260	Volatile Organics	NELAP	5/16/2003
4-Nitroaniline	EPA 8270	Extractable Organics	NELAP	5/16/2003
4-Nitrophenol	EPA 8270	Extractable Organics	NELAP	5/16/2003
4-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	5/16/2003
5-Nitro-o-toluidine	EPA 8270	Extractable Organics	NELAP	5/16/2003
7,12-Dimethylbenz(a) anthracene	EPA 8270	Extractable Organics	NELAP	5/16/2003
a-a-Dimethylphenethylamine	EPA 8270	Extractable Organics	NELAP	5/16/2003
Acenaphthene	EPA 8270	Extractable Organics	NELAP	5/16/2003
Acenaphthylene	EPA 8270	Extractable Organics	NELAP	5/16/2003
Acetone	EPA 8260	Volatile Organics	NELAP	5/16/2003
Acetonitrile	EPA 8260	Volatile Organics	NELAP	5/16/2003
Acetophenone	EPA 8270	Extractable Organics	NELAP	5/16/2003
Acrolein (Propenal)	EPA 8260	Volatile Organics	NELAP	5/16/2003
Acrylonitrile	EPA 8260	Volatile Organics	NELAP	5/16/2003
Aldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Allyl chloride (3-Chloropropene)	EPA 8260	Volatile Organics	NELAP	3/30/2006
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
alpha-Chlordane	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Aluminum	EPA 6010	Metals	NELAP	5/16/2003

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E87551
Microbac Laboratories, Inc., Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
Aniline	EPA 8270	Extractable Organics	NELAP	5/16/2003
Anthracene	EPA 8270	Extractable Organics	NELAP	5/16/2003
Antimony	EPA 6010	Metals	NELAP	5/16/2003
Antimony	EPA 6020	Metals	NELAP	5/16/2003
Aramite	EPA 8270	Extractable Organics	NELAP	5/16/2003
Aroclor-1016 (PCB-1016)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Aroclor-1221 (PCB-1221)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Aroclor-1232 (PCB-1232)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Aroclor-1242 (PCB-1242)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Aroclor-1248 (PCB-1248)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Aroclor-1254 (PCB-1254)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Aroclor-1260 (PCB-1260)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Arsenic	EPA 6010	Metals	NELAP	5/16/2003
Arsenic	EPA 6020	Metals	NELAP	5/16/2003
Atrazine	OVL MSS01/GC-MS	Extractable Organics	NELAP	7/30/2010
Barium	EPA 6010	Metals	NELAP	5/16/2003
Barium	EPA 6020	Metals	NELAP	3/30/2006
Benzaldehyde	OVL MSS01/GC-MS	Extractable Organics	NELAP	5/7/2008
Benzene	EPA 8260	Volatile Organics	NELAP	5/16/2003
Benzidine	EPA 8270	Extractable Organics	NELAP	5/16/2003
Benzo(a)anthracene	EPA 8270	Extractable Organics	NELAP	5/16/2003
Benzo(a)pyrene	EPA 8270	Extractable Organics	NELAP	5/16/2003
Benzo(b)fluoranthene	EPA 8270	Extractable Organics	NELAP	3/1/2011
Benzo(g,h,i)perylene	EPA 8270	Extractable Organics	NELAP	5/16/2003
Benzo(k)fluoranthene	EPA 8270	Extractable Organics	NELAP	5/16/2003
Benzoic acid	EPA 8270	Extractable Organics	NELAP	5/16/2003
Benzyl alcohol	EPA 8270	Extractable Organics	NELAP	5/16/2003
Beryllium	EPA 6010	Metals	NELAP	5/16/2003
beta-BHC (beta-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Biphenyl	OVL MSS01/GC-MS	Extractable Organics	NELAP	5/7/2008
bis(2-Chloroethoxy)methane	EPA 8270	Extractable Organics	NELAP	5/16/2003
bis(2-Chloroethyl) ether	EPA 8270	Extractable Organics	NELAP	5/16/2003
bis(2-Chloroisopropyl) ether (2,2'-Oxybis(1-chloropropane))	EPA 8270	Extractable Organics	NELAP	5/16/2003
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 8270	Extractable Organics	NELAP	5/16/2003
Boron	EPA 6010	Metals	NELAP	5/16/2003
Bromide	EPA 9056	General Chemistry	NELAP	5/16/2003

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E87551
Microbac Laboratories, Inc., Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
Bromobenzene	EPA 8260	Volatile Organics	NELAP	5/16/2003
Bromochloromethane	EPA 8260	Volatile Organics	NELAP	5/16/2003
Bromodichloromethane	EPA 8260	Volatile Organics	NELAP	5/16/2003
Bromoform	EPA 8260	Volatile Organics	NELAP	5/16/2003
Butyl benzyl phthalate	EPA 8270	Extractable Organics	NELAP	5/16/2003
Cadmium	EPA 6010	Metals	NELAP	5/16/2003
Cadmium	EPA 6020	Metals	NELAP	3/30/2006
Calcium	EPA 6010	Metals	NELAP	5/16/2003
Caprolactam	OVL MSS01/GC-MS	Extractable Organics	NELAP	5/7/2008
Carbazole	EPA 8270	Extractable Organics	NELAP	5/16/2003
Carbon disulfide	EPA 8260	Volatile Organics	NELAP	5/16/2003
Carbon tetrachloride	EPA 8260	Volatile Organics	NELAP	5/16/2003
Chlordane (tech.)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Chloride	EPA 9056	General Chemistry	NELAP	5/16/2003
Chlorobenzene	EPA 8260	Volatile Organics	NELAP	5/16/2003
Chlorobenzilate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/30/2006
Chloroethane	EPA 8260	Volatile Organics	NELAP	5/16/2003
Chloroform	EPA 8260	Volatile Organics	NELAP	5/16/2003
Chloroprene	EPA 8260	Volatile Organics	NELAP	5/16/2003
Chromium	EPA 6010	Metals	NELAP	5/16/2003
Chromium	EPA 6020	Metals	NELAP	3/30/2006
Chromium VI	EPA 7196	General Chemistry	NELAP	3/30/2006
Chrysene	EPA 8270	Extractable Organics	NELAP	5/16/2003
cis-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	5/16/2003
cis-1,3-Dichloropropene	EPA 8260	Volatile Organics	NELAP	5/16/2003
Cobalt	EPA 6010	Metals	NELAP	5/16/2003
Cobalt	EPA 6020	Metals	NELAP	3/30/2006
Copper	EPA 6010	Metals	NELAP	5/16/2003
Copper	EPA 6020	Metals	NELAP	3/30/2006
Cyclohexane	OVL MSV01/GC-MS	Volatile Organics	NELAP	5/7/2008
Cyclohexanone	OVL MSV01/GC-MS	Volatile Organics	NELAP	5/7/2008
Dalapon	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
delta-BHC	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Diallate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Dibenz(a,h)anthracene	EPA 8270	Extractable Organics	NELAP	5/16/2003
Dibenzofuran	EPA 8270	Extractable Organics	NELAP	5/16/2003

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State Surgeon General

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State Laboratory ID: E87551 **EPA Lab Code: OH00218** **(740) 373-4071**

E87551
Microbac Laboratories, Inc., Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
Dibromochloromethane	EPA 8260	Volatile Organics	NELAP	5/16/2003
Dibromofluoromethane	EPA 8260	Volatile Organics	NELAP	5/16/2003
Dibromomethane	EPA 8260	Volatile Organics	NELAP	5/16/2003
Dicamba	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Dichlorodifluoromethane	EPA 8260	Volatile Organics	NELAP	5/16/2003
Dichloroprop (Dichlorprop)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Dieldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Diesel range organics (DRO)	EPA 8015	Extractable Organics	NELAP	11/5/2004
Diethyl ether	EPA 8260	Volatile Organics	NELAP	5/16/2003
Diethyl phthalate	EPA 8270	Extractable Organics	NELAP	5/16/2003
Di-isopropylether (DIPE)	OVL MSV01/GC-MS	Volatile Organics	NELAP	5/7/2008
Dimethoate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Dimethyl phthalate	EPA 8270	Extractable Organics	NELAP	5/16/2003
Dimethyl sulfide	OVL MSV01/GC-MS	Volatile Organics	NELAP	5/7/2008
Dimethyldisulfide	OVL MSV01/GC-MS	Volatile Organics	NELAP	5/7/2008
Di-n-butyl phthalate	EPA 8270	Extractable Organics	NELAP	5/16/2003
Di-n-octyl phthalate	EPA 8270	Extractable Organics	NELAP	5/16/2003
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8270	Extractable Organics	NELAP	5/16/2003
Diphenylamine	EPA 8270	Extractable Organics	NELAP	5/16/2003
Disulfoton	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/1/2011
Endosulfan I	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Endosulfan II	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Endosulfan sulfate	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Endrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Endrin aldehyde	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Endrin ketone	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Ethanol	EPA 8015	Volatile Organics	NELAP	5/16/2003
Ethyl acetate	EPA 8260	Volatile Organics	NELAP	3/30/2006
Ethyl methacrylate	EPA 8260	Volatile Organics	NELAP	5/16/2003
Ethyl methanesulfonate	EPA 8270	Extractable Organics	NELAP	5/16/2003
Ethylbenzene	EPA 8260	Volatile Organics	NELAP	5/16/2003
Ethylene glycol	EPA 8015	Volatile Organics	NELAP	5/16/2003
Ethyl-t-butylether (ETBE)	OVL MSV01/GC-MS	Volatile Organics	NELAP	5/7/2008
Famphur	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Fluoranthene	EPA 8270	Extractable Organics	NELAP	5/16/2003

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E87551
Microbac Laboratories, Inc., Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
Fluorene	EPA 8270	Extractable Organics	NELAP	5/16/2003
Fluoride	EPA 9056	General Chemistry	NELAP	5/16/2003
Formaldehyde	EPA 8315	Extractable Organics	NELAP	5/16/2003
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
gamma-Chlordane	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Gasoline range organics (GRO)	EPA 8015	Extractable Organics	NELAP	11/5/2004
Heptachlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Heptachlor epoxide	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Hexachlorobenzene	EPA 8270	Extractable Organics	NELAP	5/16/2003
Hexachlorobutadiene	EPA 8260	Volatile Organics	NELAP	5/16/2003
Hexachlorobutadiene	EPA 8270	Extractable Organics	NELAP	5/16/2003
Hexachlorocyclopentadiene	EPA 8270	Extractable Organics	NELAP	5/16/2003
Hexachloroethane	EPA 8270	Extractable Organics	NELAP	5/16/2003
Hexachlorophene	EPA 8270	Extractable Organics	NELAP	5/16/2003
Hexachloropropene	EPA 8270	Extractable Organics	NELAP	5/16/2003
Hexamethylphosphoramide (HMPA)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/30/2006
Ignitability	EPA 1010	General Chemistry	NELAP	5/16/2003
Indeno(1,2,3-cd)pyrene	EPA 8270	Extractable Organics	NELAP	5/16/2003
Iodomethane (Methyl iodide)	EPA 8260	Volatile Organics	NELAP	5/16/2003
Iron	EPA 6010	Metals	NELAP	5/16/2003
Isobutyl alcohol (2-Methyl-1-propanol)	EPA 8260	Volatile Organics	NELAP	3/30/2006
Isodrin	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Isophorone	EPA 8270	Extractable Organics	NELAP	5/16/2003
Isoprene	OVL MSV01/GC-MS	Volatile Organics	NELAP	5/7/2008
Isopropyl alcohol (2-Propanol)	EPA 8015	Volatile Organics	NELAP	5/16/2003
Isopropylbenzene	EPA 8260	Volatile Organics	NELAP	5/16/2003
Isosafrole	EPA 8270	Extractable Organics	NELAP	5/16/2003
Kepone	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Lead	EPA 6010	Metals	NELAP	5/16/2003
Lead	EPA 6020	Metals	NELAP	5/16/2003
Lithium	EPA 6010	Metals	NELAP	5/16/2003
Magnesium	EPA 6010	Metals	NELAP	5/16/2003
Malathion	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/1/2011
Manganese	EPA 6010	Metals	NELAP	5/16/2003
Manganese	EPA 6020	Metals	NELAP	3/30/2006
MCPA	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	5/16/2003

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E87551
Microbac Laboratories, Inc., Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
MCPP	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Mercury	EPA 7471	Metals	NELAP	2/6/2004
Methacrylonitrile	EPA 8260	Volatile Organics	NELAP	5/16/2003
Methanol	EPA 8015	Volatile Organics	NELAP	5/16/2003
Methapyrilene	EPA 8270	Extractable Organics	NELAP	5/16/2003
Methoxychlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Methyl acetate	OVL MSV01/GC-MS	Volatile Organics	NELAP	5/7/2008
Methyl bromide (Bromomethane)	EPA 8260	Volatile Organics	NELAP	5/16/2003
Methyl chloride (Chloromethane)	EPA 8260	Volatile Organics	NELAP	5/16/2003
Methyl methacrylate	EPA 8260	Volatile Organics	NELAP	5/16/2003
Methyl methanesulfonate	EPA 8270	Extractable Organics	NELAP	5/16/2003
Methyl parathion (Parathion, methyl)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/1/2011
Methyl tert-butyl ether (MTBE)	EPA 8260	Volatile Organics	NELAP	5/16/2003
Methylcyclohexane	OVL MSV01/GC-MS	Volatile Organics	NELAP	5/7/2008
Methylene chloride	EPA 8260	Volatile Organics	NELAP	5/16/2003
Molybdenum	EPA 6010	Metals	NELAP	5/16/2003
Naphthalene	EPA 8260	Volatile Organics	NELAP	5/16/2003
Naphthalene	EPA 8270	Extractable Organics	NELAP	5/16/2003
n-Butyl alcohol	EPA 8260	Volatile Organics	NELAP	3/30/2006
n-Butylbenzene	EPA 8260	Volatile Organics	NELAP	5/16/2003
n-Hexane	OVL MSV01/GC-MS	Volatile Organics	NELAP	5/7/2008
Nickel	EPA 6010	Metals	NELAP	5/16/2003
Nickel	EPA 6020	Metals	NELAP	3/30/2006
Nitrate	EPA 9056	General Chemistry	NELAP	5/16/2003
Nitrite	EPA 9056	General Chemistry	NELAP	5/16/2003
Nitrobenzene	EPA 8270	Extractable Organics	NELAP	5/16/2003
Nitrobenzene	EPA 8330	Extractable Organics	NELAP	5/16/2003
Nitrocellulose	OVL KNITRO-C-S/UV-VIS	General Chemistry	NELAP	5/7/2008
Nitroglycerin	EPA 8330	Extractable Organics	NELAP	6/13/2007
Nitroguanidine	OVL HPLC05/HPLC-UV	Extractable Organics	NELAP	5/7/2008
Nitroquinoline-1-oxide	EPA 8270	Extractable Organics	NELAP	5/16/2003
n-Nitrosodiethylamine	EPA 8270	Extractable Organics	NELAP	5/16/2003
n-Nitrosodimethylamine	EPA 8270	Extractable Organics	NELAP	5/16/2003
n-Nitroso-di-n-butylamine	EPA 8270	Extractable Organics	NELAP	5/16/2003
n-Nitrosodi-n-propylamine	EPA 8270	Extractable Organics	NELAP	5/16/2003
n-Nitrosodiphenylamine	EPA 8270	Extractable Organics	NELAP	5/16/2003

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Microbac Laboratories, Inc., Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
n-Nitrosomethylethylamine	EPA 8270	Extractable Organics	NELAP	5/16/2003
n-Nitrosomorpholine	EPA 8270	Extractable Organics	NELAP	5/16/2003
n-Nitrosopiperidine	EPA 8270	Extractable Organics	NELAP	5/16/2003
n-Nitrosopyrrolidine	EPA 8270	Extractable Organics	NELAP	5/16/2003
n-Propylbenzene	EPA 8260	Volatile Organics	NELAP	5/16/2003
o,o,o-Triethyl phosphorothioate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	EPA 8330	Extractable Organics	NELAP	5/16/2003
o-Toluidine	EPA 8270	Extractable Organics	NELAP	5/16/2003
Paint Filter Liquids Test	EPA 9095	General Chemistry	NELAP	5/16/2003
Parathion, ethyl	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/1/2011
Pentachlorobenzene	EPA 8270	Extractable Organics	NELAP	5/16/2003
Pentachloroethane	OVL MSS01/GC-MS	Extractable Organics	NELAP	5/7/2008
Pentachloronitrobenzene (Quintozene)	EPA 8270	Extractable Organics,Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Pentachlorophenol	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Pentachlorophenol	EPA 8270	Extractable Organics	NELAP	5/16/2003
Pentaerythritoltetranitrate (PETN)	EPA 8330	Extractable Organics	NELAP	6/13/2007
Perchlorate	EPA 6850	General Chemistry	NELAP	7/30/2010
pH	EPA 9040	General Chemistry	NELAP	2/6/2004
pH	EPA 9045	General Chemistry	NELAP	2/6/2004
Phenacetin	EPA 8270	Extractable Organics	NELAP	5/16/2003
Phenanthrene	EPA 8270	Extractable Organics	NELAP	5/16/2003
Phenol	EPA 8270	Extractable Organics	NELAP	5/16/2003
Phorate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/1/2011
Phosphorus, total	EPA 6010	Metals	NELAP	7/30/2010
p-Isopropyltoluene	EPA 8260	Volatile Organics	NELAP	5/16/2003
Potassium	EPA 6010	Metals	NELAP	5/16/2003
Pronamide (Kerb)	EPA 8270	Extractable Organics	NELAP	5/16/2003
Propionitrile (Ethyl cyanide)	EPA 8260	Volatile Organics	NELAP	3/30/2006
Pyrene	EPA 8270	Extractable Organics	NELAP	5/16/2003
Pyridine	EPA 8270	Extractable Organics	NELAP	5/16/2003
RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)	EPA 8330	Extractable Organics	NELAP	5/16/2003
Reactive cyanide	Sec. 7.3 SW-846	General Chemistry	NELAP	5/16/2003
Reactive sulfide	Sec. 7.3 SW-846	General Chemistry	NELAP	5/16/2003
Safrole	EPA 8270	Extractable Organics	NELAP	5/16/2003
sec-Butylbenzene	EPA 8260	Volatile Organics	NELAP	5/16/2003

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158 Starlite Drive
Marietta, OH 45750

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
Selenium	EPA 6010	Metals	NELAP	5/16/2003
Selenium	EPA 6020	Metals	NELAP	11/7/2003
Silver	EPA 6010	Metals	NELAP	3/1/2011
Silver	EPA 6020	Metals	NELAP	3/30/2006
Silvex (2,4,5-TP)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Sodium	EPA 6010	Metals	NELAP	5/16/2003
Strontium	EPA 6010	Metals	NELAP	5/16/2003
Styrene	EPA 8260	Volatile Organics	NELAP	5/16/2003
Sulfate	EPA 9056	General Chemistry	NELAP	5/16/2003
Sulfide	EPA 9030/9034	General Chemistry	NELAP	5/16/2003
Sulfotepp	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Synthetic Precipitation Leaching Procedure	EPA 1312	General Chemistry	NELAP	5/16/2003
T-amylmethylether (TAME)	OVL MSV01/GC-MS	Volatile Organics	NELAP	5/7/2008
tert-Butyl alcohol	EPA 8260	Volatile Organics	NELAP	5/16/2003
tert-Butylbenzene	EPA 8260	Volatile Organics	NELAP	5/16/2003
Tetrachloroethylene (Perchloroethylene)	EPA 8260	Volatile Organics	NELAP	5/16/2003
Tetrachlorvinphos (Stirophos, Gardona)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/30/2006
Tetraethyl pyrophosphate (TEPP)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	3/30/2006
Tetryl (methyl-2,4,6-trinitrophenylnitramine)	EPA 8330	Extractable Organics	NELAP	5/16/2003
Thallium	EPA 6010	Metals	NELAP	5/16/2003
Thallium	EPA 6020	Metals	NELAP	5/16/2003
Thionazin (Zinophos)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Tin	EPA 6010	Metals	NELAP	5/16/2003
Titanium	EPA 6010	Volatile Organics	NELAP	3/30/2006
Toluene	EPA 8260	Volatile Organics	NELAP	5/16/2003
Total cyanide	EPA 9010/9014	General Chemistry	NELAP	7/30/2010
Total organic carbon	Lloyd Khan	General Chemistry	NELAP	5/7/2008
Total Petroleum Hydrocarbons (TPH)	FL-PRO	Extractable Organics	NELAP	5/16/2003
Total Petroleum Hydrocarbons (TPH)	TX1005	Extractable Organics	NELAP	3/30/2006
Total Petroleum Hydrocarbons (TPH)	TX1006	Extractable Organics	NELAP	3/30/2006
Toxaphene (Chlorinated camphene)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	5/16/2003
Toxicity Characteristic Leaching Procedure	EPA 1311	General Chemistry	NELAP	5/16/2003
trans-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	5/16/2003
trans-1,3-Dichloropropylene	EPA 8260	Volatile Organics	NELAP	5/16/2003
trans-1,4-Dichloro-2-butene	EPA 8260	Volatile Organics	NELAP	5/16/2003
Trichloroethene (Trichloroethylene)	EPA 8260	Volatile Organics	NELAP	5/16/2003

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E87551
Microbac Laboratories, Inc., Ohio Valley Division
158 Starlite Drive
Marietta, OH 45750

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
Trichlorofluoromethane	EPA 8260	Volatile Organics	NELAP	5/16/2003
Uranium	EPA 6020	Metals	NELAP	7/30/2010
Vanadium	EPA 6010	Metals	NELAP	5/16/2003
Vanadium	EPA 6020	Metals	NELAP	3/30/2006
Vinyl acetate	EPA 8260	Volatile Organics	NELAP	5/16/2003
Vinyl chloride	EPA 8260	Volatile Organics	NELAP	5/16/2003
Xylene (total)	EPA 8260	Volatile Organics	NELAP	5/16/2003
Zinc	EPA 6010	Metals	NELAP	5/16/2003
Zinc	EPA 6020	Metals	NELAP	3/30/2006
Zirconium	OVL ME600/ICP-AES	Metals	NELAP	7/30/2010

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APPENDIX D

KEY PERSONNEL
JOB DESCRIPTIONS

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Job Description
Ohio Valley Laboratory

POSITION: Managing Director/Laboratory Director
CLASSIFICATION: Exempt
REPORTS TO: President/CEO

Position Summary and Interrelationships:

The Managing Director reports to the President of Microbac Laboratories, Inc. and manages the business development and technical staff presented in the organization charts of this section (Figures 1 and 2). The Managing Director has primary responsibility for assuring compliance with ISO/IEC 17025:2005. The Technical Director/QAO, Senior Chemist – QA/QC, and all departmental supervisors will assist in the implementation of the specific requirements of this standard. The Managing Director also serves as the Laboratory Director, and has general responsibility for business development and operations. Included are strategic planning, resource allocation and profit and loss for the analytical division as a whole. It is the Managing Director's responsibility to obtain and develop both financial and personnel resources in an effort to maintain quality services and to match resources with the market demands. Additional responsibilities include proposal development and review, production management. Other duties include oversight of the laboratory safety and waste management programs, certifying that personnel with appropriate educational and/or technical background perform all tests for which the laboratory is accredited, monitoring standards of performance in quality control and quality assurance, and ensuring that sufficient numbers of qualified personnel are employed to supervise and perform the work of the laboratory. The Managing Director has authority to:

Responsibilities and Authorities:

1. Reviews and approves quality policies, the quality manual, and laboratory standard operating procedures (SOP).

2. Maintains SOP documents file in hard copy and computer format and distributes revisions to the various laboratory departments.

3. Reviews laboratory quality assurance data, laboratory records for precision and accuracy, statistical control limits, and method detection limits, limits of detection (LOD), and limits of quantitation (LOQ).

4. Reviews statistical warning and control limits and analytical control charts.

5. Performs internal system and technical audits and recommends corrective action plans for areas of deficiency.

6. Introduces internal “blind” performance evaluation samples into the LIMS and reports results of studies to management.

7. Prepares monthly quality assurance reports to management.

8. Communicates any quality concerns to the Technical Director and Managing Director.

9. Communicates the QA program objectives and requirements to the laboratory staff and clients.

10. Schedules and orders proficiency testing (PT) samples and prepares reports for auditing or certifying agencies.

11. Reviews PT data and scores, communicates unacceptable analytical performance to the Managing Director, and prepares corrective action plans for auditing or certifying agencies.

12. Implements system for maintaining calibration records of balances, thermometers, etc.

13. Maintains all records of laboratory certification

14. Assists clients and field operations in the preparation of specific QA Project Plans (QAPPs).

15. Assists in the development of technical training procedures and performs staff training.

16. Reviews and approves laboratory and analyst demonstrations of capability.

17. Performs other duties as directed by the Managing Director.

18. Performs audits of sub-contractor laboratories as necessary.

19. Develops and maintains a system of quality control standards, which are independent of calibration standards.

20. Assists the Managing Director in development and maintaining the health and

safety program and a waste disposal system.

21. Approve policies and procedures.

22. Implementation and maintenance of the quality management system.

23. Review and approve contracts and tenders.

24. Approve certificates-of-analysis (laboratory report).

25. Evaluating staff training effectiveness.

26. Stopping nonconforming work.

27. Resuming nonconforming work.

28. Quality Planning (Management Review).

Education/Experience Requirements:

1. BS/BA Degree - Chemistry Minor (20 semester hours) and ten years of laboratory experience.

or 2. BS/BA Degree – Chemistry Major (30 semester hours) and five years of laboratory experience.

or 3. MS/PhD Degree – Chemistry Major and three years of laboratory experience.

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Job Description
Ohio Valley Laboratory

POSITION: Technical Director
CLASSIFICATION: Exempt
REPORTS TO: Managing Director

Position Summary and Interrelationships:

The Technical Director reports to the Managing Director and is responsible for the following departments and programs: QA/QC, IT, Support Services, and methods development. The Technical Director directs the activities of the Quality Assurance Officer (QAO), the Senior Chemist for Methods Development, the Computer Programmers and IT support staff, and the Support Services Supervisor.

Responsibilities and Authorities:

1. Directs/coordinates the QA/QC program with the assistance of the QAO.

2. Directs/coordinates the development and maintenance of the Laboratory Information Management System (LIMS), the network fileservers and work stations, and all hardware software applications.

3. Evaluates/coordinates the development of all new laboratory technology and new analytical methods with assistance of the Senior Chemist.

4. Directs/coordinates the activities of the Support Services department including sample login, sample custody, building maintenance, shipping/receiving, and waste management.

5. Reviews laboratory quality assurance data, laboratory records for precision and accuracy, statistical control limits, and method detection limits, limits of detection (LOD), and limits of quantitation (LOQ).

6. Performs internal system and technical audits and recommends corrective action plans for areas of deficiency.

7. Communicates any quality concerns to the Technical Director and Managing Director.

8. Communicates the QA program objectives and requirements to the laboratory staff and clients.

9. Assists clients and field operations in the preparation of specific QA Project Plans (QAPPs).

10. Assists in the development of technical training procedures and performs staff training.

11. Develops and maintains a system of quality control standards, which are independent of calibration standards.

12. Approves technical policies and procedures

13. Implementation and maintenance of the quality management system

14. Review and approve contracts and tenders

15. Approves certificates-of-analysis (laboratory reports)

16. Evaluates staff training effectiveness

17. Stops nonconforming work

18. Resumes nonconforming work

19. Performs internal audits

20. Performs other duties as directed by the Managing Director.

Education/Experience Requirements:

1. BS/BA Degree - Chemistry Minor (20 semester hours) and ten years of laboratory experience.

or 2. BS/BA Degree – Chemistry Major (30 semester hours) and five years of laboratory experience.

or 3. MS/PhD Degree – Chemistry Major and three years of laboratory experience.

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Job Description
Ohio Valley Laboratory

POSITION: Quality Assurance Officer
CLASSIFICATION: Exempt
REPORTS TO: Technical Director

Position Summary and Interrelationships:

The Quality Assurance Officer (QAO) reports to the Technical Director and functions independently of the laboratory operations. The QAO supervises the QA Administrative Assistant and coordination with the Document Control Officer. The QAO is responsible for development, implementation, and oversight of the laboratory Quality Assurance Program. It is the QAO's responsibility to assess and ensure the quality of all work performed in the laboratory.

Responsibilities and Authorities:

1. Reviews and approves quality policies, the quality manual, and laboratory standard operating procedures (SOP).

2. Maintains SOP documents file in hard copy and computer format and distributes revisions to the various laboratory departments.

3. Reviews laboratory quality assurance data, laboratory records for precision and accuracy, statistical control limits, and method detection limits, limits of detection (LOD), and limits of quantitation (LOQ).

4. Reviews statistical warning and control limits and analytical control charts.

5. Performs internal system and technical audits and recommends corrective action plans for areas of deficiency.

6. Introduces internal "blind" performance evaluation samples into the LIMS and reports results of studies to management.

7. Prepares monthly quality assurance reports to management.

8. Communicates any quality concerns to the Technical Director and Managing Director.

9. Communicates the QA program objectives and requirements to the laboratory staff and clients.

10. Schedules and orders proficiency testing (PT) samples and prepares reports for auditing or certifying agencies.

11. Reviews PT data and scores, communicates unacceptable analytical performance to the Managing Director, and prepares corrective action plans for auditing or certifying agencies.

12. Implements system for maintaining calibration records of balances, thermometers, etc.

13. Maintains all records of laboratory certification.

14. Assists clients and field operations in the preparation of specific QA Project Plans (QAPPs).

15. Assists in the development of technical training procedures and performs staff training.

16. Reviews and approves laboratory and analyst demonstrations of capability.

17. Performs other duties as directed by the Managing Director.

18. Performs audits of sub-contractor laboratories as necessary.

19. Develops and maintains a system of quality control standards, which are independent of calibration standards.

20. Assists the Managing Director in development and maintaining the health and safety program and a waste disposal system.

21. Approve policies and procedures.

22. Implementation and maintenance of the quality management system.

23. Evaluating staff training effectiveness.

24. Has stop work authority.

25. Monitors the laboratory's corrective action processes.

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Education/Experience Requirements:

1. BS/BA Degree - Chemistry Minor (20 semester hours) and ten years of laboratory experience.

or 2. BS/BA Degree – Chemistry Major (30 semester hours) and five years of laboratory experience.

or 3. MS/PhD Degree – Chemistry Major and three years of laboratory experience.

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Job Description
Ohio Valley Laboratory

POSITION: Conventionals Laboratory Supervisor
CLASSIFICATION: Exempt
REPORTS TO: Managing Director

Position Summary and Interrelationships:

The Conventionals/Wet Chemistry Supervisor reports to the Managing Director. The Conventionals/Wet Chemistry Supervisor is responsible for coordinating the production and quality control of all work involving preparation and analysis of samples by wet chemical methods in accordance with company policies and Standard Operating Procedures (SOP). General duties include implementation of laboratory safety program in the Wet Chemistry department, implementation of the laboratory quality control program for wet chemical analysis in accordance with company SOPs and prudent laboratory practices, scheduling production of routine and non-routine work, supervising all technicians/analysts involved in sample preparation, standard preparation, and instrumental analyses.

Responsibilities and Authorities:

1. Schedules and reviews work of all analysts and lab assistants
2. Implements the laboratory Chemical Hygiene Plan and all laboratory SOPs
3. Schedules instrument maintenance
4. Performs employee orientation, training, and performance reviews
5. Performs QC review of all departmental data
6. Maintains inventory of supplies and chemicals
7. Performs general review of departmental data deliverables (Level 4)
8. Takes corrective action on all out-of-control analyses and submits reports to the QC Supervisor and Laboratory Manager
9. Evaluates staffing and instrumentation requirements and makes recommendations

to management.

10. Approves policies and procedures

11. Implementation and maintenance of the quality management system

12. Approves departmental data and reports

13. Evaluating staff training effectiveness

Education/Experience Requirements:

1. Advanced Degree in chemistry and two years of wet lab experience.

or 2. BS/BA Degree with chemistry major and three years of wet lab experience.

or 3. BS/BA Degree with Chemistry minor and four years of wet lab experience.

or 4. AS/BA Degree in science and 8-10 years of wet lab experience.

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Job Description
Ohio Valley Laboratory

POSITION: Metals Laboratory Supervisor
CLASSIFICATION: Exempt
REPORTS TO: Managing Director

Position Summary and Interrelationships:

The Metals Laboratory Supervisor reports to the Managing Director. The Metals Laboratory Supervisor is responsible for coordinating the production and quality control of all work involving digestion and analysis of samples by AA and ICP methods in accordance with company policies and Standard Operating Procedures (SOP). General duties include implementation of laboratory safety program in the metals department, implementation of the laboratory quality control program for metals analyzed in accordance with company SOPs and prudent laboratory practices, scheduling, production of routine and non-routine work, supervising all technicians/analysts involved in standard preparation, sample digestion and instrumental analyses. Other duties include the scheduling of routine maintenance and emergency service for departmental instrumentation, preparing daily work schedules for full and part-time employees, monitoring departmental backlogs, turnaround time, priority analysis deadlines, reviewing and approving data generated by the metals department.

Responsibilities and Authorities:

1. Schedules and reviews work of all analysts and lab assistants;

2. Implements the laboratory Chemical Hygiene Plan, Comprehensive QA Plan, and all laboratory SOPs;

3. Schedules instrument maintenance;

4. Performs employee orientation, training, and performance reviews;

5. Performs QC review of all departmental data;

6. Maintains inventory of supplies and chemicals;

7. Performs general review of departmental data deliverables (Level 4);

8. Takes corrective action on all out-of-control analyses and submits reports to the QC Supervisor and Laboratory Manager;

9. Evaluates staffing and instrumentation requirements and makes recommendations to management;

10. Approve policies and procedures

11. Implementation and maintenance of the quality management system

12. Approve departmental reports and data packages.

13. Evaluating staff training effectiveness

Education/Experience Requirements:

1. Advanced Degree in chemistry and two years of environmental laboratory experience

or 2. BS/BA Degree with chemistry major and four years of environmental laboratory experience

or 3. BS/BA Degree with Chemistry minor and five years of environmental laboratory experience

or 4. AS/BA Degree in science and eight to ten years of environmental laboratory experience.

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Job Description
Ohio Valley Laboratory

POSITION: Semivolatile Organics Laboratory Supervisor
CLASSIFICATION: Exempt
REPORTS TO: Managing Director

Position Summary and Interrelationships:

The Semivolatile Organics Supervisor reports to the Managing Director. The Semivolatile Organics Supervisor is responsible for coordinating the production and quality control of all work involving instrumental analysis of samples by HPLC, IC, GC/FID, GC/ECD, and GC/MS employing semivolatile methods in accordance with company policies and Standard Operating Procedures (SOP). General duties include implementation of laboratory safety program in the department, implementation of the laboratory quality control program for semivolatile organics analyzed in accordance with company SOPs and prudent laboratory practices. Other duties include scheduling production of routine and non-routine work, supervising technicians/analysts involved in standard preparation and instrumental analyses, scheduling routine maintenance and emergency service for departmental instrumentation, preparing daily work schedules of full and part-time employees, monitoring departmental backlogs, turnaround time, and priority analysis deadlines and reviewing and approving data generated by the department.

Responsibilities and Authorities:

1. Schedules and reviews work of all analysts and lab assistants;

2. Implements the laboratory Chemical Hygiene Plan, Comprehensive QA Plan, and all laboratory SOPs;

3. Schedules instrument maintenance;

4. Performs employee orientation, training, and performance reviews;

5. Performs QC review of all departmental data;

6. Maintains inventory of supplies and chemicals;

7. Performs general review of departmental data deliverables (Level 4);

8. Takes corrective action on all out-of-control analyses and submits reports to the QC Supervisor and Laboratory Manager;

9. Evaluates staffing and instrumentation requirements and makes recommendations to management;

10. Approve policies and procedures;

11. Implementation and maintenance of the quality management system;

12. Approves departmental data and reports;

13. Evaluating staff training effectiveness.

Education/Experience Requirements:

1. Advanced Degree in chemistry and two years of GC/MS experience.

or 2. BS/BA Degree with chemistry major and three years of GC/MS experience.

or 3. BS/BA Degree with Chemistry minor and four years of GC/MS experience.

or 4. AS/BA Degree in science and 8-10 years of GC/MS experience.

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Job Description
Ohio Valley Laboratory

POSITION: Volatile Organics Laboratory Supervisor
CLASSIFICATION: Exempt
REPORTS TO: Managing Director

Position Summary and Interrelationships:

The Volatile Organics Supervisor reports to the Managing Director. The Volatile Organics Supervisor is responsible for coordinating the production and quality control of all work involving preparation and analysis of samples for volatile organics analysis (VOA) by GC/PID/FID/TCD and GC/MS methods in accordance with company policies, client QAPPs, and Standard Operating Procedures (SOP). Specific duties include, but are not limited to, implementation of laboratory safety program in the department, implementation of the laboratory quality control program, scheduling production of routine and non-routine work, supervising all technicians/analysts, instrumental analyses, scheduling routine maintenance and emergency service for departmental instrumentation, preparing daily work schedules for employees, monitoring departmental backlogs, turnaround time, and priority analysis deadlines and reviewing and approving data generated by the department.

Responsibilities and Authorities:

1. Schedules and reviews work of all analysts and lab assistants
2. Implements the laboratory Chemical Hygiene Plan, Comprehensive QA Plan, and all laboratory SOPs
3. Schedules instrument maintenance
4. Performs employee orientation, training, and performance reviews
5. Performs QC review of all departmental data
6. Maintains inventory of supplies and chemicals
7. Performs general review of departmental data deliverables (Level 4)

8. Takes corrective action on all out-of-control analyses and submits reports to the QC Supervisor and Laboratory Manager

9. Evaluates staffing and instrumentation requirements and makes recommendations to management

10. Approve policies and procedures

11. Implementation and maintenance of the quality management system

12. Approves departmental reports and data packages

13. Evaluating staff training effectiveness

Education/Experience Requirements:

1. Advanced Degree in chemistry and two years of GC/MS experience.

or 2. BS/BA Degree with chemistry major and three years of GC/MS experience.

or 3. BS/BA Degree with Chemistry minor and four years of GC/MS experience.

or 4. AS/BA Degree in science and 8-10 years of related experience.

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Job Description
Ohio Valley Laboratory

POSITION: Extraction Laboratory Supervisor
CLASSIFICATION: Exempt
REPORTS TO: Managing Director

Position Summary and Interrelationships:

The Organic Sample Preparation Supervisor reports to the Managing Director. The Organic Sample Preparation Supervisor is responsible for all organic extractions. He ensures that all samples for organics analysis are prepared in accordance with the appropriate USEPA methods, that appropriate QC samples are prepared, and that all samples are extracted within the appropriate regulatory holding times. Other responsibilities include preparation of samples for extractable organic analysis, methods development for unusual matrices and preparation of standards, sample cleanup as required, TCLP extraction procedures, ordering of supplies and standards for extraction laboratory, and maintenance of extraction lab documentation.

Responsibilities and Authorities:

1. Schedules and reviews work of all analysts and lab assistants;
2. Implements the laboratory Chemical Hygiene Plan, Comprehensive QA Plan, and all laboratory SOPs;
3. Schedules instrument maintenance;
4. Performs employee orientation, training, and performance reviews;
5. Performs QC review of all departmental data;
6. Maintains inventory of supplies and chemicals;
7. Performs general review of departmental data deliverables (Level 4);
8. Takes corrective action on all out-of-control analyses and submits reports to the QC Supervisor and Laboratory Manager;
9. Evaluates staffing and instrumentation requirements and makes recommendations

to management;

10. Approve policies and procedures;

11. Implementation and maintenance of the quality management system;

12. Approves departmental data and reports;

13. Evaluating staff training effectiveness.

Education/Experience Requirements:

1. Advanced Degree in chemistry and two years of related experience.

or 2. BS/BA Degree with chemistry major and three years of related experience.

or 3. BS/BA Degree with Chemistry minor and four years of related experience.

or 4. AS/BA Degree in science and 8-10 years of related experience.

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Job Description
Ohio Valley Laboratory

POSITION: Support Services Supervisor
CLASSIFICATION: Exempt
REPORTS TO: Technical Director

Position Summary and Interrelationships:

The Support Services Supervisor reports to the Technical Director. The Support Services Supervisor is responsible for the non-analytical operations of the laboratory. General duties include coordinating and supervising all activities associated with login, sample containers and kit preparation, sample disposal, and the Microbac courier services. Other responsibilities include supervision of shipping/receiving, peer review of login, logging, temperature blanks and coordination of the laboratory waste management system.

Responsibilities and Authorities:

1. Schedules or coordinates, and reviews as necessary, the work customer service representatives, sample custodians, and support service assistants.

2. Implements the laboratory Chemical Hygiene Plan, Comprehensive QA Plan, Waste Management Plan, and all other departmental standard operating procedures.

3. Assists in the development and regular revision of pertinent standard operating procedures.

4. Performs departmental employee orientation, training, and performance reviews.

5. Schedules Support Services vehicle maintenance.

6. Coordinates or schedules Microbac sample courier service.

7. Maintains inventory of supplies for sample kits.

8. Supervises the laboratory waste management system, including the proper disposal of all sample residuals in accordance with company policies and pertinent government regulations.

9. Assists in the maintenance of the physical facility through the efforts of departmental assistants or outside contractors.

10. Assists in proposal development, writing quotations, customer service activities, and selected project and account management.

11. Performs other duties as required in special projects or emergencies.

10. Approve policies and procedures

11. Implementation and maintenance of the quality management system

12. Evaluating staff training effectiveness

Education/Experience Requirements:

1.0 AS/BA Degree in science and 3-5 years of related experience.

or 2. 5 -10 years of laboratory experience.

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Job Description
Ohio Valley Laboratory

POSITION: Chemists/Data Specialist
CLASSIFICATION: Exempt
REPORTS TO: Managing Director

Position Summary and Interrelationships:

The Chemist/Data Specialist reports to the Managing Director. The Chemist/Data Specialists (CDS) perform important functions at the beginning and end of the process chain. At project inception, they critically review all data quality objectives, EDD specifications, and regulatory/program requirements and customize instructions to the laboratory and MIS staff accordingly. Method builds, new regulatory/field applications and other non-routine requests are researched and processed by the CDS, with the support of senior management. All finalized data packages, including electronic data deliverables, are routed back to the CDS for a final review of completeness, accuracy and assured compliance to client specification. Post delivery, the CDS fields all technical questions associated with the data package, its validation and integration. Depending on the scale and scope of a project, the CDS may be assigned complete project management responsibilities. As project manager, they coordinate all facets of supporting services and are the client's primary contact for the duration of the project. In this role, the CDS initiates electronic reporting in a variety of media and configurations, including portal uploads and electronic data verifications.

Responsibilities and Authorities:

1. All technical review for proposals & new awards (methods, reporting limits, compound lists, QC). Creates "drop-in" technical narratives and tables for proposals based on technical review of RFP/QAP. Supports sales channels through clarification of discrepancies between lab capabilities and project specifications at proposal stage.

2. All workorders, kit requests and project set up in LIMS (p-keys, account level pricing, etc)

3. All interface with MIS for EDD development and progress tracking through final EDD design.

4. All interface with sampling crew as required

5. All subcontracting arrangements

6. Communication of client requirements to lab as well as communication of lab issues to the client

7. Review of all folders from log-in, resolution of anomalies with client and submittal of sample receipt acknowledgements.

8. Expediting work to insure turn around times (TAT) (no penalties, capture all premiums)

9. All forms of data review (complete, correct and compliant with contract provisions) including EDD

10. Interface with validators and auditors

11. Participation in on-going process improvement initiatives, and subsequent cross-training. Occasional research in methods development and changing regulations to support future product line expansions.

12. Some travel required as technical sales support (including some overnights) and for client-required project kick-offs.

13. Accept new work within the capacity guidelines of the Managing Director

14. Identify nonconforming work and potential preventative actions

15. Process client complaints

Education/Experience Requirements:

1. BS/BA Degree – Chemistry Minor (20 semester hours)

or 2. BS/BA Degree – Natural Science Major
1 year of related lab experience
8 hours college chemistry

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Job Description
Ohio Valley Laboratory

POSITION: Client Services Supervisor
CLASSIFICATION: Exempt
REPORTS TO: Managing Director

Position Summary and Interrelationships:

The Client Services Supervisor reports to the Managing Director. This position supervises, coordinates, and reviews the tasks of the Client Services Representatives (CSR) and related departmental activities. In addition to supervision, the position has the same duties, technical requirements, responsibilities, and authorities as Chemists/Data Specialists.

Responsibilities and Authorities:

1. Coordinates, schedules and reviews work of Client Service Representatives

2. Implements the laboratory Chemical Hygiene Plan, Comprehensive QA Plan, and all departmental SOPs

3. Performs employee orientation, training, and performance reviews

4. Evaluates staffing requirements and makes recommendations to management

5. Approve policies and procedures

6. Implementation and maintenance of the quality management system

7. Evaluating staff training effectiveness

8. Performs technical review for proposals & new awards (methods, reporting limits, compound lists, QC). Creates “drop-in” technical narratives and tables for proposals based on technical review of RFP/QAP. Supports sales channels through clarification of discrepancies between lab capabilities and project specifications at proposal stage.

9. Performs workorders, kit requests and project set up in LIMS (p-keys, account level pricing, etc)

10. Interfaces with MIS for EDD development and progress tracking through final EDD design.

11. Interfaces with sampling crew as required

12. Subcontracting arrangements

13. Communication of client requirements to lab as well as communication of lab issues to the client

14. Review folders from log-in, resolution of anomalies with client and submittal of sample receipt acknowledgements.

15. Expediting work to insure turn around times (TAT) (no penalties, capture all premiums)

16. Performing data review (complete, correct and compliant with contract provisions) including EDD

17. Interfaces with validators and auditors

18. Participation in on-going process improvement initiatives, and subsequent cross-training. Occasional research in methods development and changing regulations to support future product line expansions.

19. Some travel required as technical sales support (including some overnights) and for client-required project kick-offs.

20. Accept new work within the capacity guidelines of the Managing Director

21. Identify nonconforming work and potential preventative actions

22. Process client complaints

Education/Experience Requirements:

1. Advanced Degree in chemistry and two years of experience.
or 2. BS/BA Degree with chemistry major and three years of experience.
or 3. BS/BA Degree with Chemistry minor and four years of experience.
or 4. AS/BA Degree in science and 8-10 years of related experience.

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Job Description
Ohio Valley Laboratory

POSITION: Client Services Representatives
CLASSIFICATION: Non-Exempt
REPORTS TO: Client Services Supervisor

Position Summary and Interrelationships

Client Services Representatives (CSR) have two primary roles. They function as project/account managers on routine and repeat events with an assigned list of clients. They also assist Chemists/Data Specialists in the logistical coordination of major projects and provide administrative support for those projects. Chemists/Data Specialists provide technical/chemistry support to the CSR's on an "as needed" basis.

Responsibilities and Authorities

1. Primary liaison with select list of clients. Gathers and transmits to the laboratory all essential order entry information via work orders and account/project setup in LIMS. Selects and issues orders to subcontracting labs as required. Performs all routine customer service functions for assigned clients (phones, e-mails, etc) and provides additional coverage as assigned backup to other CSR's.

2. Reviews in-process master folders following sample receipt from log-in. Reconciles any anomalies with client. Enters field data where required. Sends sample receipt confirmations to clients as required by contracts. Approves release of samples to the lab through a LIMS change in status.

3. Reviews deliverables post production as final check of case completeness, correctness and compliance with specifications. Deliverables include required EDD's, approval invoices and subcontracted reports.

4. Performs invoicing, transmittal and AR functions with accuracy and on-time.

5. Assists in the development and implementation of process changes to maximize efficiency, conserve resources and promote optimal customer care as directed by Client Services Supervisor.

6. Requires strong attention to detail, ability to work under pressure, excellent oral and written communication skills, computer aptitude, and superior interpersonal

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skills to maintain established standards for client care and interaction with co-workers.

7. Work hours will have limited flexibility to insure coverage. Routine hours for this position have been established as 8-5. On occasion, the position may require you to stay later than 5:00 p.m. as the workload dictates.

Education/Experience Requirements:

1. AS Degree in Natural Science

or 2. High School Diploma
2 years related lab experience

Attachment C
Subcontractor Laboratory Standard Operating Procedures
(Provided on CD)

GULF COAST ANALYTICAL LABORATORIES, INC
EXTRACTIONS
STANDARD OPERATING PROCEDURES

PROCEDURE: EXT-003
PAGE: 1 of 6
EFFECTIVE DATE: 11/18/2011
APPROVED BY:
QA/QC APPROVED:

SUBJECT	SCOPE AND APPLICATION This procedure is designed for the preparation of aqueous samples and TCLP extracts which may contain Extractable Base/Neutral/Acid organic compounds. A measured volume of sample, approximately 1.0 L or 200 mL for TCLP, is serially extracted with Methylene chloride at a pH <2 and again at a pH >11.
MATRIX	Water
REFERENCE	SW-846 Method 3510C EPA 625
PRESERVATIVE	Cool to ≤ 6^0C but not frozen.
SAMPLE COLLECTION	Samples should be collected and stored in one-liter glass containers.
HOLDING TIME	Samples must be extracted within 7 days of collection. Extracts must be analyzed within 40 days following extraction. TCLP: From collection to TCLP extraction – 14 days From TCLP extraction to preparative extraction – 7 days From preparative extraction to analysis – 40 days
DEFINITIONS	See Appendix A 1. 625 Spiking Solution – for this laboratory, this refers to a spiking solution that contains the full list of compounds. The laboratory refers to this as the long list spiking solution. 2. 8270 Spiking Solution – for this laboratory, this refers to a spiking solution that contains fewer compounds. The laboratory refers to this as the short list spiking solution. This spiking solution must not be used when analyzing samples for DOD, AFCEE, South Carolina or when full list spikes are required.
SAFETY	Each employee is directly responsible for complete awareness of all health hazards associated with every chemical that he/she uses. The employee must be aware of these hazards, and all associated protective wear and spill clean-up procedures PRIOR TO the use of any chemical. In all cases, the applicable material safety data sheet (MSDS) and your supervisor or safety officer should be consulted. The bottle labels also provide important information that must be noted. Personnel performing this procedure may be working with flammables,

poisons, toxins, carcinogens, teratogens, mutagens, and biohazards. In particular, approved gloves, safety glasses, and lab coats must be worn. In addition to other measures prescribed by the division, solvents must be handled in ventilated hoods.

APPARATUS

Water bath - Organomation S-Evap-KD Solvent Evaporator, or equivalent, heated with concentric ring cover and capable of temperature control (±5°C). The bath must be used in a hood.

Separatory Funnel – 2 L with Teflon stopcock

Kuderna-Danish (K-D) apparatus
A) Concentrator tube (receiver)- 10mL, graduated
B) Evaporation flask - 500mL, attach to tube with blue clamp
C) Snyder column - three-ball macro

Snyder column – two-ball micro

Glass Wool

Glass funnels or Teflon Funnels – packed with glass wool and fill with Sodium sulfate; rinsed with Methylene chloride; collect rinsate in an Erlenmeyer flask and then discard in the appropriate waste container.

Erlenmeyer flask

100 mL Volumetric Flask

Boiling chips, Teflon or equivalent

pH indicator paper with pH range 2-14

Glass Graduated cylinders – 1000 mL and 100 mL

1.0 mL pipettor or 1.0 mL gas tight syringe

Glass beaker for micro-Snyder process

Hot plate

Glas-col mechanical shaker

1.0 mL class “A” volumetric flask

REAGENTS

All organic reagents used must be of Pesticide quality, inorganic reagents must be Reagent grade. Label all containers and squeeze bottles with reagent ID, lot number, date received, date opened and expiration date. Label prepared standards as described in SOP GEN-006. Follow manufacturer’s instruction for reagent expiration and storage. When the Manufacturer fails to provide an expiration date, the expiration date will be 12 months from the date opened or sooner if the reagents show signs of deterioration such as change in color, clumping, separation, etc.

Deionized water

Sodium hydroxide solution, 50%(ACS) - Dissolve 1000 g NaOH into 1000 mL of DI water. Record in log book. Label the container with the lot number, expiration date and concentration.

Sodium sulfate (ACS) - granular, anhydrous, heated to 400 ^{0}C for 4 hours in a shallow tray, cooled and stored in a glass containers with Teflon lined screw top lids.

Sulfuric acid solution (1:1) - 500mL H_2SO_4 (sp. gr. 1.84) added slowly to 500mL reagent water.

Methylene chloride

STANDARDS

All standards used must be pure material or from prepared certified solutions. The Certificate of Analysis shall be kept on file. Standards are to be stored according to manufacturer's instruction and will expire on the date specified by the manufacturer. Label all working standards with date prepared, concentration, Standard ID number, expiration date and the initials of individual preparing the standard. Label prepared standards as described in SOP GEN-006.

Surrogate Standard Spiking Solution

1. Surrogate standards are added to all samples, including QC.

2. Stock surrogate standard – a purchased standard in Methanol containing the following surrogates at the listed concentration:

50 µg/mL	100 µg/mL
Nitrobenzene-d_5	Phenol-d_5
2-fluorobiphenyl	2-Fluorophenol
Terphenyl-d_{14}	2,4,6-Tribromophenol

3. Store the spiking solutions at 4°C in amber glass bottles with Teflon-lined caps. The solutions must be replaced when expired (manufacturer's date), or sooner if comparison with quality control check samples indicate a problem.

4. Spiking Solutions (625) – stored at ≤ 6°C in amber glass Teflon-sealed containers until manufacturer's expiration date, or sooner if comparisons with quality control check samples indicate a problem.

5. 625 Spiking Solution – full list of compounds. The spiking solution is purchased at a concentration of 100 µg/mL in Methanol. Spike 1.0 mL of the 625 spiking solution into the LCS/LCSD and MS for full list methods. The spiking solution is purchased at a concentration of 100 µg/mL and is spiked directly into the LCS/LCSD and MS.

Note: A MSD is not required for method 625.

Additional spiking solutions may be purchased to include additional analytes requested by the client.

6. Base Neutral Spiking Solution (5000 µg/mL), Store at ≤ 6^0C in sealed ampules until use. Expires according to the manufacturer's expiration date or 6 months after preparation whichever is sooner or if comparisons with quality control check samples indicate a problem.

7. Acid Spiking Solution (7500 µg/mL Store at ≤ 6^0C in sealed ampules until use. Expires according to the manufacturer's expiration date or 6 months after preparation whichever is sooner or if comparisons with quality control check samples indicate a problem.

8. 8270 Working Spike Solution (100 µg/mL) – add 2.0 mL of Base, Neutral spiking solution and 1.34 mL of Acid spiking solution to a volumetric flask and bring to a final volume of 100 mL with Acetone.

NOTE: This is a short list spiking solution and should not be used when analyzing samples for DOD, AFCEE, and South Carolina or when full list spikes are needed.

PROCEDURE

1. Rinse all separatory funnels with methylene chloride three times. Discard solvent rinse into solvent waste container.

2. Label each separatory funnel with the sample ID to be extracted. Complete the laboratory extraction sheet with the sample ID. Fill in the extraction sheet information as each item is completed. An extraction sheet is attached.

3. Measure 1000 mL DI water with a graduated cylinder and pour into the separatory funnels labeled Blank, LCS and LCSD.

4. With each extraction batch, a method blank, LCS, LCSD and MS/MSD are included. 625 extraction batches only require a method blank, LCS/LCSD, and MS. Document on the extraction log if insufficient sample is available for a MS and/or MSD.

5. Use a Sharpie to mark the water meniscus on each sample container. This mark will later determine the initial sample volume. For TCLP BNA extraction, use a graduated cylinder to measure 200 mL of the sample.

6. Shake and mix the sample well. Pour the entire contents of the sample container into a labeled separatory funnel. Check the pH of each sample using a

Pasteur pipette and strip of pH paper. Adjust the pH of the sample to a pH of <2 by using 1:1 Sulfuric acid. This should take ≈3 mL for most samples.

7. Add 1.0 mL of the surrogate standard spiking solution to each separatory funnel and mix well. Spike the LCS/LCSD and the MS/MSD with 1.0 mL of the required spiking solution. For samples requiring SIMS analysis, add 100 µL of the surrogate standard spiking solution to each separatory funnel and 100 µL of 625 spiking solution to the LCS/LCSD and the MS/MSD pairs instead of the 1.0 mL required for routine extraction used for 8270 samples.

8. Use 60 mL of Methylene chloride to rinse the sample bottle and graduated cylinder (after rinsing the bottle, transfer to the graduated cylinder).

   Transfer this rinse solvent to the separatory funnel. Shake the funnel and vent. Place the funnel on the shaker and set timer for two minutes to extract. Allow the organic (lower) layer to separate from the water phase for at least 10 minutes. If the emulsion interface between layers is more than one-third the volume of the solvent layer, the technician must employ mechanical techniques to effect a phase separation. Optimum techniques depend upon the sample and may include stirring, filtration of the emulsion through glass wool, centrifugation, or other physical methods. Filter the Methylene chloride extract directly through a prepared glass funnel and collect in a K-D apparatus, fitted with a 10 mL graduated receiver. Using the Methylene chloride rinse bottle, rinse the funnel with a stream of Methylene chloride and collect in the K-D apparatus.

   Note: If significant amounts of sediment are in the bottom of the sample container, it may not be possible to rinse with the solvent. Contact project management to determine additional instructions from the client. If the client requests only the liquid phase be analyzed, the liquid-liquid extraction can be used. See SOP EXT-004. If the client request both phases analyzed, separate the phases and proceed. Solids are extracted using SOP EXT-001.

9. Add a second 60 mL volume of Methylene chloride to the separatory funnel and repeat the extraction a second time. Allow the organic layer to separate approximately five minutes and then combine this extract with the extract from step 8. Perform a third extraction in the same manner as the second.

10. Add approximately 7 mL of the Sodium hydroxide solution to each funnel. Check the pH and verify it is >11. Additional Sodium hydroxide solution is added if the pH is not >11. Serially extract three times with 60 mL aliquots of Methylene chloride in the same manner as the acid extraction was performed. Collect

and combine the extracts as above and label as BNA.

11. Using the Methylene chloride rinse bottle rinse the funnel and Sodium sulfate thoroughly with a stream of Methylene chloride and collect the rinse in the KD flask.

12. The initial sample volume is determined by filling the sample container with water to the mark indicating the water meniscus. Pour the entire contents into a 1000 mL graduated cylinder. Record the initial volume on the bench sheet.

13. Add one or two Teflon boiling chips to the K-D apparatus. Rinse the 3 ball Snyder column with methylene chloride. Attach the Snyder column to the evaporation flask. Place the K-D apparatus on the water bath. Adjust the vertical position of the apparatus and the water temperature as required to complete the concentration in 10 to 15 minutes. At the proper rate of distillation the balls of the column will chatter but the column will not flood with condensed solvent. When the apparent volume of liquid reaches 5.0 – 6.0 mL, remove the K-D apparatus from the water bath and allow it to drain and cool for at least 10 minutes. Remove the Snyder column and evaporation flask.

14. Rinse a two-ball micro-Snyder column with Methylene chloride. Add another clean, boiling chip to the concentrator tube and attach the two-ball micro-Snyder column. Place the receiver apparatus on a hot water bath (water bath below boiling) so that the concentrator tube is partially immersed in the hot water. Adjust the vertical position of the apparatus and the water temperature as required to complete the concentration in 5 to 10 minutes. At the proper rate of distillation, the balls of the column will actively chatter but the chambers will not flood with condensed solvent. When the apparent volume of liquid reaches about 0.5 mL, remove the apparatus from the water bath and allow it to drain for at least 10 minutes while cooling. Remove the Snyder column. Adjust the final volume to 1.0mL with Methylene chloride in a 1.0 mL Class “A” volumetric tube. Transfer the extract to a Teflon-sealed crimp cap auto-sampler vial and label as BNA, as appropriate.

15. Enter the prep batch information in the LIMS. Sign the extraction sheet. Deliver a copy of the extraction log and the extracts to the GCMS Semivolatiles laboratory. If an analyst is not available to receive the samples, place in the appropriate refrigerator with the extraction sheet.

16. Extracts are analyzed using SOP GCMSSV-001 or GCMSSV-002.

METHOD PERFORMANCE

1. The recovery of surrogates is used to monitor unusual matrix effects, sample processing problems, etc. The recovery of matrix spiking compounds, when compared to laboratory control sample (LCS) recoveries, indicates the presence or absence of unusual matrix effects.

2. The performance of each 3500 method will be dictated by the overall performance of the sample preparation in combination with the cleanup method and/or the analytical determinative method.

POLLUTION PREVENTION

See QAPP Section 13.2

WASTE MANAGEMENT

See SOP GEN-009

METHOD MODIFICATIONS

The following are modifications of EPA 625 to correspond with SW-846 3510 guidance

1. The acid extraction is performed first. This is done to improve the recovery of phenols that can decompose if the sample is made basic prior to the acid extraction.

2. The base-neutral and acid extracts are combined prior to concentration.

BASE NEUTRAL/ACID SAMPLE PREPARATION FORM

EXTRACTION DATE/TIME: _____

MATRIX: _____ WATER _____ SOIL _____ OTHER

LEVEL: _____ LOW _____ MEDIUM

BATCH #: _____

	CLIENT & GROUP #	GCAL ID	INITIAL VOL/WT mL g	FINAL VOLUME (mL)	BN pH	ACID pH	COMMENTS	METHOD
1								_____ LIQUID LIQUID/3520 EXTRACTION
2								
3								
4								_____ SEPARATIORY FUNNEL/3510 EXTRACTION
5								
6								
7								_____ SONICATOR/3550
8								
9								_____ SOXHLET/3540
10								
11								_____ GPC CLEANUP/3640
12								
13								_____ WASTE DILUTION/3580
14								TCLP EXTRACTION FLUID #1 _____
15								
16								TCLP EXTRACTION FLUID #2 _____
17								
18								
19								MECL2/Acetone No: _____
20								
21								ACETONE LOT NO: _____
22								
23								
24								MeCL2 Lot No: _____
25								
26								Sodium Sulfate Lot No: _____
27								
28								

COMMENTS: SAMPLE PREPARATION INCLUDES DETERMINATION OF SAMPLE VOLUME/WEIGHT, SOLVENT EXTRACTION AND EVAPORATION OF SOLVENT TO FINAL VOLUME

SURROGATE ID _____
VOLUME _____
CONCENTRATION _____
NaOH _____

8270 SPIKE ID _____
VOLUME _____
CONCENTRATION _____
ACID _____

625 SPIKE ID _____
VOLUME _____
ONCENTRATION _____

SPIKE WITNESS _____

_____ TECHNICIAN DATE

_____ SUPERVISOR DATE

APPENDIX A

GLOSSARY

ACCEPTANCE LIMITS – data quality limits specified by the test method or generated by the laboratory. Specified limits placed on an item, process, or service defined in the requirement document.

ACCURACY – a measure of how close a measured value is to a known true value. Accuracy is assessed by means of reference samples and percent recoveries of spiked samples. The degree of agreement between an observed value and an accepted reference value. Accuracy includes combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator.

ALIQUOT – a discrete, measure, or representative portion of a sample taken for analysis.

ANALYTE – the chemical element or compound an analyst seeks to determine; the chemical element of interest.

ANALYTICAL BATCH – the basic unit for analytical quality control, defined as samples that are analyzed together with the same method sequence and the same lots of reagents and with the manipulations common to each sample within the same time period or in continuous sequential time periods. Samples in each batch should be of similar composition (e.g., groundwater, sludge, ash).

ANALYTICAL SAMPLE – any solution or media introduced into an instrument on which an analysis is performed, excluding instrument calibration, initial calibration verification, initial calibration blank, continuing calibration verification, and continuing calibration blank. The following are all analytical samples: undiluted and diluted samples (EPA and non-EPA), predigestion spike samples, duplicate samples, serial dilution samples, analytical spike samples, post digestion spike samples, interference check samples (ICS), CRDL standard for AA(CRA), CRDL standard for ICP(CRI), laboratory control sample(LCS), preparation blank(PB), and linear range analysis sample(LRS).

ANALYST – the designated individual who performs the "hands on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.

AREA UNITS – a term used in gas chromatography that indicates the peak area of a compound exiting a chromatographic column. The size or area of the peak is proportional to the amount of analyte in the sample.

ATOMIC ABSORPTION (AA) – a technique for analyzing metal using an element-specific lamp that emits a characteristic light spectrum. A sample is heated in a flame or graphite furnace and the light beam is passed through it. When the sample absorbs light, an energy loss is detected and is translated into a concentration of metal in the sample. This technique detects one metal at a time.

AUDIT – a systematic check to determine the quality of some function or activity. Two basic types are performance audits and system audits. Perform audits involve a quantitative comparison of the laboratory's results to those of a proficiency sample containing known concentration of analytes. A system audit is a qualitative evaluation that normally consists of an onsite review of a lab's quality assurance system and physical facilities.

BACKGROUND CORRECTION – a technique usually employed relative to metals analysis, which compensates for variable background contribution to the instrument signal in the determination of trace elements.

BATCH – environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A batch is composed of a maximum of twenty environmental samples. A preparation batch is composed of environmental sample of the same matrix, meeting the above-mentioned criteria and with a maximum time between the start of processing the first and last sample in the batch to be 24 hours. An analytical batch is composed of prepared environmental samples (extracts, digestates or concentrates) and/or those samples not requiring preparation, which are analyzed together as a group using the same calibration curve or factor. An analytical batch can include samples originating from various environmental matrices.

BIAS – the deviation of the mean of replicate analytical measurements from a reference analyte concentration. Relative bias is represented by analytical measurement mean minus the reference analyte concentration and the difference divided by the reference analyte concentration. See accuracy and precision.

4-BROMO-FLUOROBENZENE (BFB) – the compound used to check the tuning of the instrument, and is used as a surrogate compound spiked into every sample for volatile analysis. A compound utilized in EPA gas chromatography/mass spectrometry (GC/MS) volatile methods to establish mass spectral instrument performance.

BIOCHEMICAL OXYGEN DEMAND (BOD) – A measure of the amount of oxygen consumed in the biochemical processes that break down organic matter in water. A larger BOD value indicates a greater degree of organic pollution. A related term, BOD5, is the amount of dissolved oxygen consumed in five days.

BIOSEED – the bacterial culture used to inoculate a sample for testing.

BLANK – an artificial sample designed to monitor the introduction of artifacts into the measurement process. For aqueous samples, reagent water is used as a blank matrix. There are several types of blanks, which monitor a variety of processes: 1.)*laboratory blank* is taken through sample preparation and analysis only. It is a test for contamination in sample preparation and analyses. 2.)*storage blank* is stored and analyzed with samples at the laboratory. It is a test for contamination in sample storage as well as sample preparation and analysis. 3.)*trip blank* is shipped to and from the field with the sample containers. It is not opened in the field and, therefore, provides a test for contamination from sample preservation, site conditions, and transport as well as sample storage, preparation, and analysis. It is most commonly used for volatile organics. 4.)*field blank* is opened in the field and tests for contamination from the atmosphere as well as those activities listed under the trip blank.

BNA – base, neutral and acid extractable compounds. The term base, neutral and acid refer to the pH condition of the sample undergoing extraction. Certain compounds extract more efficiently from water under acidic conditions. Such compounds are often referred to as “acid extractables.”

CALIBRATE – to determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter or other device, or the correct value for each setting of a control knob. The levels of the applied calibration standard should bracket the range of planned or expect sample measurements.

CALIBRATION – The systematic determination of the relationship of the response of the measurement system to the concentration of the analyte of interest.

Instrument calibration performed before any samples are analyzed is called the initial calibration. Subsequent checks on the instrument calibration performed throughout analysis are called continuing calibration verification.

CALIBRATION BLANK (CB) – a volume of reagent water in the same matrix as the calibration standards but without the analyte.

CALIBRATION CURVE – the graphical relationship between the known values, such as concentrations, of a series of calibration standards and their analytical response.

CALIBRATION METHOD – a defined technical procedure for performing a calibration.

CALIBRATION STANDARD – a certified material used to calibrate an instrument.

CERTIFIED REFERENCE MATERIAL (CRM) – reference material, one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body. (ISO Guide 30)

CONTINUING CALIBRATION VERIFICATION (CCV) – used to evaluate the performance of the instrument system with respect to a defined set of method criteria. The CCVs are used to verify instrument performance during analysis. The CCV shall be prepared from the same stock standard solution used to prepare the calibration curve.

CHAIN-OF-CUSTODY–Procedures and associated documents designed to trace the custody of a sample from the point of origin to final disposition, with the intent of legally demonstrating that custody remained intact and the tampering or substitutions were precluded.

CHEMICAL OXYGEN DEMAND (COD) – A measure of the oxygen required to oxidize all compounds in water, both organic and inorganic.

COMBINED STANDARD UNCERTAINTY – The standard uncertainty of the analytical measurement result that is the sum in quadrature (square-root-of-the-sum-of-the-squares) of the component standard uncertainties.

CORRECTIVE ACTION – the action taken to eliminate the causes of an existing non-conformity, defect, or other undesirable situation to prevent reoccurrence.

COVERAGE FACTOR – the numerical factor used as a multiplier of the combined standard uncertainty to expand the uncertainty corresponding to a specific level of confidence. The Student's *t*-distribution is used for determining the coverage factor.

DEMONSTRATION OF CAPABILITY (DOC) – a procedure used to establish the ability of the analyst to generate acceptable accuracy.

DEIONIZED WATER (DI) – water from which the majority of ions have been removed. Water that is contaminant free and used in the laboratory, the resistivity should be ≤ 18 mega ohms.

DISSOLVED METALS -- metallic elements determined on a water sample that has been passed through a 0.45-um filter.

DISSOLVED OXYGEN (DO) – the oxygen freely available in water, an indicator of water quality.

DISSOLVED SOLIDS – disintegrated organic and inorganic material contained in water. Excessive amounts make water unfit to drink or use in industrial processes.

DRY WEIGHT – the weight of a sample based on percent solids. The weight of a sample after drying in an oven at a specified temperature.

DUPLICATE MEASUREMENT – a duplicate measurement is a second measurement made on the same or identical sample of material to assist in the evaluation of measurement of variance.

DUPLICATE SAMPLE – two samples taken from the same population and carried through certain stages of sampling and testing. Duplicate sample include field co-located duplicate samples, field-split duplicate samples, and laboratory duplicate subsamples.

EXPANDED UNCERTAINTY – the quantity defining an interval enveloping the analytical measurement that captures a large fraction of the distribution of analyte concentrations that could be attributable to the quantity measured. The combined standard uncertainty is multiplied by the coverage factor to calculate the expanded uncertainty.

EXTERNAL STANDARDS – a method of quantifying chromatographic data in which standards of known concentration are analyzed prior to unknown samples. The chromatographic peak area (or height) of a sample component is compared to a calibration curve of a peak area constructed from the standard data for that component. This comparison allows the concentration of the component in the sample to be determined.

FECAL COLIFORM BACTERIA – bacteria found in mammals' intestinal tracts. Their presence in water or sludge is an indicator of pollution and possible contamination by pathogens.

FLAME IONIZATION DETECTOR (FID) – a gas chromatography detector in which the column effluent gas is mixed with hydrogen and burned in air or oxygen. The ions and electrons produced in the flame generate an electric current proportional to the amount of materials in the detector. The FID responds to nearly all organic compounds, but it does not respond to air and water, which makes it exceptionally suited to environmental analysis.

FLASHPOINT – the lowest temperature at which a flammable liquid gives off sufficient vapor to form an ignitable mixture with air near its surface or within a vessel. Combustion does not continue.

GAS CHROMATOGRAPHY (GC) – a technique for detecting organic compounds by using their physical and chemical properties to separate a mixture. The compounds are identified and quantified with various types of detectors as they exit the chromatograph. Selection of detectors is dependent on the particular compounds of interest.

GAS CHROMATOGRAPHY MASS SPECTROMETRY (GCMS) – a technique in which sample analytes are bombarded with electrons as they exit a gas chromatography column and are fragmented into characteristics ion patterns. The mass spectrometer is the detector. It can determine which fragments are present and therefore the identity of the compounds.

GLUCOSE GLUTAMIC ACID (GGA) – used as a laboratory control standard in BOD procedures.

GRAPHITE FURNACE – a technique used for the analysis of metals. An atomic absorption spectrophotometer heats the sample within a graphite tube using an electrical current. It is also commonly called a flameless furnace and

generally provides greater sensitivity for certain metals than flame or inductively coupled argon plasma techniques.

GRAVIMETRIC - analyses based on the direct or indirect weighing of the analyte in question. This technique usually requires the use of an analytical balance with a sensitivity of 0.1 mg or better.

HALL ELECTROLYTIC CONDUCTIVITY DETECTOR – an element-selective gas chromatography detector primarily intended for trace analysis of organic compounds containing chlorine, nitrogen or sulfur. In operation, this detector pyrolyzes the column effluent gas into soluble electrolytes that are dissolved in a stream of deionized liquid. The observed change in electrical conductivity, proportional to the amount of material present, is measured.

HAZARDOUS WASTE – waste regulated under RCRA that can pose a substantial or potential hazard to human health or the environment when improperly managed. Such wastes possess at least one of four characteristics (ignitability, corrosivity, reactivity, or toxicity) or appear on special EPA hazardous waste lists. The term is not interchangeable with hazardous substances or material.

HEADSPACE - Any area in a container not completely filled by the sample in which gases can collect.

HEAVY METALS – metallic elements with high atomic weights, i.e., mercury, chromium, cadmium, arsenic, and lead. They can damage the health of plants and animals at low concentrations and tend to accumulate in the food chain.

HOLDING TIME – the maximum times that samples may be held before analysis and still be considered valid or not compromised. The storage time allowed between sample collection and sample analysis when the designated preservation and storage techniques are employed.

HYDROCARBONS – chemical compounds that consist entirely of carbon and hydrogen.

ICP – Inductively coupled plasma is a type of instrument used for metals analysis. Because the temperature of the plasma is considerable higher (10,000°K) than the temperature of a flame atomic absorption spectrophotometer, it is especially useful for refractory metals. Some instruments are also capable of performing simultaneous multielement analysis.

ICP-MS - Inductively coupled plasma mass spectrometry (ICP-MS) is a type of mass spectrometry highly sensitive and capable of the determination of a range of metals and several non-metals at concentrations below one part in 10^{12} (part per trillion). It is based on coupling together an inductively coupled plasma as a method of producing ions with a mass spectrometer as a method of separating and detecting the ions. In trace elemental analysis, the method has advantages of high speed, precision and sensitivity.

IGNITABLE – capable of burning or causing a fire.

INORGANIC CHEMICALS – chemical substances of mineral origin, unlike organic chemicals whose structure relies on carbon atoms.

INITIAL CALIBRATION VERIFICATION (ICV) - also referred to as the Independent Calibration Verification for this laboratory. A standard solution used to verify the calibration curve derived from a source independent of the instrument calibration standard. The ICV is use to quantify second source standard variance and bias.

INSTRUMENT CALIBRATION STANDARD - a reference material used to standardize an analytical instrument.

INSTRUMENT DETECTION LIMIT (IDL) - a term utilized in the EPA Inorganic Contract Laboratory Program. The IDL is three times the standard deviation obtained for the analysis of a standard solution (each analyte in reagent water) at a concentration of three to five times that of the IDL on three nonconsecutive days with seven consecutive measurements per day. The IDL is the concentration equivalent to a signal, due to the analyte of interest, which is the smallest signal that can be distinguished from background noise by a particular instrument. The IDL should always be below the method detection limit, and is not used for compliance data reporting, but may be used for statistical data analysis and comparing the attributes of different instruments.

INSTRUMENT PERFORMANCE CHECK - The analyses of one of the ICSs to verified initial and continuing calibration (CCV). The IPC is used to quantify the instrumental testing repeatability variance and bias.

INSTRUMENT TUNING - a technique used in gas chromatography/mass spectrometry procedures to verify that the instrument is properly calibrated to produce reliable mass spectral information. See 4-Bromofluorobenzene under "B".

INTERNAL STANDARDS - compounds added to every standard, blank, matrix spike, matrix spike duplicate, sample (for volatile organics), and sample extract (for semivolatiles) at a known concentration, prior to analysis. Internal standards are used as the basis for quantification of the target compound.

IONIZATION - Utilized in mass spectrometry to fragment analyte molecules into smaller segments. These smaller mass segments are then separated and plotted to form a "mass spectrum" which is used to identify the parent molecule. Electron impact is one example of ionization used in mass spectrometry. In more technical terms. Ionization is the process by which neutral atoms or groups of atoms become electrically charged, either positively or negatively, by the loss or gain of electrons.

ISOMERS - chemical compounds with the same molecular weight and atomic composition by differing molecular structure, e.g., n-pentane and 2-methylbutane.

LABORATORY CONTROL SAMPLE (LCS) - a clean-matrix reference sample spiked with a standard with an established analyte concentration. The LCS is carried through the entire chemical preparation and testing procedures. The LCS is used to quantify the variance and bias of the chemical preparation and instrumental testing stages without matrix interference. Also called a Laboratory fortified blank (LFB).

LABORATORY CONTROL SAMPLE DUPLICATE (LCSD) – a duplicate of the laboratory control sample in a clean matrix that is carried through the entire chemical preparation and testing procedures.

LABORATORY DUPLICATE SAMPLE (LAB DUPLICATE) - a portion of the collected sample that is carried through the chemical preparation and testing. The laboratory duplicate subsample is used to quantify the variance of the chemical preparation and instrumental testing stages with matrix interferences.

LEACHATE - a liquid that results from water collecting contaminants as it trickles through wastes, agricultural pesticides or fertilizers. Leaching may occur in farming areas, feedlots, and landfills, and may result in hazardous substances entering surface water, groundwater or soil.

LDEQ – Louisiana Department of Environmental Quality

LIBRARY SEARCH - a technique in which an unknown mass spectrum of a compound is compared to the mass spectra of compounds contained in a computer library in an

effort to identify the compound. Compounds identified in this manner are referred to as tentatively identified compounds (TICs).

LIMIT OF DETECTION (LOD) – an estimate of the minimum amount of a substance that an analytical process can reliable detect. An LOD is analyte and matrix specific and may be laboratory dependent.

LIMIT OF QUANTIATION (LOQ) – the minimum levels, concentrations, or quantities of a target variable (e.g. target analyte) that can be reported with a specified degree of confidence..

LIMS – laboratory information management system. Horizons is the LIMS used by GCAL.

LINEAR CALIBRATION RANGE – the concentration range over which the instrument response is linear.

LOG-IN - the receipt and initial management of an environmental sample. It generally includes identifying who sent the sample; maintaining chain-of-custody; checking report and invoice information; recording analysis requested, including methodology and special instructions; and assigning a discreet in-lab identification, usually a number or bar code.

MASS SPECTRUM - a plot of ion mass/charge ratio versus intensity. A fragmentation pattern results from the particles whose mass distribution is characteristic of the parent molecule. Qualitative information is provided by a mass spectrum.

MATERIAL SAFETY DATA SHEET (MSDS) - a compilation of information required under the OSHA Communication Standard on the identity of hazardous chemicals and their associated health and physical hazards, exposure limits and precautions.

MATRIX - The physical characteristics or state of a sample – e.g., water, soil, sludge.

MATRIX INTERFERENCE - the influence of the sample matrix or sample components upon the ability of qualitatively identifies and quantitatively measures compounds in environmental samples.

MATRIX MODIFIERS - chemicals added to samples for metals analysis, which are used to lessen the effects of chemical interference, viscosity and surface tension.

MATRIX SPIKE (MS) – aliquot of a sample fortified (spiked) with known quantities of specific compounds and subjected to the entire analytical procedure in order to indicate the appropriateness of the method for the matrix by measuring recovery of the spike. Matrix spiked samples are used to quantify the variance and bias of the chemical preparation and testing stages with matrix interference.

MATRIX SPIKE DUPLICATE (MSD) - a second aliquot of the same matrix as the matrix spike that is spiked to determine the precision of the method.

METHOD DETECTION LIMIT (MDL) - the minimum concentration of compound that can be measured and reported within 99% confidence that the value is above zero and is determined from analysis of a sample in a given matrix containing the analyte.

MUST – denotes a mandatory requirement.

NARRATIVE - in an analytical report, a descriptive documentation of any problems encountered in processing the samples, along with corrective action taken and problem resolution.

NUTRIENT - any substance assimilated by living things that promote growth. The term is generally applied to nitrogen and phosphorus in wastewater, but is also applied to other essential and trace elements.

ORGANIC - generally, any compound that contains carbon bonded to a hydrogen or halogen atom.

OXIDATION - the process in chemistry whereby electrons are removed from a molecule.

PCBs - Polychlorinated biphenyl, a group of toxic persistent chemicals used in transformers and capacitors for insulating purposes and in gas pipeline systems as a lubricant. Sale of PCBs for new uses was banned by law in 1979.

PERCENT RECOVERY - a measure of accuracy that is calculated as the measured value relative to the true value expressed as a percent.

PERFORMANCE AUDIT - a quantitative evaluation of a measurement system that involves the analysis of standard reference samples or materials which are certified as to their chemical composition or physical characteristics.

PROFICIENCY TEST (PT) SAMPLE - a sample of known composition (unknown to the laboratory), provided by an external source, which is used to evaluate lab performance. For certification purposes the PT sample is purchased from an approved provider.

pH - a numerical designation of relative acidity and alkalinity. A pH of 7.0 indicates precise neutrality. Progressively higher values indicate increasing alkalinity and lower values increasing acidity.

POLLUTANT - generally, any substance introduced into the environment that adversely affects the usefulness of a resource.

PRACTICAL QUANTITATION LIMIT (PQL) - the lowest level that can be reliable achieved within specified limits of precision and accuracy routine laboratory operating conditions. The lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value.

PRECISION - a measure of the ability to reproduce analytical results. It is generally determined through the analysis of duplicate samples. The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range in either absolute or relative terms.

PRESERVATIVE - a chemical or reagent added to a sample to prevent or slow decomposition or degradation of a target analyte or a physical process. Physical and chemical preservation may be used in tandem to prevent sample deterioration.

PURGE AND TRAP - a technique used in the analysis of volatile organic where analytes are purged from a sample by means of an inert gas and trapped on a sorbent column. The sorbent is then flashheated and the analytes are transferred onto a gas chromatographic column for separation and identification.

PURGEABLE ORGANIC - an organic compound that is generally less than 20% soluble in water and has a boiling point at or below 200°C. A volatile organic. An organic compound is generally considered to be purgeable if it can be removed from water using the purging process.

QC BASED NESTED APPROACH - a procedure for estimating the uncertainty of measurement using quality control data. The procedure is described in SOP QA-013.

QUALITY ASSURANCE (QA) - all those planned and systematic actions necessary to provide adequate confidence in laboratory results. An integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets the defined standards of quality with a stated level of confidence.

QUALITY ASSURANCE PROGRAM PLAN - a written assembly of management policies, objectives, principle and general procedures that outlines how the laboratory intends to generate data of known and accepted quality.

QUALITY CONTROL (QC) – the overall system of technical activities whose purpose to measure and control the quality of a product or service so that it meets the needs of the users.

QUALITY CONTROL CHART - a graph of analytical measurement results for a specific QC standard plotted sequentially with upper and lower control limits (±3SD). A central line that is the best estimate of the average variable plotted, and upper and lower marginal exceedence limits (±4SD) are usually included in the Quality Control Chart. The chart may also include upper and lower warning limits (±2SD).

QUALITY SYSTEM – a structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items) and services. The quality system provides the framework for planning, implement and assessing work performed by the organization and for carrying out required QA and QC.

r^2 – Correlation Coefficient Squared – paramet6er used to evaluate the fit of linear or quadratic regression curve fit of initial calibration data.

RAW DATA – any original information from a measurement activity or study recorded in a laboratory note book, worksheets, records, memoranda, notes, or exact copies thereof that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data may include photography, microfilm or microfilm copies, computer printouts, magnetic media, including dictated observations, and recorded data from automated instruments.

REACTIVITY - the tendency of a chemical to explode under normal management conditions, to react violently when mixed with water, or to generate toxic gases.

REAGENT WATER - water in which an interference is not observed at or above the minimum quantitation limit of interest.

REFERENCE MATERIAL - a traceable standard with an established analyte concentration. Material or substance whose property values are sufficiently homogenous, stable and well established to be used for the calibration of an apparatus, the assessment of a measurement method or for assigning values to materials (ISO Guide 30)

REFERENCE METHOD – a method of known and documented accuracy and precision issued by an organization recognized as competent to do so.

RELATIVE RETENTION TIME – a measure of the shift in retention time of an analyte when referenced to an internal standard.

RELATIVE RESPONSE FACTOR (RRF) - a measure of the relative mass spectral response of an analyte compared to its internal standard. RRFs are determined by analysis of standards and are used in the calculation of concentrations of analytes in samples.

REPLICATE ANALYSES - two or more results representing the same sample parameter. Replicate analyses are used to quantify the analytical measurement repeatability precision.

RPD – Relative Percent Difference, a relative difference between two analyses calculated by dividing the absolute difference of those two results by the average of their two values, then multiplying by 100.

RESOLUTION - the degree of separation between peaks eluting from a chromatographic column. Sufficient resolution between peaks is required for proper quantitation of unknown analytes.

RETENTION TIME - a term used in gas and liquid chromatography describing the time elapsed from the sample injection until the specific compound elutes or exits the chromatographic column at the detector. Each compound has a characteristics retention time on a specific column; therefore, this information is used to qualitatively identify the compounds in the sample.

SAMPLE – portion of material collect for chemical analysis, identified by a unique number assigned by the LIMS.

SHALL – denotes a requirement that is mandatory whenever the criterion for conformance with the specification requires that there be no deviation. This does not prohibit the use of alternative approaches or methods for implementing the specification so long as the requirement is fulfilled.

SHOULD – denotes a guideline or recommendation whenever noncompliance with the specification is permissible.

SOLID WASTE – non-liquid, non-soluble materials, ranging from municipal garbage to industrial waste, that contain complex, and sometimes hazardous, substances. Solid wastes include sewage sludge, agricultural refuse, demolition wastes, mining residues, and even liquids and gases in containers.

SOLVENT - a substance, usually liquid, capable of dissolving or dispersing one or more other substances.

SPIKE – a known mass of target analyte added to a blank sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.

STANDARD CURVE - a curve that plots concentrations of known analyte standards versus the instrument response to the analyte. Calibration standards are prepared by diluting the stock analyte solution in graduated amounts that cover the expected range of the samples being analyzed. The calibration standards must be prepared by using the same type of acid or solvent at the same concentration as for the samples following sample preparation. This is applicable to organic and inorganic chemical analyses.

STANDARD OPERATING PROCEDURE - a detailed written description of how a laboratory executes a particular procedure or method intended to standardize its performance.

STANDARDIZED REFERENCE MATERIAL (SRM) – a certified reference material produced by the U.S. National Institute of Standards and Technology or other equivalent organization and characterized for absolute content, independent of analytical method.

STANDARD UNCERTAINTY - the analytical measurement uncertainty expressed as a standard deviation. The relative standard deviation represents the relative standard uncertainty.

SURROGATE - an organic compound similar to the analyte of interest in chemical composition, extraction and chromatography, but not normally found in environmental samples. Primarily used in chromatography techniques, the surrogate is spiked into quality control blanks, calibration and check standards, samples (including duplicated and QC reference samples) and spiked samples before analysis. A percent recovery is calculated for each surrogate.

SUSPENDED SOLIDS - small pollutant particles that float on the surface of, or are suspended in, sewage or other liquids. They resist removal by conventional means.

TARGET COMPOUND - specific compounds that are to be quantified in a sample based on a standard list of potential compounds.

TENTATIVELY IDENTIFIED COMPOUNDS (TICs) - compounds detected in samples that are not target compounds, internal standards, system monitoring compounds or surrogates. TICs usually consist of up to 30 peaks that are greater than 10% of the peak areas, or heights, of the nearest internal standard. They are subjected to mass spectral library searches for tentative identification. A client may specify the number of unknown peaks in its samples it wishes the laboratory to tentatively identify.

TOTAL METALS - metallic elements that have been digested prior to analysis.

TYPE A EVALUATION UNCERTAINTY - the method of evaluation of uncertainty by the statistical analysis of a series of test results.

TYPE B EVALUATION OF UNCERTAINTY - the method of evaluation of uncertainty by means other than statistical analysis.

UNCERTAINTY - the parameter associated with the analytical measurement results that characterizes the dispersion of the values that could be reasonable attributed to the quantity measured.

UNCERTAINTY INTERVAL - the range of analyte concentrations that an analytical measurement could represent at a specified level of confidence. The relative standard deviation is used to represent the relative standard uncertainty in the QC-based Nested Approach.

VALIDATION –the process for evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, or contractual specifications. It essentially evaluates performance against predetermined specifications.

VOA - volatile organic analysis

VOA BOTTLE - a vial used to contain samples for volatile organic analysis.

VOLATILE COMPOUNDS - compounds amendable to analysis by purge and trap. Synonymous with purgeable compounds.

VOLATILE ORGANIC COMPOUND (VOC) - any organic compound that participates in atmospheric photochemical reactions, except for those designated by the EPA Administrator as having negligible photochemical reactivity.

WET CHEMISTRY - procedures that involve distillations, colorimetric determinations and titrimetric measurements. Examples are chloride, nitrates, sulfates and biochemical oxygen demand.

GULF COAST ANALYTICAL LABORATORIES, Inc.
EXTRACTIONS
STANDARD OPERATING PROCEDURES

PROCEDURE: EXT-001
PAGE: 1 of 4
EFFECTIVE DATE: 11/18/2011
APPROVED BY:
QA/QC APPROVED:

SUBJECT	SCOPE AND APPLICATION
	This procedure is designed for the preparation of soil/sediment samples that may contain Base/Neutral/Acid compounds at levels of approximately 330 µg/kg to 20,000 µg/kg.
	A 30 g portion of sample is mixed with anhydrous Sodium sulfate and extracted with 1:1 Methylene chloride-Acetone using an ultrasonic probe. If peaks are present at greater than 20,000 µg/kg, discard the extract and prepare the sample by the medium level method. This fraction is for GC/MS analysis of BNAs.
MATRIX	Solid
REFERENCE	SW-846 Method 3550C
PRESERVATIVE	Cool ≤ 6°C but not frozen
SAMPLE COLLECTION	Samples should be collected and stored in glass containers.
HOLDING TIME	Samples must be extracted within 14 days of sample collection. Extracts must be analyzed within 40 days following extraction.
DEFINITIONS	See Appendix A Glossary
	1.625 Spiking Solution – for this laboratory, this refers to a spiking solution that contains the full list of compounds. The laboratory refers to this as the long list spiking solution.
	2.8270 Spiking Solution – for this laboratory, this refers to a spiking solution that contains fewer compounds. The laboratory refers to this as the short list spiking solution. This spiking solution must not be used when analyzing samples for DOD, AFCEE, South Carolina or when full list spikes are required.
SAFETY	Each employee is directly responsible for complete awareness of all health hazards associated with every chemical that he/she uses. The employee must be aware of these hazards and all associated protective wear and spill clean-up procedures PRIOR TO the use of any chemicals. In all cases, the applicable material safety data sheet (MSDS) and your supervisor or safety officer should be consulted. The bottle labels also provide important information that must be noted. Personnel performing this procedure may be working with flammables, poisons, toxins, carcinogens, teratogens, mutagens, and biohazards. In particular, approved gloves, safety glasses, and lab coats must be worn.

In addition to other measures prescribed by the division, solvents must be handled in ventilated hoods.

APPARATUS

250 ml beaker

Kuderna-Danish (K-D) apparatus
A) Concentrator tube, 10 mL graduated
B) Evaporation flask, 500 mL (attach to tube with blue clamp)
C) Snyder column – 3 ball macro, rinsed three times with methylene chloride

Snyder column – 2 ball micro, rinsed three times with methylene chloride

Sonicator, Fisher Scientific Ultrasonic Dismembrator equipped with ¾ inch disruptor horn.

Glass funnels – rinsed with methylene chloride
Filter paper – Fisherbrand P8, 18.5 cm or equivalent
Analytical balance, capable of weighing 0.1 g
1.0 mL pipettor or 1.0 mL gas tight syringe
1.0 mL Class "A" volumetric flask
5.0 mL Class "A" volumetric flask
10.0 mL Class "A" volumetric flask
1000 µL Eppendorf
Boiling chips – Teflon or equivalent
Pasteur Pipets and bulb
2 mL glass vials with PTFE (Teflon) lined crimp caps
Spatula, stainless steel
Hot plate

Steam bath - Organomation S-Evap-KD Solvent Evaporator, or equivalent, heated with concentric ring cover and capable of temperature control (±5°C). The bath must be used in a hood.

REAGENTS

All organic solvent shall be of pesticide grade or equivalent. Label all containers and squeeze bottles with reagent ID, lot, and expiration date. Follow manufacturer's instruction for reagent expiration and storage. When the Manufacturer fails to provide an expiration date, the expiration date will be 12 months from the date opened or sooner if the reagents show signs of deterioration such as change in color, clumping, etc.

Methylene chloride

Acetone

Sodium sulfate – reagent grade, granular, anhydrous, heat to 400°C for 4 hours. Store prepared Sodium sulfate in glass jars with Teflon lined screw caps. Keep covered at all times when not in use. Record the preparation in the logbook. Label jar with prepared lot number and expiration date.

STANDARDS

All standards used must be pure material or from prepared certified solutions. The Certificate of Analysis shall be kept on file. Follow manufacturer's instruction for standard expiration and storage. Label all working

standards with date prepared, concentration, Standard ID number, expiration date and the initials of individual preparing the standard.

1. Surrogate Standard Spiking Solution

   Surrogate standards are added to all samples including QC.

   Stock surrogate standard – a purchased standard prepared in methanol containing the following surrogates at the listed concentration:

50 µg/mL	100 µg/mL
Nitrobenzene-d_5	Phenol-d_5
2-Fluorobiphenyl	2-Fluorophenol
Terphenyl-d_{14}	2,4,6-Tribromophenol

   Store the spiking solutions at ≤ 6°C in Teflon-sealed amber glass containers. The solutions must be replaced when expired (manufacturer's date), or sooner if comparison with quality control check samples indicate a problem.

2. Spiking Solutions (8270C/625) – stored at ≤ 6°C in Teflon-sealed amber glass containers until manufacturer's expiration date.

   A. 625 Spiking Solution – full list of compounds. The spiking solution is purchased at a concentration of 100 µg/mL in Methanol. Spike 1.0 mL of the 625 spiking solution into the LCS/LCSD and MS/MSD.

   B. Additional spiking solutions may be purchased to include additional analytes requested by the client.

PROCEDURE

Sample Extraction

1. Label each beaker with the sample ID of the sample or QC sample to be extracted. Complete the extraction sheet with the sample ID's. Fill in the extraction sheet information as completed. An extraction sheet is attached.

2. With each extraction batch, a method blank, LCS/ LCSD and MS/MSD are included. Document on the extraction sheet if insufficient sample is available for a MS/MSD. For the method blank, LCS, and LCSD weigh 30 grams Sodium sulfate into a 250 mL beaker. Spike the LCS/LCSD with 1.0 mL of the appropriate spiking solution. Spike the blank and LCS/LCSD with 1.0 mL of surrogate standard spiking solution.

3. Homogenize sample by pouring the contents of the sample container onto a piece of butcher paper and chop and mix with a spatula. Remove any foreign object such as sticks, leaves, or rocks. Weigh approximately 30 g of homogenized sample to the nearest 0.1 g into a 250 mL beaker. Add 1.0 mL of the surrogate standard spiking solution to each sample and the QC samples.

Add 1.0 mL of the appropriate spiking solution to the MS/MSD. For samples requiring SIMS analysis, add 100 µL of the surrogate standard spiking solution to each of the samples (including the QC samples) and 100 µL of the 625 spiking solution to the LCS/LCSD and MS/MSD pairs instead of the 1.0 mL used for routine extraction of BNA samples. Add 30 g of Anhydrous Sodium sulfate. Mix well. The sample should have a free flowing sandy texture at this point. If not free flowing, add sodium sulfate until the sample is free flowing.

4. Immediately, add at least 100 mL of 1:1 Methylene Chloride/Acetone to each beaker. The solvent level should be about 2 inches above the sample in the beaker.

5. Fisher Scientific (Model 500) Dismembrator must be tested before use. Press test button on front panel. If the sonicator is functioning correctly the instrument returns to ready mode and is ready for use. If an error message is given see instrument manual. Place the probe of the sonicator about ½ inch below the surface of the solvent but above the sediment layer. Sonicate each sample for 3 minutes.

6. Decant and filter extracts through glass funnels lined with folded FisherBrand P8 filter paper into a KD apparatus consisting of 10 mL concentrator tube and a 500 ml evaporation flask.

7. Repeat extraction two more times with two additional 100 mL portions of 1:1 Methylene chloride-Acetone. Decant the extraction solvent after each sonication. On the final sonication, filter the entire sample and rinse filter with Methylene chloride.

8. Add 1 or 2 boiling chips. Attach a three-ball Snyder column. Pre-wet the Snyder column by adding about 1.0 mL methylene chloride to the top of the column. Place the K-D apparatus on a hot water bath. Adjust the vertical position of the apparatus and the water temperature as required to complete the concentration in 10 to 15 minutes. At the proper rate of distillation the balls of the column will actively chatter but the chambers will not flood with condensed solvent. When the apparent volume is below 5 mL, remove the K-D apparatus and allow it to cool and drain for at least 10 minutes. After extract cools it will condense in the bottom of the receiver causing an increase in volume.

9. Remove the 3 ball Snyder column and evaporation flask. Add one or two clean boiling chips to the concentrator tube and attach a two-ball micro-Snyder column. Pre-wet the Snyder column by adding about 0.4 mL of methylene chloride to the top of the column. Place the concentrator tube with the micro Snyder column in a hot water bath (80 to 90°) so that the concentrator tube is partially immersed in the hot water. Adjust the vertical position of the apparatus and the water temperature as required to complete the concentration

in five to 10 minutes. At the proper rate of distillation, the balls of the column will actively chatter but the chambers will not flood with condensed solvent. When the apparent volume of liquid reaches about 0.5 mL, remove the concentrator tube with the Snyder column from the water bath and allow it to cool and drain for at least 10 minutes. Adjust the final volume to 1.0 mL using a Class "A" volumetric flask with methylene chloride. Transfer the extract to an auto-sampler vial, seal with a Teflon lined crimp cap and label.

10. Enter the prep information in the LIMS. Deliver a copy of the extraction log and the extracts to the GCMS-Semivolatiles laboratory. If no one is available to receive the extracts, place the extracts in the appropriate refrigerator.

METHOD PERFORMANCE

1. The recovery of surrogates is used to monitor unusual matrix effects, sample processing problems, etc. The recovery of matrix spiking compounds, when compared to laboratory control sample (LCS) recoveries, indicates the presence or absence of unusual matrix effects.

2. The performance of each 3500 method will be dictated by the overall performance of the sample preparation in combination with the cleanup method and/or the analytical determinative method.

POLLUTION PREVENTION — See QAPP Section 13.2

WASTE MANAGEMENT — See SOP GEN-009

METHOD MODIFICATION

1. Procedure step 4 – The extraction solvent is added to the sample to be approximately 2 inches above the solid sample in the beaker. Exactly 100mL is not measured as stated in the method.

2. surrogate and matrix spikes in lieu of a syringe.

APPENDIX A

GLOSSARY

ACCEPTANCE LIMITS – data quality limits specified by the test method or generated by the laboratory. Specified limits placed on an item, process, or service defined in the requirement document.

ACCURACY – a measure of how close a measured value is to a known true value. Accuracy is assessed by means of reference samples and percent recoveries of spiked samples. The degree of agreement between an observed value and an accepted reference value. Accuracy includes combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator.

ALIQUOT – a discrete, measure, or representative portion of a sample taken for analysis.

ANALYTE – the chemical element or compound an analyst seeks to determine; the chemical element of interest.

ANALYTICAL BATCH – the basic unit for analytical quality control, defined as samples that are analyzed together with the same method sequence and the same lots of reagents and with the manipulations common to each sample within the same time period or in continuous sequential time periods. Samples in each batch should be of similar composition (e.g., groundwater, sludge, ash).

ANALYTICAL SAMPLE – any solution or media introduced into an instrument on which an analysis is performed, excluding instrument calibration, initial calibration verification, initial calibration blank, continuing calibration verification, and continuing calibration blank. The following are all analytical samples: undiluted and diluted samples (EPA and non-EPA), predigestion spike samples, duplicate samples, serial dilution samples, analytical spike samples, post digestion spike samples, interference check samples (ICS), CRDL standard for AA(CRA), CRDL standard for ICP(CRI), laboratory control sample(LCS), preparation blank(PB), and linear range analysis sample(LRS).

ANALYST – the designated individual who performs the "hands on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.

AREA UNITS – a term used in gas chromatography that indicates the peak area of a compound exiting a chromatographic column. The size or area of the peak is proportional to the amount of analyte in the sample.

ATOMIC ABSORPTION (AA) – a technique for analyzing metal using an element-specific lamp that emits a characteristic light spectrum. A sample is heated in a flame or graphite furnace and the light beam is passed through it. When the sample absorbs light, an energy loss is detected and is translated into a concentration of metal in the sample. This technique detects one metal at a time.

AUDIT – a systematic check to determine the quality of some function or activity. Two basic types are performance audits and system audits. Perform audits involve a quantitative comparison of the laboratory's results to those of a proficiency sample containing known concentration of analytes. A system audit is a qualitative evaluation that normally consists of an onsite review of a lab's quality assurance system and physical facilities.

BACKGROUND CORRECTION – a technique usually employed relative to metals analysis, which compensates for variable background contribution to the instrument signal in the determination of trace elements.

BATCH – environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A batch is composed of a maximum of twenty environmental samples. A preparation batch is composed of environmental sample of the same matrix, meeting the above-mentioned criteria and with a maximum time between the start of processing the first and last sample in the batch to be 24 hours. An analytical batch is composed of prepared environmental samples (extracts, digestates or concentrates) and/or those samples not requiring preparation, which are analyzed together as a group using the same calibration curve or factor. An analytical batch can include samples originating from various environmental matrices.

BIAS – the deviation of the mean of replicate analytical measurements from a reference analyte concentration. Relative bias is represented by analytical measurement mean minus the reference analyte concentration and the difference divided by the reference analyte concentration. See accuracy and precision.

4-BROMO-FLUOROBENZENE (BFB) – the compound used to check the tuning of the instrument, and is used as a surrogate compound spiked into every sample for volatile analysis. A compound utilized in EPA gas chromatography/mass spectrometry (GC/MS) volatile methods to establish mass spectral instrument performance.

BIOCHEMICAL OXYGEN DEMAND (BOD) – A measure of the amount of oxygen consumed in the biochemical processes that break down organic matter in water. A larger BOD value indicates a greater degree of organic pollution. A related term, BOD5, is the amount of dissolved oxygen consumed in five days.

BIOSEED – the bacterial culture used to inoculate a sample for testing.

BLANK – an artificial sample designed to monitor the introduction of artifacts into the measurement process. For aqueous samples, reagent water is used as a blank matrix. There are several types of blanks, which monitor a variety of processes: 1.)*laboratory blank* is taken through sample preparation and analysis only. It is a test for contamination in sample preparation and analyses. 2.)*storage blank* is stored and analyzed with samples at the laboratory. It is a test for contamination in sample storage as well as sample preparation and analysis. 3.)*trip blank* is shipped to and from the field with the sample containers. It is not opened in the field and, therefore, provides a test for contamination from sample preservation, site conditions, and transport as well as sample storage, preparation, and analysis. It is most commonly used for volatile organics. 4.)*field blank* is opened in the field and tests for contamination from the atmosphere as well as those activities listed under the trip blank.

BNA – base, neutral and acid extractable compounds. The term base, neutral and acid refer to the pH condition of the sample undergoing extraction. Certain compounds extract more efficiently from water under acidic conditions. Such compounds are often referred to as “acid extractables.”

CALIBRATE – to determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter or other device, or the correct value for each setting of a control knob. The levels of the applied calibration standard should bracket the range of planned or expect sample measurements.

CALIBRATION – The systematic determination of the relationship of the response of the measurement system to the concentration of the analyte of interest.

Instrument calibration performed before any samples are analyzed is called the initial calibration. Subsequent checks on the instrument calibration performed throughout analysis are called continuing calibration verification.

CALIBRATION BLANK (CB) – a volume of reagent water in the same matrix as the calibration standards but without the analyte.

CALIBRATION CURVE – the graphical relationship between the known values, such as concentrations, of a series of calibration standards and their analytical response.

CALIBRATION METHOD – a defined technical procedure for performing a calibration.

CALIBRATION STANDARD – a certified material used to calibrate an instrument.

CERTIFIED REFERENCE MATERIAL (CRM) – reference material, one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body. (ISO Guide 30)

CONTINUING CALIBRATION VERIFICATION (CCV) – used to evaluate the performance of the instrument system with respect to a defined set of method criteria. The CCVs are used to verify instrument performance during analysis. The CCV shall be prepared from the same stock standard solution used to prepare the calibration curve.

CHAIN-OF-CUSTODY–Procedures and associated documents designed to trace the custody of a sample from the point of origin to final disposition, with the intent of legally demonstrating that custody remained intact and the tampering or substitutions were precluded.

CHEMICAL OXYGEN DEMAND (COD) – A measure of the oxygen required to oxidize all compounds in water, both organic and inorganic.

COMBINED STANDARD UNCERTAINTY – The standard uncertainty of the analytical measurement result that is the sum in quadrature (square-root-of-the-sum-of-the-squares) of the component standard uncertainties.

CORRECTIVE ACTION – the action taken to eliminate the causes of an existing non-conformity, defect, or other undesirable situation to prevent reoccurrence.

COVERAGE FACTOR – the numerical factor used as a multiplier of the combined standard uncertainty to expand the uncertainty corresponding to a specific level of confidence. The Student's *t*-distribution is used for determining the coverage factor.

DEMONSTRATION OF CAPABILITY (DOC) – a procedure used to establish the ability of the analyst to generate acceptable accuracy.

DEIONIZED WATER (DI) – water from which the majority of ions have been removed. Water that is contaminant free and used in the laboratory, the resistivity should be ≤ 18 mega ohms.

DISSOLVED METALS -- metallic elements determined on a water sample that has been passed through a 0.45-um filter.

DISSOLVED OXYGEN (DO) – the oxygen freely available in water, an indicator of water quality.

DISSOLVED SOLIDS – disintegrated organic and inorganic material contained in water. Excessive amounts make water unfit to drink or use in industrial processes.

DRY WEIGHT – the weight of a sample based on percent solids. The weight of a sample after drying in an oven at a specified temperature.

DUPLICATE MEASUREMENT – a duplicate measurement is a second measurement made on the same or identical sample of material to assist in the evaluation of measurement of variance.

DUPLICATE SAMPLE – two samples taken from the same population and carried through certain stages of sampling and testing. Duplicate sample include field co-located duplicate samples, field-split duplicate samples, and laboratory duplicate subsamples.

EXPANDED UNCERTAINTY – the quantity defining an interval enveloping the analytical measurement that captures a large fraction of the distribution of analyte concentrations that could be attributable to the quantity measured. The combined standard uncertainty is multiplied by the coverage factor to calculate the expanded uncertainty.

EXTERNAL STANDARDS – a method of quantifying chromatographic data in which standards of known concentration are analyzed prior to unknown samples. The chromatographic peak area (or height) of a sample component is compared to a calibration curve of a peak area constructed from the standard data for that component. This comparison allows the concentration of the component in the sample to be determined.

FECAL COLIFORM BACTERIA – bacteria found in mammals' intestinal tracts. Their presence in water or sludge is an indicator of pollution and possible contamination by pathogens.

FLAME IONIZATION DETECTOR (FID) – a gas chromatography detector in which the column effluent gas is mixed with hydrogen and burned in air or oxygen. The ions and electrons produced in the flame generate an electric current proportional to the amount of materials in the detector. The FID responds to nearly all organic compounds, but it does not respond to air and water, which makes it exceptionally suited to environmental analysis.

FLASHPOINT – the lowest temperature at which a flammable liquid gives off sufficient vapor to form an ignitable mixture with air near its surface or within a vessel. Combustion does not continue.

GAS CHROMATOGRAPHY (GC) – a technique for detecting organic compounds by using their physical and chemical properties to separate a mixture. The compounds are identified and quantified with various types of detectors as they exit the chromatograph. Selection of detectors is dependent on the particular compounds of interest.

GAS CHROMATOGRAPHY MASS SPECTROMETRY (GCMS) – a technique in which sample analytes are bombarded with electrons as they exit a gas chromatography column and are fragmented into characteristics ion patterns. The mass spectrometer is the detector. It can determine which fragments are present and therefore the identity of the compounds.

GLUCOSE GLUTAMIC ACID (GGA) – used as a laboratory control standard in BOD procedures.

GRAPHITE FURNACE – a technique used for the analysis of metals. An atomic absorption spectrophotometer heats the sample within a graphite tube using an electrical current. It is also commonly called a flameless furnace and

generally provides greater sensitivity for certain metals than flame or inductively coupled argon plasma techniques.

GRAVIMETRIC - analyses based on the direct or indirect weighing of the analyte in question. This technique usually requires the use of an analytical balance with a sensitivity of 0.1 mg or better.

HALL ELECTROLYTIC CONDUCTIVITY DETECTOR – an element-selective gas chromatography detector primarily intended for trace analysis of organic compounds containing chlorine, nitrogen or sulfur. In operation, this detector pyrolyzes the column effluent gas into soluble electrolytes that are dissolved in a stream of deionized liquid. The observed change in electrical conductivity, proportional to the amount of material present, is measured.

HAZARDOUS WASTE – waste regulated under RCRA that can pose a substantial or potential hazard to human health or the environment when improperly managed. Such wastes possess at least one of four characteristics (ignitability, corrosivity, reactivity, or toxicity) or appear on special EPA hazardous waste lists. The term is not interchangeable with hazardous substances or material.

HEADSPACE - Any area in a container not completely filled by the sample in which gases can collect.

HEAVY METALS – metallic elements with high atomic weights, i.e., mercury, chromium, cadmium, arsenic, and lead. They can damage the health of plants and animals at low concentrations and tend to accumulate in the food chain.

HOLDING TIME – the maximum times that samples may be held before analysis and still be considered valid or not compromised. The storage time allowed between sample collection and sample analysis when the designated preservation and storage techniques are employed.

HYDROCARBONS – chemical compounds that consist entirely of carbon and hydrogen.

ICP – Inductively coupled plasma is a type of instrument used for metals analysis. Because the temperature of the plasma is considerable higher (10,000°K) than the temperature of a flame atomic absorption spectrophotometer, it is especially useful for refractory metals. Some instruments are also capable of performing simultaneous multielement analysis.

ICP-MS - Inductively coupled plasma mass spectrometry (ICP-MS) is a type of mass spectrometry highly sensitive and capable of the determination of a range of metals and several non-metals at concentrations below one part in 10^{12} (part per trillion). It is based on coupling together an inductively coupled plasma as a method of producing ions with a mass spectrometer as a method of separating and detecting the ions. In trace elemental analysis, the method has advantages of high speed, precision and sensitivity.

IGNITABLE – capable of burning or causing a fire.

INORGANIC CHEMICALS – chemical substances of mineral origin, unlike organic chemicals whose structure relies on carbon atoms.

INITIAL CALIBRATION VERIFICATION (ICV) - also referred to as the Independent Calibration Verification for this laboratory. A standard solution used to verify the calibration curve derived from a source independent of the instrument calibration standard. The ICV is use to quantify second source standard variance and bias.

INSTRUMENT CALIBRATION STANDARD - a reference material used to standardize an analytical instrument.

INSTRUMENT DETECTION LIMIT (IDL) - a term utilized in the EPA Inorganic Contract Laboratory Program. The IDL is three times the standard deviation obtained for the analysis of a standard solution (each analyte in reagent water) at a concentration of three to five times that of the IDL on three nonconsecutive days with seven consecutive measurements per day. The IDL is the concentration equivalent to a signal, due to the analyte of interest, which is the smallest signal that can be distinguished from background noise by a particular instrument. The IDL should always be below the method detection limit, and is not used for compliance data reporting, but may be used for statistical data analysis and comparing the attributes of different instruments.

INSTRUMENT PERFORMANCE CHECK - The analyses of one of the ICSs to verified initial and continuing calibration (CCV). The IPC is used to quantify the instrumental testing repeatability variance and bias.

INSTRUMENT TUNING - a technique used in gas chromatography/mass spectrometry procedures to verify that the instrument is properly calibrated to produce reliable mass spectral information. See 4-Bromofluorobenzene under "B".

INTERNAL STANDARDS - compounds added to every standard, blank, matrix spike, matrix spike duplicate, sample (for volatile organics), and sample extract (for semivolatiles) at a known concentration, prior to analysis. Internal standards are used as the basis for quantification of the target compound.

IONIZATION - Utilized in mass spectrometry to fragment analyte molecules into smaller segments. These smaller mass segments are then separated and plotted to form a "mass spectrum" which is used to identify the parent molecule. Electron impact is one example of ionization used in mass spectrometry. In more technical terms. Ionization is the process by which neutral atoms or groups of atoms become electrically charged, either positively or negatively, by the loss or gain of electrons.

ISOMERS - chemical compounds with the same molecular weight and atomic composition by differing molecular structure, e.g., n-pentane and 2-methylbutane.

LABORATORY CONTROL SAMPLE (LCS) - a clean-matrix reference sample spiked with a standard with an established analyte concentration. The LCS is carried through the entire chemical preparation and testing procedures. The LCS is used to quantify the variance and bias of the chemical preparation and instrumental testing stages without matrix interference. Also called a Laboratory fortified blank (LFB).

LABORATORY CONTROL SAMPLE DUPLICATE (LCSD) – a duplicate of the laboratory control sample in a clean matrix that is carried through the entire chemical preparation and testing procedures.

LABORATORY DUPLICATE SAMPLE (LAB DUPLICATE) - a portion of the collected sample that is carried through the chemical preparation and testing. The laboratory duplicate subsample is used to quantify the variance of the chemical preparation and instrumental testing stages with matrix interferences.

LEACHATE - a liquid that results from water collecting contaminants as it trickles through wastes, agricultural pesticides or fertilizers. Leaching may occur in farming areas, feedlots, and landfills, and may result in hazardous substances entering surface water, groundwater or soil.

LDEQ – Louisiana Department of Environmental Quality

LIBRARY SEARCH - a technique in which an unknown mass spectrum of a compound is compared to the mass spectra of compounds contained in a computer library in an

effort to identify the compound. Compounds identified in this manner are referred to as tentatively identified compounds (TICs).

LIMIT OF DETECTION (LOD) – an estimate of the minimum amount of a substance that an analytical process can reliable detect. An LOD is analyte and matrix specific and may be laboratory dependent.

LIMIT OF QUANTIATION (LOQ) – the minimum levels, concentrations, or quantities of a target variable (e.g. target analyte) that can be reported with a specified degree of confidence..

LIMS – laboratory information management system. Horizons is the LIMS used by GCAL.

LINEAR CALIBRATION RANGE – the concentration range over which the instrument response is linear.

LOG-IN - the receipt and initial management of an environmental sample. It generally includes identifying who sent the sample; maintaining chain-of-custody; checking report and invoice information; recording analysis requested, including methodology and special instructions; and assigning a discreet in-lab identification, usually a number or bar code.

MASS SPECTRUM - a plot of ion mass/charge ratio versus intensity. A fragmentation pattern results from the particles whose mass distribution is characteristic of the parent molecule. Qualitative information is provided by a mass spectrum.

MATERIAL SAFETY DATA SHEET (MSDS) - a compilation of information required under the OSHA Communication Standard on the identity of hazardous chemicals and their associated health and physical hazards, exposure limits and precautions.

MATRIX - The physical characteristics or state of a sample – e.g., water, soil, sludge.

MATRIX INTERFERENCE - the influence of the sample matrix or sample components upon the ability of qualitatively identifies and quantitatively measures compounds in environmental samples.

MATRIX MODIFIERS - chemicals added to samples for metals analysis, which are used to lessen the effects of chemical interference, viscosity and surface tension.

MATRIX SPIKE (MS) – aliquot of a sample fortified (spiked) with known quantities of specific compounds and subjected to the entire analytical procedure in order to indicate the appropriateness of the method for the matrix by measuring recovery of the spike. Matrix spiked samples are used to quantify the variance and bias of the chemical preparation and testing stages with matrix interference.

MATRIX SPIKE DUPLICATE (MSD) - a second aliquot of the same matrix as the matrix spike that is spiked to determine the precision of the method.

METHOD DETECTION LIMIT (MDL) - the minimum concentration of compound that can be measured and reported within 99% confidence that the value is above zero and is determined from analysis of a sample in a given matrix containing the analyte.

MUST – denotes a mandatory requirement.

NARRATIVE - in an analytical report, a descriptive documentation of any problems encountered in processing the samples, along with corrective action taken and problem resolution.

NUTRIENT - any substance assimilated by living things that promote growth. The term is generally applied to nitrogen and phosphorus in wastewater, but is also applied to other essential and trace elements.

ORGANIC - generally, any compound that contains carbon bonded to a hydrogen or halogen atom.

OXIDATION - the process in chemistry whereby electrons are removed from a molecule.

PCBs - Polychlorinated biphenyl, a group of toxic persistent chemicals used in transformers and capacitors for insulating purposes and in gas pipeline systems as a lubricant. Sale of PCBs for new uses was banned by law in 1979.

PERCENT RECOVERY - a measure of accuracy that is calculated as the measured value relative to the true value expressed as a percent.

PERFORMANCE AUDIT - a quantitative evaluation of a measurement system that involves the analysis of standard reference samples or materials which are certified as to their chemical composition or physical characteristics.

PROFICIENCY TEST (PT) SAMPLE - a sample of known composition (unknown to the laboratory), provided by an external source, which is used to evaluate lab performance. For certification purposes the PT sample is purchased from an approved provider.

pH - a numerical designation of relative acidity and alkalinity. A pH of 7.0 indicates precise neutrality. Progressively higher values indicate increasing alkalinity and lower values increasing acidity.

POLLUTANT - generally, any substance introduced into the environment that adversely affects the usefulness of a resource.

PRACTICAL QUANTITATION LIMIT (PQL) - the lowest level that can be reliable achieved within specified limits of precision and accuracy routine laboratory operating conditions. The lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value.

PRECISION - a measure of the ability to reproduce analytical results. It is generally determined through the analysis of duplicate samples. The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range in either absolute or relative terms.

PRESERVATIVE - a chemical or reagent added to a sample to prevent or slow decomposition or degradation of a target analyte or a physical process. Physical and chemical preservation may be used in tandem to prevent sample deterioration.

PURGE AND TRAP - a technique used in the analysis of volatile organic where analytes are purged from a sample by means of an inert gas and trapped on a sorbent column. The sorbent is then flashheated and the analytes are transferred onto a gas chromatographic column for separation and identification.

PURGEABLE ORGANIC - an organic compound that is generally less than 20% soluble in water and has a boiling point at or below 200°C. A volatile organic. An organic compound is generally considered to be purgeable if it can be removed from water using the purging process.

QC BASED NESTED APPROACH - a procedure for estimating the uncertainty of measurement using quality control data. The procedure is described in SOP QA-013.

QUALITY ASSURANCE (QA) - all those planned and systematic actions necessary to provide adequate confidence in laboratory results. An integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets the defined standards of quality with a stated level of confidence.

QUALITY ASSURANCE PROGRAM PLAN - a written assembly of management policies, objectives, principle and general procedures that outlines how the laboratory intends to generate data of known and accepted quality.

QUALITY CONTROL (QC) – the overall system of technical activities whose purpose to measure and control the quality of a product or service so that it meets the needs of the users.

QUALITY CONTROL CHART - a graph of analytical measurement results for a specific QC standard plotted sequentially with upper and lower control limits (±3SD). A central line that is the best estimate of the average variable plotted, and upper and lower marginal exceedence limits (±4SD) are usually included in the Quality Control Chart. The chart may also include upper and lower warning limits (±2SD).

QUALITY SYSTEM – a structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items) and services. The quality system provides the framework for planning, implement and assessing work performed by the organization and for carrying out required QA and QC.

r^2 – Correlation Coefficient Squared – paramet6er used to evaluate the fit of linear or quadratic regression curve fit of initial calibration data.

RAW DATA – any original information from a measurement activity or study recorded in a laboratory note book, worksheets, records, memoranda, notes, or exact copies thereof that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data may include photography, microfilm or microfilm copies, computer printouts, magnetic media, including dictated observations, and recorded data from automated instruments.

REACTIVITY - the tendency of a chemical to explode under normal management conditions, to react violently when mixed with water, or to generate toxic gases.

REAGENT WATER - water in which an interference is not observed at or above the minimum quantitation limit of interest.

REFERENCE MATERIAL - a traceable standard with an established analyte concentration. Material or substance whose property values are sufficiently homogenous, stable and well established to be used for the calibration of an apparatus, the assessment of a measurement method or for assigning values to materials (ISO Guide 30)

REFERENCE METHOD – a method of known and documented accuracy and precision issued by an organization recognized as competent to do so.

RELATIVE RETENTION TIME – a measure of the shift in retention time of an analyte when referenced to an internal standard.

RELATIVE RESPONSE FACTOR (RRF) - a measure of the relative mass spectral response of an analyte compared to its internal standard. RRFs are determined by analysis of standards and are used in the calculation of concentrations of analytes in samples.

REPLICATE ANALYSES - two or more results representing the same sample parameter. Replicate analyses are used to quantify the analytical measurement repeatability precision.

RPD – Relative Percent Difference, a relative difference between two analyses calculated by dividing the absolute difference of those two results by the average of their two values, then multiplying by 100.

RESOLUTION - the degree of separation between peaks eluting from a chromatographic column. Sufficient resolution between peaks is required for proper quantitation of unknown analytes.

RETENTION TIME - a term used in gas and liquid chromatography describing the time elapsed from the sample injection until the specific compound elutes or exits the chromatographic column at the detector. Each compound has a characteristics retention time on a specific column; therefore, this information is used to qualitatively identify the compounds in the sample.

SAMPLE – portion of material collect for chemical analysis, identified by a unique number assigned by the LIMS.

SHALL – denotes a requirement that is mandatory whenever the criterion for conformance with the specification requires that there be no deviation. This does not prohibit the use of alternative approaches or methods for implementing the specification so long as the requirement is fulfilled.

SHOULD – denotes a guideline or recommendation whenever noncompliance with the specification is permissible.

SOLID WASTE – non-liquid, non-soluble materials, ranging from municipal garbage to industrial waste, that contain complex, and sometimes hazardous, substances. Solid wastes include sewage sludge, agricultural refuse, demolition wastes, mining residues, and even liquids and gases in containers.

SOLVENT - a substance, usually liquid, capable of dissolving or dispersing one or more other substances.

SPIKE – a known mass of target analyte added to a blank sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.

STANDARD CURVE - a curve that plots concentrations of known analyte standards versus the instrument response to the analyte. Calibration standards are prepared by diluting the stock analyte solution in graduated amounts that cover the expected range of the samples being analyzed. The calibration standards must be prepared by using the same type of acid or solvent at the same concentration as for the samples following sample preparation. This is applicable to organic and inorganic chemical analyses.

STANDARD OPERATING PROCEDURE - a detailed written description of how a laboratory executes a particular procedure or method intended to standardize its performance.

STANDARDIZED REFERENCE MATERIAL (SRM) – a certified reference material produced by the U.S. National Institute of Standards and Technology or other equivalent organization and characterized for absolute content, independent of analytical method.

STANDARD UNCERTAINTY - the analytical measurement uncertainty expressed as a standard deviation. The relative standard deviation represents the relative standard uncertainty.

SURROGATE - an organic compound similar to the analyte of interest in chemical composition, extraction and chromatography, but not normally found in environmental samples. Primarily used in chromatography techniques, the surrogate is spiked into quality control blanks, calibration and check standards, samples (including duplicated and QC reference samples) and spiked samples before analysis. A percent recovery is calculated for each surrogate.

SUSPENDED SOLIDS - small pollutant particles that float on the surface of, or are suspended in, sewage or other liquids. They resist removal by conventional means.

TARGET COMPOUND - specific compounds that are to be quantified in a sample based on a standard list of potential compounds.

TENTATIVELY IDENTIFIED COMPOUNDS (TICs) - compounds detected in samples that are not target compounds, internal standards, system monitoring compounds or surrogates. TICs usually consist of up to 30 peaks that are greater than 10% of the peak areas, or heights, of the nearest internal standard. They are subjected to mass spectral library searches for tentative identification. A client may specify the number of unknown peaks in its samples it wishes the laboratory to tentatively identify.

TOTAL METALS - metallic elements that have been digested prior to analysis.

TYPE A EVALUATION UNCERTAINTY - the method of evaluation of uncertainty by the statistical analysis of a series of test results.

TYPE B EVALUATION OF UNCERTAINTY - the method of evaluation of uncertainty by means other than statistical analysis.

UNCERTAINTY - the parameter associated with the analytical measurement results that characterizes the dispersion of the values that could be reasonable attributed to the quantity measured.

UNCERTAINTY INTERVAL - the range of analyte concentrations that an analytical measurement could represent at a specified level of confidence. The relative standard deviation is used to represent the relative standard uncertainty in the QC-based Nested Approach.

VALIDATION –the process for evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, or contractual specifications. It essentially evaluates performance against predetermined specifications.

VOA - volatile organic analysis

VOA BOTTLE - a vial used to contain samples for volatile organic analysis.

VOLATILE COMPOUNDS - compounds amendable to analysis by purge and trap. Synonymous with purgeable compounds.

VOLATILE ORGANIC COMPOUND (VOC) - any organic compound that participates in atmospheric photochemical reactions, except for those designated by the EPA Administrator as having negligible photochemical reactivity.

WET CHEMISTRY - procedures that involve distillations, colorimetric determinations and titrimetric measurements. Examples are chloride, nitrates, sulfates and biochemical oxygen demand.

GULF COAST ANALYTICAL LABORATORIIES, INC
WET LAB
STANDARD OPERATING PROCEDURE

PROCEDURES: WL-015
PAGE: 1 OF 13
EFFECTIVE DATE: 05/18/10
APPROVED BY:
QA/QC APPROVED:

SUBJECT — SCOPE AND APPLICATION

This method measures the concentration of Cyanide in a sample after distillation, colormetrically on a Lachat analyzer. This is applicable to the determination of Cyanide in drinking and surface waters, domestic and industrial wastes, sludges, and soils.

MATRIX — Water and Solid

REFERENCES — Total Cyanide - SW846 9012A/SM 18th Edition 4500 CN E
Cyanide Amenable to Chlorination - SW846 9012A/SM 18th Edition 4500 CN E
Free Cyanide - Standard Methods 18th Edition 4500-CN
LACHAT Method 10-204-00-1-X

PRESERVATION — Cool 4°C
NaOH to pH >12, 0.6g Ascorbic acid (waters)

SAMPLE COLLECTION — Samples may be collected in plastic or glass 1-liter containers

HOLDING TIME — 14 Days

DEFINITIONS — See SOP GEN-016

SAFETY — Each employee is directly responsible for complete awareness of all health hazards associated with every chemical that he/she uses. The employee must be aware of these hazards, and all associated protective wear and spill clean-up procedures PRIOR TO the use of any chemical. In all cases, the applicable material safety data sheet (MSDS) and your supervisor or safety officer should be consulted. The bottle labels also provide important information that must be noted. Personnel performing this procedure may be working with flammables, poisons, toxins, carcinogens, teratogens, mutagens, and biohazards. In particular, approved gloves, safety glasses, and lab coats must be worn. In addition to other measures prescribed by the division, solvents and chemicals must be handled in ventilated hoods.

INTERFERENCES

1. Chlorine decomposes most Cyanides. Test the sample for Chlorine and treat if necessary as required in this SOP.

2. Sulfides adversely affect the colormetric

procedure. Test the sample and treat as necessary as required in this SOP.

3. High results may result for samples that contain Nitrate and/or Nitrite. Pre-treat all samples with Sulfamic acid.

DISTILLATIONREAGENTS

1. Sulfuric Acid, 18N (1:1): slowly add 500mL of concentrated H_2SO_4 to 500mL of DI water.

2. Magnesium chloride solution: 510g of $MgCl_2 \cdot 6H_2O$ into 1000 mL volumetric flask, dissolve and dilute to 1 L with DI water. Larger volumes of the solution may be prepared.

3. Sulfamic Acid

4. Acetate Buffer Solution: Dissolve 410g Sodium trihydrate ($NaC_2H_3O_2 \cdot 3H_2O$) in 500mL DI water. Add Glacial acetic acid to make solution with pH 4.5 (approximately 500mL).

5. Zinc Acetate solution: Dissolve 100g $Zn(C_2H_3O_2) \cdot H_2O$ in 500mL DI water. Dilute to 1L with DI water.

6. Methyl Red Indicator Soln. 0.1% Aqueous - commercially prepared

7. 1.25 M Sodium hydroxide: Weigh 100 g of 50% Sodium hydroxide in a 1000 mL volumetric flask and dilute to volume with DI water.

8. Calcium hypochlorite solution: 5g of Calcium hypochlorite ($Ca(OCl)_2$) in 100 DI water.

9. Ascorbic acid: crystals

10. 1N Sodium Hydroxide: Weigh 160 g of 50% Sodium hydroxide in a 2000 mL volumetric flask and dilute to volume with DI water.

11. Acetic Acid 1:9 - mix 10 mLs Acetic Acid with 90 mLs DI water.

12. 50% Sodium hydroxide (w/w)

13. 0.1N Sodium thiosulfate

14. Deionized water (DI)

15. Stock Cyanide Standard 1000 mg/L - commercially prepared (secondary source from calibration standard)

16. Cyanide working standard 100 mg/L - Prepare by diluting 10 mL of the 1000 mg/L stock standard to 100 mL in a volumetric flask. Add 25 mL of the 1N Sodium Hydroxide and dilute to volume with deionized water.

17. Bismuth Nitrate Solution - 30g $BI(NO_3)\cdot 5H_2O$ in 100mL DI. Add 250 mL of Glacial acetic acid. Stir until dissolved. Dilute to 1 liter.

18. Glacial acetic acid

19. Lead acetate paper

20. KI Starch paper

APPARATUS

Closed Distillation System:
Condensers
CN Boiling Flasks (1000mL)
Thistle Tubes
Scrubber bottles (125 mL)
Hood
Cork-Boiling Flask holders
100mL volumetric flask
Specimen cups
Graduated cylinders, 500mL, 100mL, 50mL
Scoopula spatulas
Analytical balance
Stir bars
Magnetic Stirrer
Squirt Bottles (1000mL)
Plastic catch bottles
Disposable pipettes 10 mL
Mechanical pipet
1000mL beakers

QC PREPARATION

Prepare a bench sheet

Method Blank - Pour 500mL of DI water in 500mL Cyanide boiling flask. Prepare one blank for each batch of twenty or fewer samples.

LCS - Pour 500mL of DI water into two 500mL Cyanide boiling flask. Two LCS's will be prepared: Low-level

(0.020 mg/L) and High-level (0.100 mg/L). Label the flasks as LCSL and LCSH. The spike standard will be added later. Prepare the LCS's for each batch of twenty or fewer samples. Perform a LCSDH if insufficient sample is available to perform a matrix duplicate.

Duplicates - Duplicate one sample in each batch of twenty or fewer samples for each matrix type. This is not performed if sufficient sample is not available.

Matrix Spikes - Perform a matrix spike on one sample in each batch of ten or fewer samples for each matrix type. The spike standard will be added later. This is not performed if sufficient sample is not available. Matrix spike duplicates maybe performed if required for a specific project.

NOTE: DO NOT ADD SPIKES OR REAGENTS TO FLASK UNTIL HOOKED UP IN A CLOSED DISTILLATION SYSTEM.

PROCEDURE

Pretreatment for Cyanides Amenable to Chlorination

1. Prepare samples as follows:

   Water – Measure 500mL of sample into a graduated cylinder and transfer to a 1000mL beaker.
   Solid - Weigh 10.0g of sample into a 1000mL beaker and add 500mL DI water.

   Record the sample IDs and sample volumes or weights on the bench sheet.

2. Place the beaker containing the sample on a magnetic stir plate and place a stir bar in the beaker. Begin stirring the sample. Work in the hood.

3. Test sample with pH paper, add drop wise 1.25 M NaOH until pH is 11 to 12. The pH of the sample was tested at sample receiving but should be rechecked to verify. If the pH is not within the required range, contact the project manager.

4. Maintain the pH between 11 and 12 while adding the Calcium hypochlorite solution until chlorinated. The sample is chlorinated when the KI starch paper turns a blue/purple color. Add the Calcium hypochlorite solution in 2mL increments until chlorinated.

5. Maintain excess chlorination for one hour with continuous stirring. Check the sample every 15 minutes to verify chlorinating. If chlorination is not maintained add additional Calcium hypochlorite and continue to monitor.

6. After one hour, add 1 mL portions of 0.1N Sodium thiosulfate to neutralize chlorination. Check sample with KI starch paper until no chlorine excess is seen. The KI starch paper should remain white. Once the sample is neutralized, add 5mL of excess Sodium thiosulfate solution.

7. Add 500mLs of treated sample in beaker to 500mL CN boiling flask.

8. Follow the procedure for Total Cyanide. If a sample is only logged in for Cyanide amenable to chlorination, a Total Cyanide distillation without pretreatment must also be performed.

Sample Preparation - Total and Free Cyanide

Record on the bench sheet.

1. Waters - Pour 500mL of sample into a labeled Cyanide boiling flask. Set up additional flasks for the sample selected as the batch duplicate and matrix spike.

   Solids - Weigh up 10.0g of soil/sludge sample and 1.0g of concentrated waste sample into a labeled Cyanide boiling flask, then add 500 mL of DI water. Set up additional flasks for the sample selected as the batch duplicate and matrix spike.

   A. Test for Residual chlorine in the sample with KI starch paper. A blue color indicates the sample needs treatment. Add Ascorbic acid, a few crystals at a time, until no color is indicated on the paper. Add an additional 0.6g of Ascorbic acid.

   B. Use Lead acetate paper to check the sample for Sulfide. A positive test is indicated by a black color on the paper. If positive, treat with 50 mL of Bismuth nitrate solution through the air inlet tube (perform in hood).

Mix for 3 minutes prior to adding H_2SO_4.

C. Use a scoopula to add approximately 1 gram of Sulfamic acid followed by DI water to rinse thistle tube. (The Sulfamic acid is added to eliminate the possible interference from Nitrate and/or Nitrite).

2. After all the QC and samples have been put in CN boiling flasks, each one will need a scrubber bottle that contains 25mL of 1N NaOH and 75mL of DI water.

3. Label all the scrubber bottles accordingly.

4. Place a thistle tube in each CN-boiling flask.

5. Put a plastic catch bottle in each heating mantle under condenser. Clean condensers with 1:1 H_2SO_4 followed by DI water rinse (as needed). Be sure to place plastic catch bottles in mantles to catch rinse because the 1:1 H_2SO_4 will harm the mantles.

6. Clean the scrubber caps and tubing by acid washing with 1:1 H_2SO_4 then follow with DI water rinse in the sink.

7. *Be sure to turn on the water and the vent in the hood.

8. Once this is done, begin setting up the closed distillation rack by placing each Cyanide boiling flask in a mantle and connecting the condenser to it.

9. Place the scrubber bottle that corresponds to the flask in the clamp that is next to it.

10. Place the scrubber cap and tubing in the scrubber bottle, attaching the tubing and stopper to the top of the corresponding condenser.

11. Attach the vacuum pump hose to the front of the scrubber cap. Once all vacuum pump hoses are attached, turn on the pump. The scrubber solution in the scrubber and the sample in the CN-boiling flask should be bubbling. The scrubber solution should not bubble high enough so that it goes into the vacuum tubing. This can be adjusted with a dial that goes with each vacuum hose. The scrubber

solution must be bubbling at all times during the distillation or when the heat is turned on, the sample will boil over.

12. Once pump has been turned on and the system is considered closed, reagents may now be added.

13. Add 100uL of the 100mg/L Cyanide working standard to the LCSL and 500uL of the 100 mg/L Cyanide working standard to the LCSH. Add 250uL of the 100mg/L Cyanide working standard to the matrix spike sample for waters and 1000 uL of the 100mg/L Cyanide working standard for solids. Add directly into the flasks. To LCS, spike, and spike dup boiling flasks, use a mechanical pipet to add 250uL of 100mg/L Cyanide standard.

14. Perform the following for Total Cyanide:

    A. Add 50mL of 1:1 H_2SO_4

    B. Add 20mL of Magnesium Chloride 2.5 M Solution

    C. Rinse thistle tubes with DI water.

    D. Turn on heating mantles.

15. Perform the following for Free Cyanide:

    A. Add 10mL Acetate Buffer

    B. Add 10mL Zinc Acetate Solution

    C. Add 1mL Methyl Red Indicator. Color should turn red. If it turns yellow, add drop wise Acetic acid 1:9 until color turns red.

    D. Rinse thistle tubes with DI water.

    E. Turn on heat mantles.

16. Make sure unused mantles are unplugged.

17. Heat Total, Amenable, and Free Cyanide samples to boiling and reflux for one hour.

18. Turn off heat and continue airflow for at least 30 minutes.

19. Unplug the stoppers from the top of all condensers,

the hoses from caps, and take the scrubber bottles down.

20. Transfer the scrubber bottle solution to labeled specimen cups. Deliver to the wet lab with a copy of the bench sheet.

ANALYSIS PROCEDURE

REAGENTS & STANDARDS

1. Chloramine T - Weigh 1.0g Chloramine T and place in a 250mL volumetric flask. Dissolve in deionized water. Dilute to final volume with deionized water. Prepare fresh daily.

2. 0.25N Sodium hydroxide - weigh 20g of 50% Sodium hydroxide in a 1000mL volumetric flask and dilute to volume with deionized water.

3. Phosphate Buffer - Weigh 97g KH_2PO_4 and place in a 1000mL volumetric flask. Dissolve in deionized water. Stir for thirty minutes to ensure that the reagent is completely dissolved. Dilute to final volume with deionized water. Prepare fresh monthly.

4. Pyridine Barbituric Acid - commercially prepared

5. Stock Cyanide Standard - 1000mg/L; commercially prepared

6. 100mg/L Cyanide working standard - prepare by diluting 1.0mL of the 1000mg/L stock standard to final volume of 10mL in 0.25N NaOH.

7. 10mg/L Cyanide working standard - prepare by diluting 10mL of the 100mg/L working standard to a final volume of 100mL in 0.25N NaOH. Smaller volumes of this standard may be prepared.

8. 50% Sodium hydroxide (w/w)

APPARATUS

Lachat 8000 Series FIA Analyzer
Lachat XYZ Auto Sampler
Auto Sampler trays
Disposable culture tubes, 13 x 100 mm
Computer terminal, keyboard, and printer
30 gallon Nalgene waste container
Spare parts, and tubing for Lachat
Cyanide Lachat board
Cyanide sample loop
570nm photocell

Lachat pump
Lachat Autodiluter
Mechanical pipet and tips
Volumetric flasks

TRAY SET UP

CCV
CCB
Method Blank
LCSL
LCSH
Sample #1
Sample #2
Sample #3
Sample #4
Sample #5
Sample #6
Sample #7
CCV
CCB
The sequence can continue with a CCV and CCB bracketing every 10 positions and a CCV and CCB at the end of the run.

PROCEDURE

1. Turn on Lachat and allow to warm up for approximately 10 minutes.

2. Set the temperature to 60°C. Allow the temperature to stabilize for approximately 15 minutes.

3. Hook up the Cyanide board to the Lachat analyzer.

4. Slide the 570nm photocell into the flow cell compartment.

5. Hook up the sample loop to the Lachat analyzer.

6. Run all tubing from the Lachat analyzer through the Lachat pump.

7. Place tubing from the Lachat pump into the correct reagents according to the manufacturer's instructions.

8. Turn on the pump. The setting on the pump should read 35. Using the maximum button, pump solution through the Lachat pump to the Cyanide board and on through the flow cell. Release the maximum button.

9. Double click on the desktop icon "Omnion 3.0". Click on "run" and open. A screen will appear. Look in "Data". Follow the instrument software instructions to setup the run sequence.

10. Calibration of the instrument can be accomplished in two ways: a) downloading an old calibration curve and b) performing a new calibration curve. Both are acceptable.
In order to perform a new calibration curve, pur the calibration standards into 40mL VOA vials and place alphabetically in the calibration sample tray. Vial G will be a blank that is 0.25N NaOH. Start the calibration according to the instrument instructions. The correlation coefficient must be at least 0.995 for the curve to be acceptable.

A current calibration can be downloaded and verified by analysis of a CCV. The calibration curve expires if the CCV recovery is outside 90-100%, the calibration standard source expires, or after 1 year.

The following table may be used to determine the concentration of each standard. When preparing standards, they should be prepared in 0.25N NaOH and should be prepared at 5X the actual concentration in order to account for the preparation concentration.

Standard	Concentration
A	0.250 mg/L
B	0.100 mg/L
C	0.050 mg/L
D	0.025 mg/L
E	0.010 mg/L
F	0.005 mg/L
G	0.000 mg/L

11. Pour samples into sample vials and place in the autosampler tray according to the batch sequence. Start the run according to the instrument instructions. It will take approximately 15-30 minutes for a tray to run. If any odd shaped peaks (rough edges, inverted, etc.) are observed, make a note and rerun the affected sample(s).

12. Dilute and rerun any samples that exceed the upper limit of the calibration (dilute with 0.25N NaOH).

13. Review and document the recoveries or RPDs for any QC samples. Record all required information on the bench sheet.

14. Store all solutions in the cooler. Remove the board from the instrument. Turn off the instrument.

15. Manually post the data into the LIMS or download to the LIMS.

CALCULATIONS

CN Amenable to Chlorination, mg/L = A - B

A = mg/L Total Cyanide in non-chlorinated aliquot.
B = mg/L Total Cyanide in chlorinated aliquot.

Total Cyanide mg/L = instrument reading X DF

Total Cyanide mg/kg - instrument reading X DF X Prep DFx5

DF = dilution factor

Reactive Cyanide - See formula in SOP WL-054

SOFTWARE TROUBLESHOOTING

The Lachat 8000 series FIA analyzer utilizes Lachat Software Omnion Version 3.0.218 for all data manipulation and storage. For troubleshooting help, please contact GCAL's IT Director or Lachat Instruments.

REPORTING LIMITS

	NT OF	DILUTION SAMPLE	FACTOR
Total, Free, Amenable CN WATER	0.002 mg/L	500mL	-----
Total CN - Solid	0.1 mg/kg	10.0g	X 50
Total CN - Organics	1.0 mg/kg	1.0g	X 500

QUALITY CONTROL

1. Analyze the ICV (initial calibration verification) to verify the calibration. This is an independent standard prepared at the mid-range of the calibration. The recovery must be 90-110% for the curve valid. If the recovery is outside the control limits, prepare a new standard and reanalyze. If a problem still exists, prepare new reagents, perform instrument maintenance, and make new reagents and rerun. If the recovery is still outside the control limits, perform a new 7-point calibration. A mid-range standard prepared from the same source as the calibration standards is analyzed as a CCV after every ten samples (ten injections). The recovery

must be 90-110%. If the recovery is outside the control limits, perform the steps as for the ICV. All reported samples must be bracketed by acceptable CCVs. An ICV/CCV can be reanalyzed only once if unacceptable, unless a documented reason for failure is available (contaminated solution, autosampler problem, etc.)

2. Analyze an instrument blank to verify the baseline is acceptable. This solution is also analyzed after every ten samples (ten positions). This CCB will follow each CCV. The concentration must be < 1/2 the reporting limit. If Cyanide is detected, the data is reportable if it is less than 5% of the measured concentration in the associated sample(s) or if Cyanide is < reporting limit in the associated sample(s). A CCB can be reanalyzed only once if unacceptable, unless a documented reason for failure is available (contaminated solution, autosampler problem, etc.)

3. The LCSL and LCSH recoveries must be within 80-120% of the true value for water samples. If the recovery is unacceptable, all samples in the batch must be reprepped and reanalyzed. The LCSL concentration is 0.020 mg/L (1.00 mg/kg) and the LCSH concentration is 0.100 mg/L (5.00 mg/kg). A LCSH may be performed if there was insufficient sample to perform a batch duplicate. The LCSH/LCSDH RPD should be ≤ 25.

4. The recovery control limits for the matrix spike and matrix spike duplicate (if required) are 75-125% for waters and 60-120% for solids. For DOD projects, the control limits are 80-10%. If the recovery is outside the control limits, dilute the matrix spike and reanalyze. If the recovery is acceptable when diluted, reanalyze the original sample diluted. If the recovery is still outside the control limits, matrix interference may be present and the analysis will be repeated by the method of standard additions. The MS/MSD RPD should be ≤25.

5. The RPD for duplicate analyses should be ≤25 if the concentration is ≥ 5 times the detection limit. The cause of the RPD value outside control limits should be documented if no analytical problem can be determined.

6. Method blank - A method blank is included with each batch of twenty or fewer samples. The concentration must be < 1/2 the reporting limit. If Cyanide is detected, the data is reportable if it is less than 5% of the measured concentration in the associated sample(s) or if Cyanide is < the reporting limit in the associated sample(s).

7. Contact Lachat for troubleshooting guidance or service.

METHOD PERFORMANCE Precision and accuracy data are not available at this time.

POLLUTION PREVENTION See QAPP Section 10.2

WASTE MANAGEMENT See SOP GEN-009

GULF COAST ANALYTICAL LABORATORIES, INC. PROCEDURE: WL-060
WET LAB PAGE: 1 OF 5
STANDARD OPERATING PROCEDURE EFFECTIVE DATE: 9/24/2012
APPROVED BY:
QA/QC APPROVED:

SUBJECT SCOPE AND APPLICATION

An automated Pensky-Marten closed cup tester is utilized to determine the flashpoint of both liquid and solid samples. Solids samples, however, do not fall within the scope of this method because of the inability to stir and uniformly heat the sample. If this method is requested on a soil sample in lieu of SW-846 1030, include a case narrative.

SUMMARY The sample is heated at a slow, constant rate (9-11^{o}F/min) with continual stirring (105rpm). As the sample is heated, a small electric heated coil is directed into the cup every 2^{o}F with simultaneous interruption of stirring until a flashpoint is detected by the thermal detector. By definition, the flashpoint is the lowest temperature at which the vapors above the sample will ignite when subjected to a source of ignition.

MATRIX Water and Solid

REFERENCE SW-846, 1010A
ASTM D93-02a

PRESERVATIVE Samples shall be stored at ≤ 28˚ C/ 50˚F in a glass container and above freezing. It is recommended that a dedicated container for flashpoint is used. For residual fuel oil samples, container should be filled between 85-95%. For all other sample types, the container should be between 50-85% full. It is not recommended that a sample aliquot be pulled from a container that is less than 50% full, as excessive headspace can affect test results.

HOLDING TIME Not specified by method

DEFINITIONS See SOP GEN-016

SAFETY Each employee is directly responsible for complete awareness of all health hazards associated with every chemical that he/she uses. The employee must be aware of these hazards, and all associated protective wear and spill clean-up procedures PRIOR TO the use of any chemical. In all cases, the applicable material safety data sheet (MSDS) and the supervisor or safety officer should be consulted. The bottle labels also provide important information that must be noted. Personnel performing this procedure may be working with flammables, poisons, toxins, carcinogens, teratogens, mutagens, and biohazards. In particular, approved gloves, safety glasses, and lab coats must

GULF COAST ANALTYCIAL LABORATORIES, INC.
EXTRACTIONS
STANDARD OPERATING PROCEDURE

EFFECTIVE DATE: 8/16/10
APPROVED BY:
QA/QC APPROVED: JDT

SUBJECT — SCOPE AND APPLICATION

This procedure describes the steps for the preparation of soil/solid and concentrated waste samples for the analysis of herbicides. The esters are hydrolyzed with Sodium hydroxide and extraneous organic material is removed by a solvent wash. After acidification, the acids are extracted with solvent and converted to their Methyl esters using Diazomethane as the derivatizing agent. After excess reagent is removed, the Esters are determined by gas chromatography.

MATRIX — Solid

REFERENCE — SW846 Method 8151A

PRESERVATIVE — Cool to 4°C

SAMPLE COLLECTION — Samples should be collected and stored in glass containers.

HOLDING TIME — From collection to extraction - 14 days
From extraction to analysis - 40 days

DEFINITIONS — See SOP GEN-016

SAFETY — Each employee is directly responsible for complete awareness of all health hazards associated with every chemical that he/she uses. The employee must be aware of these hazards, and all associated protective wear and spill clean-up procedures PRIOR TO the use of any chemical. In all cases, the applicable material safety data sheet (MSDS) and your supervisor or safety officer should be consulted. The bottle labels also provide important information that must be noted. Personnel performing this procedure may be working with flammables, poisons, toxins, carcinogens, teratogens, mutagens, and biohazards. In particular, approved gloves, safety glasses, and lab coats must be worn. In addition to other measures prescribed by the division, solvents must be handled in ventilated hoods.

REAGENTS — All inorganic reagents shall be reagent grade. All organic solvents shall be pesticide quality or equivalent. Store all reagents using manufacturer's recommendation. Label all reagents with the date opened and date of receipt. Label all prepared solutions as required by SOP GEN-006. If tests or appearance indicates the reagent has decomposed or is contaminated, dispose of the reagent and notify QA Department and/or supervisor.

Deionized water
Hydrochloric acid
Sulfuric acid
Acetone
Hexane
Methylene chloride
1:1 Methylene chloride/Acetone
Potassium hydroxide pellets

Diazald
Diethyl ether
Ethanol
Isooctane
Methanol
Silicic acid - 100 mesh powder

Acidified Glass Wool
Pre-extract the glass wool overnight in the liquid/liquid extractor with Methylene chloride. Rinse the glass wool once with Ether and discard the Ether. Add enough Ether to cover the glass wool and add 1.0 mL Hydrochloric acid slowly and allow to sit for 5 minutes. Pour off Ether and allow glass wool to dry.

Acidified Sodium Sulfate - Bake Sodium sulfate 4 hours in muffle furnace at 400°C. Allow Sodium sulfate to cool then transfer ≈2400 grams to a large Pyrex dish. Add Methylene chloride to cover the Sodium sulfate and stir with a glass rod. Discard the Methylene chloride and repeat this procedure. Discard the Methylene chloride and then rinse once with Ethyl ether following the same procedure as with the Methylene chloride. Add enough Ethyl ether again to cover the Sodium sulfate and then add 6 drops of concentrated Sulfuric acid from a disposable Pasteur pipette. Stir the Sodium sulfate with a glass rod and allow to sit loosely covered with foil to allow the ether to evaporate. Store the Sodium sulfate in a glass jar.

STANDARDS

Surrogate - Stock Standard: 200 ug/mL, 2,4-Dichlorophenylacetic Acid (DCAA)in Acetonitrile and stored at room temperature. Prepare a working standard (2.0 ug/mL) by adding 1 mL of the stock standard to a 100 mL volumetric flask and diluting to volume with Acetonitrile. The working standard may be held for six months or until expiration of the stock standard. Store at room temperature.

Spiking Standard - Commercially prepared Underivatized Chlorinated Herbicides Stock Standard - 100/10000 ug/mL in Acetone and stored at 4°C. Prepare a working standard at a concentration of 1.0/100 ug/mL in Methanol. The working standard may be held for six months or until expiration of the stock standard. Store at 4°C.

APPARATUS

Kuderna-Danish (K-D) apparatus - 500 mL
Concentrator tube: 10 mL, graduated, ground glass stopper is used to prevent evaporation of extracts. (receiver)
Evaporation flask: 500ml. Attach to concentration tube with blue clamp
Snyder column: two-ball micro
Boiling chips: Solvent extracted, approximately 10/40 mesh (silicon carbide or equivalent)
Water bath: Heated with concentric ring cover, capable of temperature control (±5°C). The bath should be used in a

hood.
Balance: analytical capable of accurately weighing to the nearest 0.1g.
1.0 mL pipettor
Glass stirring rod
Pasteur pipets
Pipet bulb
250 mL beakers
20 mL Scintillation vials
2 mL autosampler vials with crimp tops
1.0 mL gastight syringe
10 mL disposable glass pipette

PROCEDURE SOILS AND OTHER SOLID SAMPLES

1. Rinse all 250 mL beakers with methylene chloride. Discard solvent rinse into waste container.

2. Label each beaker with the sample ID to be extracted. Complete the Laboratory extraction sheet with the sample ID's.

3. With each extraction batch, a blank, a matrix spike/matrix spike duplicate, a laboratory control standard and a laboratory control standard duplicate are performed. The blank, MS/MSD, and LCS/LCSD are labeled with a GCAL ID (these numbers are assigned by the LIMS).

4. Homogenize sample by pouring the contents of the sample onto a piece of butcher paper, chop and mix with a tongue depressor or spatula. Remove any foreign object such as sticks, leaves, or rocks. Weigh approximately 30 g of the homogenized sample to the nearest 0.1 g into the labeled 250 mL beaker. Weigh 30 g of the acidified sodium sulfate in the blank, LCS, and LCSD beakers. Weigh 30 g of the homogenized sample chosen for spiking into the MS/MSD beakers.

5. Add 2 drops of HCL acid from a Pasteur pipette to each sample (including QC) and mix well.(pH<2)

6. Add 30 g of acidified sodium sulfate to each sample. Do not add to the blank or LCS/LCSD.

7. Add 1.0 mL of the surrogate working standard to the blank, LCS, LCSD and each sample. Add 1.0 mL of the spiking standard to the LCS/LCSD and MS/MSD.

8. Add at least 100 mL of 1:1 Methylene chloride/Acetone to cover sample. The solvent layer should be 2" above the soil.

9. Test sonicator performance. Sonicate 3 minutes and filter through funnel paper. Collect in a labeled jar containing 10 g of acidified Sodium sulfate.

10. Extract 2 more times with sufficient Methylene chloride to cover sample. Collect extracts in the labeled jar and

cap when complete.

11. Dry extract for at least 2 hours or overnight in the capped jar.

12. Tap the jar to loosen the sodium sulfate in the jar. Pour the extract through a funnel containing acidified glass wool and collect in a 250 mL K-D apparatus. Tap the jar and empty the remaining jar contents, including the sodium sulfate into the funnel. Rinse the jar several times with Methylene chloride and pour into the funnel. Rinse the funnel with Diethyl ether. Collect all liquid in the K-D apparatus.

13. Concentrate to 5 mL in the water bath. Remove the receiver and micro-snyder. Final volume to 1 mL.

14. Use a 1.0 mL gas tight syringe to dilute the extract with 1 mL of Isooctane and 0.5 mL of Methanol. Dilute to a final volume of 4 mL with Diethyl ether.

15. Use a disposable 10 mL glass pipette to add 2 mL Diazomethane solution to each receiver and let the samples stand 10 minutes with occasional swirling. The yellow color of Diazomethane should be evident and should persist for this period.

16. Add approximately 10 mg of Silicic acid to each extract to destroy the excess Diazomethane and allow to stand for 10 minutes with occasional swirling.

17. Dilute extract to 10.0 mL with Hexane.

18. Transfer an aliquot (1 to 2 mL) to a 2 mL autosampler vial and cap. Transfer the remaining extract to a 20 mL Scintillation vial and store in the extract cooler. Transfer the vials and a copy of the extraction form to the GC-Semivolatile extract cooler.

CONCENTRATED WASTE SAMPLES

1. Rinse 20 mL Scintillation vials with Ether. Discard the rinse in the appropriate waste container. Label each vial with the sample ID to be extracted. Complete the laboratory extraction sheet with the sample ID's.

2. With each extraction batch, a blank, matrix spike/matrix spike duplicate, a laboratory control standard and a laboratory control standard duplicate are performed. The blank, MS/MSD, and LCS/LCSD are labeled with a GCAL ID (these numbers are assigned by the LIMS).

3. Weigh 1 g of sample into the labeled 20 mL vial. Weigh 1 g of the sample chosen for spiking into the MS/MSD vials.

4. Add 1.0 mL of the surrogate working standard to the blank, LCS, LCSD and each sample. Add 1.0 mL of the spiking standard to the LCS/LCSD and MS/MSD.

5. Bring QC and samples to a volume of 5 mL with Diethyl ether using the marked vial as a guide.

6. Add 2.0 g of the acidified anhydrous Sodium sulfate to each vial.

7. Cap and shake each vial for 2 minutes.

8. Use a Pasteur pipet to transfer 1.0 mL of the 5 mL extract to a 20 mL Scintillation vial. Discard the remaining 4mL of extract.

9. Add 1.0 mL Isoctane and 0.5mL of Methanol to the extract and bring to a volume of 4 mL with Diethyl ether.

10. Add 2 mL of Diazomethane solution to the receiver and let the sample stand for 10 minutes with occasional swirling. The yellow color of the Diazomethane should be evident and should persist for this period.

11. Add approximately 10 mg of Silicic acid to each extract to destroy the excess Diazomethane and allow to stand for 10 minutes with occasional swirling.

12. Dilute the extract to 5 mL with Hexane.

13. Transfer an aliquot (1 to 2 mL) to a 2 mL autosampler vial and cap. Store the remaining extract in the 20 mL Scintillation vial in the extract cooler. Transfer the autosampler vials and a copy of the extraction form to the GC-Semivolatile extract cooler.

14. Record the final volume on the extraction log as 50 mL. This is due to the dilution performed when removing 1 mL of the 5 mL extract volume in Step 8.

Diazomethane Generation

Caution: Diazomethane is a known carcinogen and can explode violently under certain conditions.

- The entire apparatus should be contained in a hood.
- DO NOT heat above 90°C - An explosion may result.
- DO NOT use any type of ground glass joints, glass stirring rods, or grinding surfaces - An explosion may result.
- KEEP AWAY from alkaline metals (Na, Mg, etc.) An explosion may result.
- There should be NO solid materials (boiling chips, sediment, etc) present in the samples or generator.
- A larger volume of the Diazomethane may be prepared.

Diazomethane decomposes rapidly in the presence of solids and poses an explosion hazard.

PROCEDURE

CAUTION: ONLY experienced personnel shall operate the

Diazomethane generator. Under NO circumstances shall an inexperienced person be allowed to operate it.

1. Assemble the generator. Make sure that the gas trap and collection flasks are surrounded with an ice bath.

2. Dissolve 10 grams of Diazald in 100 mL of Ether and shake well. Place the solution in a 1 liter amber bottle. Label and cap the bottle.

3. Dissolve 10 g of KOH into 16 mL of water and add 20 mL of Ethanol. Place in an amber bottle and cap.

4. Place 45 mL of the Ether/Diazald mixture in the separatory funnel on the generator with the stopcock closed. Place 20 mL of the water/ethanol/KOH mixture in the reaction flask and submerge in a water bath that is approximately 65°C. Allow the system to come to equilibrium for about 20 minutes.

5. Fill the gas trap with ether. Start the generator by SLOWLY opening the stopcock on the separatory funnel until the ether solution begins dripping into the reaction flask. The optimum flow rate is about 60 drops per minute.

6. As the reaction progresses, a yellow liquid will begin to collect in the collection flask. Once all the Ether/Diazald mixture has been exhausted from the funnel, fill it with ten ml of ether and allow it to distill as well.

7. Turn off the hot water bath, and disassemble the generator. The Diazomethane/Ether solution is now ready to use.

METHOD PERFORMANCE

1) In single laboratory studies using organic-free reagent water and clay/still bottom samples, the mean recoveries presented in Table 4 and 5 of Method 8151A were obtained for diazomethane derivatization. The standard deviations of the percent recoveries of these measurements are also in Tables 4 and 5.

2) Table 6 of Method 8151A presents relative recoveries of the target analytes obtained using the PFBBr derivatization procedure with spiked water samples.

POLLUTION PREVENTION — See QAPP Section 10.2

WASTE MANAGEMENT — See SOP GEN-009

be worn. In addition to other measures, solvents must be handled in ventilated hoods.

APPARATUS

Herzog HFP-339-Automated Pensky Marten Closed Cup Flashpoint Tester

Fire extinguisher
PT-100 thermometer
Thermal detector
Electric igniter
Brass cup with lid
Stirring cable
Disposal container labeled flashpoint waste
Aluminum pans
Matches or lighter

REAGENTS

o-Xylene (QC); known flashpoint of 90^{o}F

PRE-ANALYSIS PROCEDURE

1. Use a thermometer to determine the ambient temperature of the room. Record the temperature in the flashpoint logbook.

2. All samples should be tested for ambient flashpoint before being loaded onto the sample apparatus.

3. Place a small amount (approximately 2ml or 2g) of sample in an aluminum pan.

4. Pass a lighted match or burning lighter 1 to 1½ inches above the sample. Do not touch the flame to sample.

5. If the sample vapors ignite, the result should be recorded as ambient in the flashpoint logbook and reported as <ambient temperature in the LIMS.

6. If the sample does not ignite, proceed to the next section in this Standard Operating Procedure.

7. Record the barometric pressure in the Flashpoint Logbook in mm Hg. The barometric pressure can be obtained from National Weather Service at the following site: http://forecast.weather.gov/MapClick.php?map.x=84&map.y=106&MapType=3&site=LIX&CiTemplate=1

PROCEDURE

A. Liquid Samples

1. Shake samples thoroughly and fill brass cup slightly past the line. This should take approximately 75 mLs of sample. Samples of very viscous material may be heated gently to aid in obtaining a homogenous sample with the lid/cap slightly loosened to avoid pressure build-up. Never heat to a temperature greater than 32˚F below a known flashpoint. If the sample is suspected of containing volatile contaminants, do not heat.

2. Place brass cup with sample in the heating block so that the three circular keys fit into the corresponding slots.

3. Turn the locking arm to the left to lock the brass cup into position.

4. Place the cup lid on the brass cup so that the rectangular key fits in the cover slot and is snug.

5. Carefully insert the PT-100 thermometer and thermal detector into the correct slots on the cup lid.

6. Check the igniter filament for damage. It should have fairly uniform distance between the coils. Replace if damaged.

7. Place the drive rod arm into the appropriate slot on the top of the cup.

8. Attach the stirring cable to both the cup lid and the stirrer coupling.

9. From the instrument display, press the “Start” button. Enter the sample number or sample ID and press “Start” again.

10. Use the right cursor to select Program 7 and press “Start”.

    NOTE: This is a screening program and should only be used when the flashpoint is unknown. If the flashpoint of the sample is already known, proceed directly to step 22 in this Standard Operating Procedure.

11. At this point the instrument display will ask for an expected flashpoint. For unknown samples, use the key pad on the instrument display to type in the number 120^{o}F. This allows the instrument to screen the sample over the range from ambient to 170^{o}F.

12. Once again, press “start”. The phrase “START TEST?” should appear. Press “start” one final time to start the analysis.

13. At this point the instrument should perform a series of checks. The analyst should verify that the igniter coil is working and the drive rod arm is detecting the proper zero position. No test can be performed if the igniter coil or the rod arm are not functioning properly.

14. Once the flashpoint has been detected or the instrument reaches 170^{o}F without detecting a flashpoint, the analysis will stop and the analyst will be alerted with an alarm.

15. To turn off the alarm, the analyst should hit the "Stop Bell" button.

16. Immediately following the analysis, the cooling system will turn on. Once the instrument is cooled to an acceptable level, once again the alarm will be sounded and the analyst should hit the "Stop Bell" button to turn it off.

17. The test result shown in the display should be recorded in the flashpoint logbook.

18. If the instrument reaches 170^{o}F without detecting a flashpoint, the result should be recorded as >170^{o}F. If this is the case, the analyst should move on to the next sample.

19. If a flashpoint is detected below 170^{o}F, it must be verified.

20. At this point, the apparatus should be carefully taken apart and all parts cleaned with a suitable solvent (deionized water, acetone, methanol, etc.).

21. To verify a flashpoint or run a known flashpoint, a fresh aliquot of sample should be used.

22. Set up a fresh aliquot of sample using steps 1 through 8 in this Standard Operating Procedure.

23. From the instrument display, use the right cursor to select Program 3 and press "Start". Any flashpoints that are to be confirmed should be run in this program.

24. Follow steps 9 through 17, except in step 12 enter the known flashpoint instead of 120^{o}F.

25. The analysis is complete if the two runs yield results that are within ± 9^{o}F of each other. If this criteria is failed, a third analysis should be performed in the ISO/ASTM-A program mode.

B. Solid Samples

Same as liquids above except for the following:

1. Samples should be homogenized with a spatula.

2. Loosely fill brass cup to line with solid sample.

3. Do not attach the stirring cable.

4. Results should fall within ± 17°F to be accepted. If this criteria is failed, a third analysis should be performed in the ISO/ASTM-A program mode. If the third analysis fails then you must report with a narrative.

CALCULATIONS No calculations are required. The instrument corrects results for barometric pressure.

DETECTION LIMIT The maximum value reported for flashpoint at Gulf Coast Analytical Laboratories, Inc. is 170°F. Because of the purpose of analyzing the flashpoints at GCAL, it is impractical to continue past this temperature. Any sample that does not flash before this temperature should be reported as >170°F in both the logbook and the LIMS.

QUALITY CONTROL

1. One QC sample should be analyzed per batch of 20 samples. o-Xylene is used as this standard and has a known flashpoint of 90°F. The control limits for this QC sample is 90 ± 2°F.

2. Any sample that has a flashpoint below 170°F should be duplicated. Liquid sample duplicate flashes should agree within ±9°F, while solid samples should agree within ±17°F.

3. The second run, the one that uses the ISO/ASTM-A program, is the run that should be reported.

METHOD PERFORMANCE *Repeatability* – The difference between successive results, obtained by the sample operator with the same apparatus under constant operating conditions on identical test material, would in the long run, in the normal and correct operation of the test method, exceed the following values in 1 case in 20.

$$r = AX,$$

$$A = 0.029,$$

X = mean result in ^{o}C, and

r = repeatability

Reproducibility – The difference between two single and independent results, obtained by different operators working in different laboratories on identical material, would in the long run, in the normal and correct operation of the test method, exceed the following values only in 1 case in 20.

R = BX,

B = 0.071,

X = mean result in ^{o}C, and

R = reproducibility

Bias – Since there is no accepted reference material suitable for determining the bias for the procedure in this test method, bias has not been determined.

Relative Bias – Statistical evaluation of the data did not detect any significant difference between the reproducibility variances of manual and automated Pensky-Martens flashpoint results for the samples studied. Evaluation of the data did not detect any significant difference between averages of manual and automated Pensky-Martens flash point for the samples studied with the exception of cycle oil and fuel oil that showed some bias. In any case of dispute, the manual procedure shall be considered the referee test.

NOTE: The precision statements were derived on clear liquids only. Refer to the research report[9] for information regarding relative bias and types of samples. Additional studies are in progress concerning relative bias.

POLLUTION PREVENTION See QAPP Section 10.2

WASTE MANAGEMENT See SOP GEN-009

GCAL

FLASHPOINT
METHOD SW-846 1010

HBN: _____
Batch: _____
Instrument ID: _____
Room Temperature: _____
Thermometer ID: _____

Analyst:_____
Date:_____
Time:_____

Barometric Pressure: _____

QC Control Limits: 90 ± 2 ^{0}F

Sample ID	Ignitor Coil (Y/N)	Rod Arm Position (Y/N)	Preliminary (Duplicate) Flashpoint Temp ^{o}F	Flashpoint Temp ^{o}F	Log-In Matrix	True Matrix	Stir (Y/N)
					N/A	N/A	

Reviewer/Date: _____

o-Xylene Lot:_____ Exp. Date:_____

Secondary Reviewer/Date: _____

APPENDIX 1

GLOSSARY

ACCEPTANCE LIMITS – data quality limits specified by the test method or generated by the laboratory. Specified limits placed on an item, process, or service defined in the requirement document.

ACCURACY – a measure of how close a measured value is to a known true value. Accuracy is assessed by means of reference samples and percent recoveries of spiked samples. The degree of agreement between an observed value and an accepted reference value. Accuracy includes combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator.

ALIQUOT – a discrete, measure, or representative portion of a sample taken for analysis.

ANALYTE – the chemical element or compound an analyst seeks to determine; the chemical element of interest.

ANALYTICAL BATCH – the basic unit for analytical quality control, defined as samples that are analyzed together with the same method sequence and the same lots of reagents and with the manipulations common to each sample within the same time period or in continuous sequential time periods. Samples in each batch should be of similar composition (e.g., groundwater, sludge, ash).

ANALYTICAL SAMPLE – any solution or media introduced into an instrument on which an analysis is performed, excluding instrument calibration, initial calibration verification, initial calibration blank, continuing calibration verification, and continuing calibration blank. The following are all analytical samples: undiluted and diluted samples (EPA and non-EPA), predigestion spike samples, duplicate samples, serial dilution samples, analytical spike samples, post digestion spike samples, interference check samples (ICS), CRDL standard for AA(CRA), CRDL standard for ICP(CRI), laboratory control sample(LCS), preparation blank(PB), and linear range analysis sample(LRS).

ANALYST – the designated individual who performs the "hands on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.

AREA UNITS – a term used in gas chromatography that indicates the peak area of a compound exiting a chromatographic column. The size or area of the peak is proportional to the amount of analyte in the sample.

ATOMIC ABSORPTION (AA) – a technique for analyzing metal using an element-specific lamp that emits a characteristic light spectrum. A sample is heated in a flame or graphite furnace and the light beam is passed through it. When the sample absorbs light, an energy loss is detected and is translated into a concentration of metal in the sample. This technique detects one metal at a time.

AUDIT – a systematic check to determine the quality of some function or activity. Two basic types are performance audits and system audits. Perform audits involve a quantitative comparison of the laboratory's results to those of a proficiency sample containing known concentration of analytes. A

system audit is a qualitative evaluation that normally consists of an onsite review of a lab's quality assurance system and physical facilities.

BACKGROUND CORRECTION – a technique usually employed relative to metals analysis, which compensates for variable background contribution to the instrument signal in the determination of trace elements.

BATCH – environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A batch is composed of a maximum of twenty environmental samples. A preparation batch is composed of environmental sample of the same matrix, meeting the above-mentioned criteria and with a maximum time between the start of processing the first and last sample in the batch to be 24 hours. An analytical batch is composed of prepared environmental samples (extracts, digestates or concentrates) and/or those samples not requiring preparation, which are analyzed together as a group using the same calibration curve or factor. An analytical batch can include samples originating from various environmental matrices.

BIAS – the deviation of the mean of replicate analytical measurements from a reference analyte concentration. Relative bias is represented by analytical measurement mean minus the reference analyte concentration and the difference divided by the reference analyte concentration. See accuracy and precision.

4-BROMO-FLUOROBENZENE (BFB) – the compound used to check the tuning of the instrument, and is used as a surrogate compound spiked into every sample for volatile analysis. A compound utilized in EPA gas chromatography/mass spectrometry (GC/MS) volatile methods to establish mass spectral instrument performance.

BIOCHEMICAL OXYGEN DEMAND (BOD) – A measure of the amount of oxygen consumed in the biochemical processes that break down organic matter in water. A larger BOD value indicates a greater degree of organic pollution. A related term, BOD5, is the amount of dissolved oxygen consumed in five days.

BIOSEED – the bacterial culture used to inoculate a sample for testing.

BLANK – an artificial sample designed to monitor the introduction of artifacts into the measurement process. For aqueous samples, reagent water is used as a blank matrix. There are several types of blanks, which monitor a variety of processes: 1.)*laboratory blank* is taken through sample preparation and analysis only. It is a test for contamination in sample preparation and analyses. 2.)*storage blank* is stored and analyzed with samples at the laboratory. It is a test for contamination in sample storage as well as sample preparation and analysis. 3.)*trip blank* is shipped to and from the field with the sample containers. It is not opened in the field and, therefore, provides a test for contamination from sample preservation, site conditions, and transport as well as sample storage, preparation, and analysis. It is most commonly used for volatile organics. 4.)*field blank* is opened in the field and tests for contamination from the atmosphere as well as those activities listed under the trip blank.

BNA – base, neutral and acid extractable compounds. The term base, neutral and acid refer to the pH condition of the sample undergoing extraction. Certain compounds extract more efficiently from water under acidic conditions. Such compounds are often referred to as "acid extractables."

CALIBRATE – to determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter or other device, or the correct value for each setting of a control knob. The levels of the applied calibration standard should bracket the range of planned or expect sample measurements.

CALIBRATION – The systematic determination of the relationship of the response of the measurement system to the concentration of the analyte of interest. Instrument calibration performed before any samples are analyzed is called the initial calibration. Subsequent checks on the instrument calibration performed throughout analysis are called continuing calibration verification.

CALIBRATION BLANK (CB) – a volume of reagent water in the same matrix as the calibration standards but without the analyte.

CALIBRATION CURVE – the graphical relationship between the known values, such as concentrations, of a series of calibration standards and their analytical response.

CALIBRATION METHOD – a defined technical procedure for performing a calibration.

CALIBRATION STANDARD – a certified material used to calibrate an instrument.

CERTIFIED REFERENCE MATERIAL (CRM) – reference material, one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body. (ISO Guide 30)

CONTINUING CALIBRATION VERIFICATION (CCV) – used to evaluate the performance of the instrument system with respect to a defined set of method criteria. The CCVs are used to verify instrument performance during analysis. The CCV shall be prepared from the same stock standard solution used to prepare the calibration curve.

CHAIN-OF-CUSTODY–Procedures and associated documents designed to trace the custody of a sample from the point of origin to final disposition, with the intent of legally demonstrating that custody remained intact and the tampering or substitutions were precluded.

CHEMICAL OXYGEN DEMAND (COD) – A measure of the oxygen required to oxidize all compounds in water, both organic and inorganic.

COMBINED STANDARD UNCERTAINTY – The standard uncertainty of the analytical measurement result that is the sum in quadrature (square-root-of-the-sum-of-the-squares) of the component standard uncertainties.

CORRECTIVE ACTION – the action taken to eliminate the causes of an existing non-conformity, defect, or other undesirable situation to prevent reoccurrence.

COVERAGE FACTOR – the numerical factor used as a multiplier of the combined standard uncertainty to expand the uncertainty corresponding to a specific level of confidence. The Student's *t*-distribution is used for determining the coverage factor.

DEMONSTRATION OF CAPABILITY (DOC) – a procedure used to establish the ability of the analyst to generate acceptable accuracy.

DEIONIZED WATER (DI) – water from which the majority of ions have been removed. Water that is contaminant free and used in the laboratory, the resistivity should be ≤ 18 mega ohms.

DISSOLVED METALS –- metallic elements determined on a water sample that has been passed through a 0.45-um filter.

DISSOLVED OXYGEN (DO) – the oxygen freely available in water, an indicator of water quality.

DISSOLVED SOLIDS – disintegrated organic and inorganic material contained in water. Excessive amounts make water unfit to drink or use in industrial processes.

DRY WEIGHT – the weight of a sample based on percent solids. The weight of a sample after drying in an oven at a specified temperature.

DUPLICATE MEASUREMENT – a duplicate measurement is a second measurement made on the same or identical sample of material to assist in the evaluation of measurement of variance.

DUPLICATE SAMPLE – two samples taken from the same population and carried through certain stages of sampling and testing. Duplicate sample include field co-located duplicate samples, field-split duplicate samples, and laboratory duplicate subsamples.

EXPANDED UNCERTAINTY – the quantity defining an interval enveloping the analytical measurement that captures a large fraction of the distribution of analyte concentrations that could be attributable to the quantity measured. The combined standard uncertainty is multiplied by the coverage factor to calculate the expanded uncertainty.

EXTERNAL STANDARDS – a method of quantifying chromatographic data in which standards of known concentration are analyzed prior to unknown samples. The chromatographic peak area (or height) of a sample component is compared to a calibration curve of a peak area constructed from the standard data for that component. This comparison allows the concentration of the component in the sample to be determined.

FECAL COLIFORM BACTERIA – bacteria found in mammals' intestinal tracts. Their presence in water or sludge is an indicator of pollution and possible contamination by pathogens.

FLAME IONIZATION DETECTOR (FID) – a gas chromatography detector in which the column effluent gas is mixed with hydrogen and burned in air or oxygen. The ions and electrons produced in the flame generate an electric current proportional to the amount of materials in the detector. The FID responds to nearly all organic compounds, but it does not respond to air and water, which makes it exceptionally suited to environmental analysis.

FLASHPOINT – the lowest temperature at which a flammable liquid gives off sufficient vapor to form an ignitable mixture with air near its surface or within a vessel. Combustion does not continue.

GAS CHROMATOGRAPHY (GC) – a technique for detecting organic compounds by using their physical and chemical properties to separate a mixture. The compounds are identified and quantified

with various types of detectors as they exit the chromatograph. Selection of detectors is dependent on the particular compounds of interest.

GAS CHROMATOGRAPHY MASS SPECTROMETRY (GCMS) – a technique in which sample analytes are bombarded with electrons as they exit a gas chromatography column and are fragmented into characteristics ion patterns. The mass spectrometer is the detector. It can determine which fragments are present and therefore the identity of the compounds.

GLUCOSE GLUTAMIC ACID (GGA) – used as a laboratory control standard in BOD procedures.

GRAPHITE FURNACE – a technique used for the analysis of metals. An atomic absorption spectrophotometer heats the sample within a graphite tube using an electrical current. It is also commonly called a flameless furnace and generally provides greater sensitivity for certain metals than flame or inductively coupled argon plasma techniques.

GRAVIMETRIC - analyses based on the direct or indirect weighing of the analyte in question. This technique usually requires the use of an analytical balance with a sensitivity of 0.1 mg or better.

HALL ELECTROLYTIC CONDUCTIVITY DETECTOR – an element-selective gas chromatography detector primarily intended for trace analysis of organic compounds containing chlorine, nitrogen or sulfur. In operation, this detector pyrolyzes the column effluent gas into soluble electrolytes that are dissolved in a stream of deionized liquid. The observed change in electrical conductivity, proportional to the amount of material present, is measured.

HAZARDOUS WASTE – waste regulated under RCRA that can pose a substantial or potential hazard to human health or the environment when improperly managed. Such wastes possess at least one of four characteristics (ignitability, corrosivity, reactivity, or toxicity) or appear on special EPA hazardous waste lists. The term is not interchangeable with hazardous substances or material.

HEADSPACE - Any area in a container not completely filled by the sample in which gases can collect.

HEAVY METALS – metallic elements with high atomic weights, i.e., mercury, chromium, cadmium, arsenic, and lead. They can damage the health of plants and animals at low concentrations and tend to accumulate in the food chain.

HOLDING TIME – the maximum times that samples may be held before analysis and still be considered valid or not compromised. The storage time allowed between sample collection and sample analysis when the designated preservation and storage techniques are employed.

HYDROCARBONS – chemical compounds that consist entirely of carbon and hydrogen.

ICP – Inductively coupled plasma is a type of instrument used for metals analysis. Because the temperature of the plasma is considerable higher (10,000^{o}K) than the temperature of a flame atomic absorption spectrophotometer, it is especially useful for refractory metals. Some instruments are also capable of performing simultaneous multielement analysis.

ICP-MS - Inductively coupled plasma mass spectrometry (ICP-MS) is a type of mass spectrometry highly sensitive and capable of the determination of a range of metals and several non-metals at concentrations below one part in 10^{12} (part per trillion). It is based on coupling together an inductively coupled plasma as a method of producing ions with a mass spectrometer as a method of separating and detecting the ions. In trace elemental analysis, the method has advantages of high speed, precision and sensitivity.

IGNITABLE – capable of burning or causing a fire.

INORGANIC CHEMICALS – chemical substances of mineral origin, unlike organic chemicals whose structure relies on carbon atoms.

INITIAL CALIBRATION VERIFICATION (ICV) - also referred to as the Independent Calibration Verification for this laboratory. A standard solution used to verify the calibration curve derived from a source independent of the instrument calibration standard. The ICV is use to quantify second source standard variance and bias.

INSTRUMENT CALIBRATION STANDARD - a reference material used to standardize an analytical instrument.

INSTRUMENT DETECTION LIMIT (IDL) - a term utilized in the EPA Inorganic Contract Laboratory Program. The IDL is three times the standard deviation obtained for the analysis of a standard solution (each analyte in reagent water) at a concentration of three to five times that of the IDL on three nonconsecutive days with seven consecutive measurements per day. The IDL is the concentration equivalent to a signal, due to the analyte of interest, which is the smallest signal that can be distinguished from background noise by a particular instrument. The IDL should always be below the method detection limit, and is not used for compliance data reporting, but may be used for statistical data analysis and comparing the attributes of different instruments.

INSTRUMENT PERFORMANCE CHECK - The analyses of one of the ICSs to verified initial and continuing calibration (CCV). The IPC is used to quantify the instrumental testing repeatability variance and bias.

INSTRUMENT TUNING - a technique used in gas chromatography/mass spectrometry procedures to verify that the instrument is properly calibrated to produce reliable mass spectral information. See 4-Bromofluorobenzene under “B”.

INTERNAL STANDARDS - compounds added to every standard, blank, matrix spike, matrix spike duplicate, sample (for volatile organics), and sample extract (for semivolatiles) at a known concentration, prior to analysis. Internal standards are used as the basis for quantification of the target compound.

IONIZATION - Utilized in mass spectrometry to fragment analyte molecules into smaller segments. These smaller mass segments are then separated and plotted to form a “mass spectrum” which is used to identify the parent molecule. Electron impact is one example of ionization used in mass spectrometry. In more technical terms. Ionization is the process by which neutral atoms or groups of atoms become electrically charged, either positively or negatively, by the loss or gain of electrons.

ISOMERS - chemical compounds with the same molecular weight and atomic composition by differing molecular structure, e.g., n-pentane and 2-methylbutane.

LABORATORY CONTROL SAMPLE (LCS) - a clean-matrix reference sample spiked with a standard with an established analyte concentration. The LCS is carried through the entire chemical preparation and testing procedures. The LCS is used to quantify the variance and bias of the chemical preparation and instrumental testing stages without matrix interference. Also called a Laboratory fortified blank (LFB).

LABORATORY CONTROL SAMPLE DUPLICATE (LCSD) – a duplicate of the laboratory control sample in a clean matrix that is carried through the entire chemical preparation and testing procedures.

LABORATORY DUPLICATE SAMPLE (LAB DUPLICATE) - a portion of the collected sample that is carried through the chemical preparation and testing. The laboratory duplicate subsample is used to quantify the variance of the chemical preparation and instrumental testing stages with matrix interferences.

LEACHATE - a liquid that results from water collecting contaminants as it trickles through wastes, agricultural pesticides or fertilizers. Leaching may occur in farming areas, feedlots, and landfills, and may result in hazardous substances entering surface water, groundwater or soil.

LDEQ – Louisiana Department of Environmental Quality

LIBRARY SEARCH - a technique in which an unknown mass spectrum of a compound is compared to the mass spectra of compounds contained in a computer library in an effort to identify the compound. Compounds identified in this manner are referred to as tentatively identified compounds (TICs).

LIMIT OF DETECTION (LOD) – an estimate of the minimum amount of a substance that an analytical process can reliable detect. An LOD is analyte and matrix specific and may be laboratory dependent.

LIMIT OF QUANTIATION (LOQ) – the minimum levels, concentrations, or quantities of a target variable (e.g. target analyte) that can be reported with a specified degree of confidence..

LIMS – laboratory information management system. Horizons is the LIMS used by GCAL.

LINEAR CALIBRATION RANGE – the concentration range over which the instrument response is linear.

LOG-IN - the receipt and initial management of an environmental sample. It generally includes identifying who sent the sample; maintaining chain-of-custody; checking report and invoice information; recording analysis requested, including methodology and special instructions; and assigning a discreet in-lab identification, usually a number or bar code.

MASS SPECTRUM - a plot of ion mass/charge ratio versus intensity. A fragmentation pattern results from the particles whose mass distribution is characteristic of the parent molecule. Qualitative information is provided by a mass spectrum.

MATERIAL SAFETY DATA SHEET (MSDS) - a compilation of information required under the OSHA Communication Standard on the identity of hazardous chemicals and their associated health and physical hazards, exposure limits and precautions.

MATRIX - The physical characteristics or state of a sample – e.g., water, soil, sludge.

MATRIX INTERFERENCE - the influence of the sample matrix or sample components upon the ability of qualitatively identifies and quantitatively measures compounds in environmental samples.

MATRIX MODIFIERS - chemicals added to samples for metals analysis, which are used to lessen the effects of chemical interference, viscosity and surface tension.

MATRIX SPIKE (MS) – aliquot of a sample fortified (spiked) with known quantities of specific compounds and subjected to the entire analytical procedure in order to indicate the appropriateness of the method for the matrix by measuring recovery of the spike. Matrix spiked samples are used to quantify the variance and bias of the chemical preparation and testing stages with matrix interference.

MATRIX SPIKE DUPLICATE (MSD) - a second aliquot of the same matrix as the matrix spike that is spiked to determine the precision of the method.

METHOD DETECTION LIMIT (MDL) - the minimum concentration of compound that can be measured and reported within 99% confidence that the value is above zero and is determined from analysis of a sample in a given matrix containing the analyte.

MUST – denotes a mandatory requirement.

NARRATIVE - in an analytical report, a descriptive documentation of any problems encountered in processing the samples, along with corrective action taken and problem resolution.

NUTRIENT - any substance assimilated by living things that promote growth. The term is generally applied to nitrogen and phosphorus in wastewater, but is also applied to other essential and trace elements.

ORGANIC - generally, any compound that contains carbon bonded to a hydrogen or halogen atom.

OXIDATION - the process in chemistry whereby electrons are removed from a molecule.

PCBs - Polychlorinated biphenyl, a group of toxic persistent chemicals used in transformers and capacitors for insulating purposes and in gas pipeline systems as a lubricant. Sale of PCBs for new uses was banned by law in 1979.

PERCENT RECOVERY - a measure of accuracy that is calculated as the measured value relative to the true value expressed as a percent.

PERFORMANCE AUDIT - a quantitative evaluation of a measurement system that involves the analysis of standard reference samples or materials which are certified as to their chemical composition or physical characteristics.

PROFICIENCY TEST (PT) SAMPLE - a sample of known composition (unknown to the laboratory), provided by an external source, which is used to evaluate lab performance. For certification purposes the PT sample is purchased from an approved provider.

pH - a numerical designation of relative acidity and alkalinity. A pH of 7.0 indicates precise neutrality. Progressively higher values indicate increasing alkalinity and lower values increasing acidity.

POLLUTANT - generally, any substance introduced into the environment that adversely affects the usefulness of a resource.

PRACTICAL QUANTITATION LIMIT (PQL) - the lowest level that can be reliable achieved within specified limits of precision and accuracy routine laboratory operating conditions. The lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value.

PRECISION - a measure of the ability to reproduce analytical results. It is generally determined through the analysis of duplicate samples. The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range in either absolute or relative terms.

PRESERVATIVE - a chemical or reagent added to a sample to prevent or slow decomposition or degradation of a target analyte or a physical process. Physical and chemical preservation may be used in tandem to prevent sample deterioration.

PURGE AND TRAP - a technique used in the analysis of volatile organic where analytes are purged from a sample by means of an inert gas and trapped on a sorbent column. The sorbent is then flashheated and the analytes are transferred onto a gas chromatographic column for separation and identification.

PURGEABLE ORGANIC - an organic compound that is generally less than 20% soluble in water and has a boiling point at or below 200^{o}C. A volatile organic. An organic compound is generally considered to be purgeable if it can be removed from water using the purging process.

QC BASED NESTED APPROACH - a procedure for estimating the uncertainty of measurement using quality control data. The procedure is described in SOP QA-013.

QUALITY ASSURANCE (QA) - all those planned and systematic actions necessary to provide adequate confidence in laboratory results. An integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets the defined standards of quality with a stated level of confidence.

QUALITY ASSURANCE PROGRAM PLAN - a written assembly of management policies, objectives, principle and general procedures that outlines how the laboratory intends to generate data of known and accepted quality.

QUALITY CONTROL (QC) – the overall system of technical activities whose purpose to measure and control the quality of a product or service so that it meets the needs of the users.

QUALITY CONTROL CHART - a graph of analytical measurement results for a specific QC standard plotted sequentially with upper and lower control limits (±3SD). A central line that is the best estimate of the average variable plotted, and upper and lower marginal exceedence limits (±4SD) are usually included in the Quality Control Chart. The chart may also include upper and lower warning limits (±2SD).

QUALITY SYSTEM – a structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items) and services. The quality system provides the framework for planning, implement and assessing work performed by the organization and for carrying out required QA and QC.

r^2 – Correlation Coefficient Squared – paramet6er used to evaluate the fit of linear or quadratic regression curve fit of initial calibration data.

RAW DATA – any original information from a measurement activity or study recorded in a laboratory note book, worksheets, records, memoranda, notes, or exact copies thereof that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data may include photography, microfilm or microfilm copies, computer printouts, magnetic media, including dictated observations, and recorded data from automated instruments.

REACTIVITY - the tendency of a chemical to explode under normal management conditions, to react violently when mixed with water, or to generate toxic gases.

REAGENT WATER - water in which an interference is not observed at or above the minimum quantitation limit of interest.

REFERENCE MATERIAL - a traceable standard with an established analyte concentration. Material or substance whose property values are sufficiently homogenous, stable and well established to be used for the calibration of an apparatus, the assessment of a measurement method or for assigning values to materials (ISO Guide 30)

REFERENCE METHOD – a method of known and documented accuracy and precision issued by an organization recognized as competent to do so.

RELATIVE RETENTION TIME – a measure of the shift in retention time of an analyte when referenced to an internal standard.

RELATIVE RESPONSE FACTOR (RRF) - a measure of the relative mass spectral response of an analyte compared to its internal standard. RRFs are determined by analysis of standards and are used in the calculation of concentrations of analytes in samples.

REPLICATE ANALYSES - two or more results representing the same sample parameter. Replicate analyses are used to quantify the analytical measurement repeatability precision.

RPD – Relative Percent Difference, a relative difference between two analyses calculated by dividing the absolute difference of those two results by the average of their two values, then multiplying by 100.

RESOLUTION - the degree of separation between peaks eluting from a chromatographic column. Sufficient resolution between peaks is required for proper quantitation of unknown analytes.

RETENTION TIME - a term used in gas and liquid chromatography describing the time elapsed from the sample injection until the specific compound elutes or exits the chromatographic column at the detector. Each compound has a characteristics retention time on a specific column; therefore, this information is used to qualitatively identify the compounds in the sample.

SAMPLE – portion of material collect for chemical analysis, identified by a unique number assigned by the LIMS.

SHALL – denotes a requirement that is mandatory whenever the criterion for conformance with the specification requires that there be no deviation. This does not prohibit the use of alternative approaches or methods for implementing the specification so long as the requirement is fulfilled.

SHOULD – denotes a guideline or recommendation whenever noncompliance with the specification is permissible.

SOLID WASTE – non-liquid, non-soluble materials, ranging from municipal garbage to industrial waste, that contain complex, and sometimes hazardous, substances. Solid wastes include sewage sludge, agricultural refuse, demolition wastes, mining residues, and even liquids and gases in containers.

SOLVENT - a substance, usually liquid, capable of dissolving or dispersing one or more other substances.

SPIKE – a known mass of target analyte added to a blank sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.

STANDARD CURVE - a curve that plots concentrations of known analyte standards versus the instrument response to the analyte. Calibration standards are prepared by diluting the stock analyte solution in graduated amounts that cover the expected range of the samples being analyzed. The calibration standards must be prepared by using the same type of acid or solvent at the same concentration as for the samples following sample preparation. This is applicable to organic and inorganic chemical analyses.

STANDARD OPERATING PROCEDURE - a detailed written description of how a laboratory executes a particular procedure or method intended to standardize its performance.

STANDARDIZED REFERENCE MATERIAL (SRM) – a certified reference material produced by the U.S. National Institute of Standards and Technology or other equivalent organization and characterized for absolute content, independent of analytical method.

STANDARD UNCERTAINTY - the analytical measurement uncertainty expressed as a standard deviation. The relative standard deviation represents the relative standard uncertainty.

SURROGATE - an organic compound similar to the analyte of interest in chemical composition, extraction and chromatography, but not normally found in environmental samples. Primarily used in chromatography techniques, the surrogate is spiked into quality control blanks, calibration and check

standards, samples (including duplicated and QC reference samples) and spiked samples before analysis. A percent recovery is calculated for each surrogate.

SUSPENDED SOLIDS - small pollutant particles that float on the surface of, or are suspended in, sewage or other liquids. They resist removal by conventional means.

TARGET COMPOUND - specific compounds that are to be quantified in a sample based on a standard list of potential compounds.

TENTATIVELY IDENTIFIED COMPOUNDS (TICs) - compounds detected in samples that are not target compounds, internal standards, system monitoring compounds or surrogates. TICs usually consist of up to 30 peaks that are greater than 10% of the peak areas, or heights, of the nearest internal standard. They are subjected to mass spectral library searches for tentative identification. A client may specify the number of unknown peaks in its samples it wishes the laboratory to tentatively identify.

TOTAL METALS - metallic elements that have been digested prior to analysis.

TYPE A EVALUATION UNCERTAINTY - the method of evaluation of uncertainty by the statistical analysis of a series of test results.

TYPE B EVALUATION OF UNCERTAINTY - the method of evaluation of uncertainty by means other than statistical analysis.

UNCERTAINTY - the parameter associated with the analytical measurement results that characterizes the dispersion of the values that could be reasonable attributed to the quantity measured.

UNCERTAINTY INTERVAL - the range of analyte concentrations that an analytical measurement could represent at a specified level of confidence. The relative standard deviation is used to represent the relative standard uncertainty in the QC-based Nested Approach.

VALIDATION –the process for evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, or contractual specifications. It essentially evaluates performance against predetermined specifications.

VOA - volatile organic analysis

VOA BOTTLE - a vial used to contain samples for volatile organic analysis.

VOLATILE COMPOUNDS - compounds amendable to analysis by purge and trap. Synonymous with purgeable compounds.

VOLATILE ORGANIC COMPOUND (VOC) - any organic compound that participates in atmospheric photochemical reactions, except for those designated by the EPA Administrator as having negligible photochemical reactivity.

WET CHEMISTRY - procedures that involve distillations, colorimetric determinations and titrimetric measurements. Examples are chloride, nitrates, sulfates and biochemical oxygen demand.

GULF COAST ANALTYCIAL LABORATORIES, INC.
EXTRACTIONS
STANDARD OPERATING PROCEDURE

EFFECTIVE DATE: 8/16/10
APPROVED BY:
QA/QC APPROVED: JDT

SUBJECT — SCOPE AND APPLICATION

This procedure describes the steps for the preparation of soil/solid and concentrated waste samples for the analysis of herbicides. The esters are hydrolyzed with Sodium hydroxide and extraneous organic material is removed by a solvent wash. After acidification, the acids are extracted with solvent and converted to their Methyl esters using Diazomethane as the derivatizing agent. After excess reagent is removed, the Esters are determined by gas chromatography.

MATRIX — Solid

REFERENCE — SW846 Method 8151A

PRESERVATIVE — Cool to 4°C

SAMPLE COLLECTION — Samples should be collected and stored in glass containers.

HOLDING TIME — From collection to extraction - 14 days
From extraction to analysis - 40 days

DEFINITIONS — See SOP GEN-016

SAFETY — Each employee is directly responsible for complete awareness of all health hazards associated with every chemical that he/she uses. The employee must be aware of these hazards, and all associated protective wear and spill clean-up procedures PRIOR TO the use of any chemical. In all cases, the applicable material safety data sheet (MSDS) and your supervisor or safety officer should be consulted. The bottle labels also provide important information that must be noted. Personnel performing this procedure may be working with flammables, poisons, toxins, carcinogens, teratogens, mutagens, and biohazards. In particular, approved gloves, safety glasses, and lab coats must be worn. In addition to other measures prescribed by the division, solvents must be handled in ventilated hoods.

REAGENTS — All inorganic reagents shall be reagent grade. All organic solvents shall be pesticide quality or equivalent. Store all reagents using manufacturer's recommendation. Label all reagents with the date opened and date of receipt. Label all prepared solutions as required by SOP GEN-006. If tests or appearance indicates the reagent has decomposed or is contaminated, dispose of the reagent and notify QA Department and/or supervisor.

Deionized water
Hydrochloric acid
Sulfuric acid
Acetone
Hexane
Methylene chloride
1:1 Methylene chloride/Acetone
Potassium hydroxide pellets

Diazald
Diethyl ether
Ethanol
Isooctane
Methanol
Silicic acid - 100 mesh powder

Acidified Glass Wool
Pre-extract the glass wool overnight in the liquid/liquid extractor with Methylene chloride. Rinse the glass wool once with Ether and discard the Ether. Add enough Ether to cover the glass wool and add 1.0 mL Hydrochloric acid slowly and allow to sit for 5 minutes. Pour off Ether and allow glass wool to dry.

Acidified Sodium Sulfate - Bake Sodium sulfate 4 hours in muffle furnace at 400°C. Allow Sodium sulfate to cool then transfer ≈2400 grams to a large Pyrex dish. Add Methylene chloride to cover the Sodium sulfate and stir with a glass rod. Discard the Methylene chloride and repeat this procedure. Discard the Methylene chloride and then rinse once with Ethyl ether following the same procedure as with the Methylene chloride. Add enough Ethyl ether again to cover the Sodium sulfate and then add 6 drops of concentrated Sulfuric acid from a disposable Pasteur pipette. Stir the Sodium sulfate with a glass rod and allow to sit loosely covered with foil to allow the ether to evaporate. Store the Sodium sulfate in a glass jar.

STANDARDS

Surrogate - Stock Standard: 200 ug/mL, 2,4-Dichlorophenylacetic Acid (DCAA)in Acetonitrile and stored at room temperature. Prepare a working standard (2.0 ug/mL) by adding 1 mL of the stock standard to a 100 mL volumetric flask and diluting to volume with Acetonitrile. The working standard may be held for six months or until expiration of the stock standard. Store at room temperature.

Spiking Standard - Commercially prepared Underivatized Chlorinated Herbicides Stock Standard - 100/10000 ug/mL in Acetone and stored at 4°C. Prepare a working standard at a concentration of 1.0/100 ug/mL in Methanol. The working standard may be held for six months or until expiration of the stock standard. Store at 4°C.

APPARATUS

Kuderna-Danish (K-D) apparatus - 500 mL
Concentrator tube: 10 mL, graduated, ground glass stopper is used to prevent evaporation of extracts. (receiver)
Evaporation flask: 500ml. Attach to concentration tube with blue clamp
Snyder column: two-ball micro
Boiling chips: Solvent extracted, approximately 10/40 mesh (silicon carbide or equivalent)
Water bath: Heated with concentric ring cover, capable of temperature control (±5°C). The bath should be used in a

hood.
Balance: analytical capable of accurately weighing to the nearest 0.1g.
1.0 mL pipettor
Glass stirring rod
Pasteur pipets
Pipet bulb
250 mL beakers
20 mL Scintillation vials
2 mL autosampler vials with crimp tops
1.0 mL gastight syringe
10 mL disposable glass pipette

PROCEDURE SOILS AND OTHER SOLID SAMPLES

1. Rinse all 250 mL beakers with methylene chloride. Discard solvent rinse into waste container.

2. Label each beaker with the sample ID to be extracted. Complete the Laboratory extraction sheet with the sample ID's.

3. With each extraction batch, a blank, a matrix spike/matrix spike duplicate, a laboratory control standard and a laboratory control standard duplicate are performed. The blank, MS/MSD, and LCS/LCSD are labeled with a GCAL ID (these numbers are assigned by the LIMS).

4. Homogenize sample by pouring the contents of the sample onto a piece of butcher paper, chop and mix with a tongue depressor or spatula. Remove any foreign object such as sticks, leaves, or rocks. Weigh approximately 30 g of the homogenized sample to the nearest 0.1 g into the labeled 250 mL beaker. Weigh 30 g of the acidified sodium sulfate in the blank, LCS, and LCSD beakers. Weigh 30 g of the homogenized sample chosen for spiking into the MS/MSD beakers.

5. Add 2 drops of HCL acid from a Pasteur pipette to each sample (including QC) and mix well.(pH<2)

6. Add 30 g of acidified sodium sulfate to each sample. Do not add to the blank or LCS/LCSD.

7. Add 1.0 mL of the surrogate working standard to the blank, LCS, LCSD and each sample. Add 1.0 mL of the spiking standard to the LCS/LCSD and MS/MSD.

8. Add at least 100 mL of 1:1 Methylene chloride/Acetone to cover sample. The solvent layer should be 2" above the soil.

9. Test sonicator performance. Sonicate 3 minutes and filter through funnel paper. Collect in a labeled jar containing 10 g of acidified Sodium sulfate.

10. Extract 2 more times with sufficient Methylene chloride to cover sample. Collect extracts in the labeled jar and

cap when complete.

11. Dry extract for at least 2 hours or overnight in the capped jar.

12. Tap the jar to loosen the sodium sulfate in the jar. Pour the extract through a funnel containing acidified glass wool and collect in a 250 mL K-D apparatus. Tap the jar and empty the remaining jar contents, including the sodium sulfate into the funnel. Rinse the jar several times with Methylene chloride and pour into the funnel. Rinse the funnel with Diethyl ether. Collect all liquid in the K-D apparatus.

13. Concentrate to 5 mL in the water bath. Remove the receiver and micro-snyder. Final volume to 1 mL.

14. Use a 1.0 mL gas tight syringe to dilute the extract with 1 mL of Isooctane and 0.5 mL of Methanol. Dilute to a final volume of 4 mL with Diethyl ether.

15. Use a disposable 10 mL glass pipette to add 2 mL Diazomethane solution to each receiver and let the samples stand 10 minutes with occasional swirling. The yellow color of Diazomethane should be evident and should persist for this period.

16. Add approximately 10 mg of Silicic acid to each extract to destroy the excess Diazomethane and allow to stand for 10 minutes with occasional swirling.

17. Dilute extract to 10.0 mL with Hexane.

18. Transfer an aliquot (1 to 2 mL) to a 2 mL autosampler vial and cap. Transfer the remaining extract to a 20 mL Scintillation vial and store in the extract cooler. Transfer the vials and a copy of the extraction form to the GC-Semivolatile extract cooler.

CONCENTRATED WASTE SAMPLES

1. Rinse 20 mL Scintillation vials with Ether. Discard the rinse in the appropriate waste container. Label each vial with the sample ID to be extracted. Complete the laboratory extraction sheet with the sample ID's.

2. With each extraction batch, a blank, matrix spike/matrix spike duplicate, a laboratory control standard and a laboratory control standard duplicate are performed. The blank, MS/MSD, and LCS/LCSD are labeled with a GCAL ID (these numbers are assigned by the LIMS).

3. Weigh 1 g of sample into the labeled 20 mL vial. Weigh 1 g of the sample chosen for spiking into the MS/MSD vials.

4. Add 1.0 mL of the surrogate working standard to the blank, LCS, LCSD and each sample. Add 1.0 mL of the spiking standard to the LCS/LCSD and MS/MSD.

5. Bring QC and samples to a volume of 5 mL with Diethyl ether using the marked vial as a guide.

6. Add 2.0 g of the acidified anhydrous Sodium sulfate to each vial.

7. Cap and shake each vial for 2 minutes.

8. Use a Pasteur pipet to transfer 1.0 mL of the 5 mL extract to a 20 mL Scintillation vial. Discard the remaining 4mL of extract.

9. Add 1.0 mL Isoctane and 0.5mL of Methanol to the extract and bring to a volume of 4 mL with Diethyl ether.

10. Add 2 mL of Diazomethane solution to the receiver and let the sample stand for 10 minutes with occasional swirling. The yellow color of the Diazomethane should be evident and should persist for this period.

11. Add approximately 10 mg of Silicic acid to each extract to destroy the excess Diazomethane and allow to stand for 10 minutes with occasional swirling.

12. Dilute the extract to 5 mL with Hexane.

13. Transfer an aliquot (1 to 2 mL) to a 2 mL autosampler vial and cap. Store the remaining extract in the 20 mL Scintillation vial in the extract cooler. Transfer the autosampler vials and a copy of the extraction form to the GC-Semivolatile extract cooler.

14. Record the final volume on the extraction log as 50 mL. This is due to the dilution performed when removing 1 mL of the 5 mL extract volume in Step 8.

Diazomethane Generation

Caution: Diazomethane is a known carcinogen and can explode violently under certain conditions.

- The entire apparatus should be contained in a hood.
- DO NOT heat above 90°C - An explosion may result.
- DO NOT use any type of ground glass joints, glass stirring rods, or grinding surfaces - An explosion may result.
- KEEP AWAY from alkaline metals (Na, Mg, etc.) An explosion may result.
- There should be NO solid materials (boiling chips, sediment, etc) present in the samples or generator.
- A larger volume of the Diazomethane may be prepared.

Diazomethane decomposes rapidly in the presence of solids and poses an explosion hazard.

PROCEDURE

CAUTION: ONLY experienced personnel shall operate the

Diazomethane generator. Under NO circumstances shall an inexperienced person be allowed to operate it.

1. Assemble the generator. Make sure that the gas trap and collection flasks are surrounded with an ice bath.

2. Dissolve 10 grams of Diazald in 100 mL of Ether and shake well. Place the solution in a 1 liter amber bottle. Label and cap the bottle.

3. Dissolve 10 g of KOH into 16 mL of water and add 20 mL of Ethanol. Place in an amber bottle and cap.

4. Place 45 mL of the Ether/Diazald mixture in the separatory funnel on the generator with the stopcock closed. Place 20 mL of the water/ethanol/KOH mixture in the reaction flask and submerge in a water bath that is approximately 65°C. Allow the system to come to equilibrium for about 20 minutes.

5. Fill the gas trap with ether. Start the generator by SLOWLY opening the stopcock on the separatory funnel until the ether solution begins dripping into the reaction flask. The optimum flow rate is about 60 drops per minute.

6. As the reaction progresses, a yellow liquid will begin to collect in the collection flask. Once all the Ether/Diazald mixture has been exhausted from the funnel, fill it with ten ml of ether and allow it to distill as well.

7. Turn off the hot water bath, and disassemble the generator. The Diazomethane/Ether solution is now ready to use.

METHOD PERFORMANCE

1) In single laboratory studies using organic-free reagent water and clay/still bottom samples, the mean recoveries presented in Table 4 and 5 of Method 8151A were obtained for diazomethane derivatization. The standard deviations of the percent recoveries of these measurements are also in Tables 4 and 5.

2) Table 6 of Method 8151A presents relative recoveries of the target analytes obtained using the PFBBr derivatization procedure with spiked water samples.

POLLUTION PREVENTION — See QAPP Section 10.2

WASTE MANAGEMENT — See SOP GEN-009

GULF COAST ANALYTICAL LABORATORIES
EXTRACTIONS
STANDARD OPERATING PROCEDURE

PROCEDURE: EXT-017
PAGE: 1 OF 6
EFFECTIVE DATE: 03/11/11
APPROVED BY:
QA/QC APPROVED:

SUBJECT — SCOPE AND APPLICATION

This procedure is designed to describe the steps for the preparation of aqueous samples and TCLP extracts for the analysis of extractable Herbicides.

The samples are extracted using a solid phase cartridge speed disk. After conditioning the disk samples are aspirated through the cartridge at low vacuum. Samples are eluted from the disk using Ethyl acetate. The eluted sample is esterified with Diazomethane. After excess reagent is removed, the Esters are determined by gas chromatography.

MATRIX — Water

REFERENCE — SW846 8151A
SW846 3535A
JT Baker Application Note

PRESERVATIVE — Cool to 4°C

SAMPLE COLLECTION — Samples should be collected and stored in 1 liter glass containers.

HOLDING TIME — From collection to extraction - 7 days
From extraction to analysis - 40 days
TCLP Herbicide – 14 days to tumble – 7 days to extract

DEFINITIONS — See SOP GEN-016

SAFETY — Each employee is directly responsible for complete awareness of all health hazards associated with every chemical that he/she uses. The employee must be aware of these hazards, and all associated protective wear and spill clean-up procedures PRIOR TO the use of any chemical. In all cases, the applicable material safety data sheet (MSDS) and your supervisor or safety officer should be consulted. The bottle labels also provide important information that must be noted. Personnel performing this procedure may be working with flammables, poisons, toxins, carcinogens, teratogens, mutagens, and biohazards. In particular, approved gloves, safety glasses, and lab coats must be worn. In addition to other measures prescribed by the division, solvents must be handled in ventilated hoods.

REAGENTS — All organic solvent shall be of HPLC grade or equivalent Reagents shall be of reagent grade or equivalent. Label all containers and squeeze bottles with reagent ID, lot, and expiration date.

Concentrated Hydrochloric acid
Methanol
DI Water
Acidified water – Add HCl to DI water until the pH is

approximately 2
Ethyl acetate
Diazald
Diethyl ether
Potassium hydroxide
Ethyl alcohol

STANDARDS

All standards used are pure material or from prepared certified solutions. The Certificate of Analysis shall be kept on file. Follow manufacturer's instruction for standard expiration and storage. Label all working standards using completed standard labels.

Surrogate – Stock Standard: 200 ug/mL, 2,4-Dichlorophenylacetic Acid (DCAA) in Acetonitrile and stored at room temperature. Prepare a working standard (2.0 ug/mL) by adding 2.0 mL of the stock standard to a 200 mL volumetric flask and diluting to volume with Acetonitrile. The working standard may be held for six months or until expiration of the stock standard. Store at room temperature.

Spiking Standard – Commercially prepared Underivatized Chlorinated Herbicides Stock Standard – 100 ug/mL in Acetone and stored at 4°C. Prepare a working standard at a concentration of 1.0 ug/ml in Methanol by adding 2.0 mL of stock standard to a 200 mL volumetric flask and diluting to volume in Methanol. The working standard may be held for six months or until expiration of the stock standard. Store at 4°C.

APPARATUS

JT Baker Speedisk H_2O-Phobic – Test each lot of disks by performing an LCS and MB before extraction of samples.
Manifold with vacuum that can maintain 25 inches of Mercury
Liter amber bottles
VOA vials 44mL
1000 mL graduated cylinder
10 mL graduated cylinder (Class "A")
Vials: Amber glass, 1-2 mL capacity with Teflon-lined screw cap
Water bath/Nitrogen stream: With temperature and gas-flow control. The bath is used in a hood.
1 mL pipettor
Pasteur pipets
Wide-range pH paper

PROCEDURE

Sample Extraction for Water

1. Using a calibrated graduated cylinder, measure 1000 mL of DI water for the Method Blank (MB), LCS, and LCSD. Pour into labeled 1 liter amber glass bottles. The MB and LCS/LCSD are labeled with a GCAL ID (these numbers are assigned by the LIMS). If sample is available perform an MS and MSD with each batch. For TCLP samples, pour 100 mL of TCLP extract into a 1 liter amber glass bottle.

2. Acidify all QC and samples to a pH of ≤ 2 using HCl acid and wide range pH paper.

3. Spike each sample with 1.0 mL surrogate working standard. Spike the LCS/LCSD and MS/MSD with 1.0 mL of the spike working standard.

4. Cover and shake each sample.

5. Condition speed disk by performing the following steps in order:

   a. Pour 6 mL of Methanol into disk and pull through. Repeat with an additional 6 mL.
   b. Pour 6 mL of DI water into disk and pull through.
   c. Pour 6 mL of Acidified water into disk and pull through.
   d. After each addition, pull the liquid through the disk but do not allow the disk to run dry between and after each step.

6. Aspirate the entire sample through the disk slowly. The sample should drain through in approximately one hour.

7. Dry the disk under vacuum for 30 minutes. Check the apparatus for any water condensation. If any is found dry with a Kim-wipe before performing sample elution.

8. Set-up the apparatus for sample elution into the VOA vial. Rinse the sample bottle with 6 mL of Ethyl acetate and pour into disk. Allow to soak for 10 minutes.

9. Elute the Ethyl acetate into the VOA vial slowly. Repeat with a second aliquot of Ethyl acetate.

10. Pour the sample into a glass concentrator tube.

11. Evaporate the sample slowly under a stream of Nitrogen to 1.0 mL.

12. Dilute the extract with 1 mL of Isooctane and 0.5 mL of Methanol. Dilute to a final volume of 4 mL with Diethyl ether.

13. Add 2 mL of Diazomethane to each sample to derivatize the Methyl esters. Allow the sample to stand for 10 minutes with occasional swirling. Verify the extract turns yellow upon adding the Diazomethane.

14. Add approximately 10 mg of Silicic acid to each extract to destroy the excess Diazomethane and allow to stand for 10 minutes with occasional stirring.

15. Pour the sample into a class “A” graduated cylinder or 10 mL volumetric. Dilute to final volume of 10.0 mL with Hexane. There should not be visible layers in the diluted sample. If any are noted, document on prep sheet and notify supervisor.

16. Bottle 1 mL of sample in a crimp-top, amber vial and transfer to the Semi-volatile GC section with a copy of the prep log.

17. Samples are analyzed using SOP GC-011.

PROCEDURE

Diazomethane Generation

Caution: Diazomethane is a known carcinogen and can explode violently under certain conditions.

- The entire apparatus should be contained in a hood.
- DO NOT heat above 90°C - An explosion may result.
- DO NOT use any type of ground, glass joints, glass stirring rods, or grinding surfaces - An explosion may result.
- KEEP AWAY from Alkaline metals (Na, Mg, etc.) An explosion may result.
- There should be NO solid materials (boiling chips, sediment, etc.) present in the samples or generator.

Diazomethane decomposes rapidly in the presence of solids and poses an explosion hazard.

PROCEDURE

Caution: ONLY experienced personnel shall operate the Diazomethane generator. Under NO circumstances shall an inexperienced person be allowed to operate it.

1. Assemble the generator. Make sure that the gas-trap and collection flasks are surrounded with an ice bath.

2. Dissolve 20 grams of Diazald in 200 mL of Diethyl ether and shake well.

3. Dissolve 20 g of KOH into 32 mL of water and add 40 mL of Ethanol. Place in an amber bottle and cap.

4. Place 90 mL of the Ether/Diazald mixture in the separatory funnel on the generator with the stopcock closed. Place 40 mL of the water/Ethanol/KOH mixture in the reaction flask and submerge in a water bath that is approximately 65°C. Allow the system to come to equilibrium for about 20 minutes.

5. Start the generator by SLOWLY opening the stopcock on the separatory funnel until the Ether solution begins dripping into the reaction flask. The optimum flow rate is about 60 drops per minute.

6. As the reaction progresses, a yellow liquid will begin to collect in the collection flask. Once all the Ether/Diazald mixture has been exhausted from the funnel, fill it with 10 mL of Ether and allow it to distill as well.

7. Turn off the hot water bath, and disassemble the generator. The Diazomethane/Ether solution is now ready to use.

8. Document Diazomethane generation in logbook and label the solution. Store sealed at 4°C.

METHOD PERFORMANCE

1) In single laboratory studies using organic-free reagent water and clay/still bottom samples, the mean recoveries presented in Table 4 and 5 of Method 8151A were obtained

for Diazomethane derivatization. The standard deviations of the percent recoveries of these measurements are also in Tables 4 and 5.

2) Table 6 of Method 8151A presents relative recoveries of the target analytes obtained using the PFBBr derivatization procedure with spiked water samples.

POLLUTION PREVENTION See QAPP Section 10.2

WASTE MANAGEMENT See SOP GEN-009

GULF COAST ANALYTICAL LABORATORIES, INC
METALS
STANDARD OPERATING PROCEDURE

PROCEDURE: MET-010
PAGE: 1 of 16
EFFECTIVE DATE: 11/25/11
APPROVED BY:
QA/QC APPROVED:

SUBJECT	SCOPE AND APPLICATION This method covers the operation of the Perkin Elmer 5300DV and 4300DV ICPs. The procedure is applicable for the analysis of aqueous samples, TCLP extracts, EPTOX extracts, soils, solids, and domestic or industrial wastes for Dissolved or Total metals. The sample is analyzed after preparation by the appropriate EPA, SW846, NIOSH, or ASTM procedure. Elements currently analyzed using these methods are listed in Table I.
MATRIX	Water and Solid
REFERENCES	EPA (EMMC) 200.7 - Determination of Metals and Trace Metals in Water and Wastes by ICP-Atomic Emission Spectrometry, Revision 4.4 (EPA Region VI Approval) (A) SW846 6010C – for South Carolina and North Carolina Projects SW846 6010B Perkin Elmer Instrument Manuals WinLab Software Guide
SAMPLE COLLECTION	Samples may be collected and stored in plastic or glass containers.
HOLDING TIME & PRESERVATION	Dissolved Metals (waters)– Filtered through a 0.45 um membrane filter then HNO_3 to pH < 2; Digestion required for 200.7 (SOP MET-005)-6 months. Analyst must wait at least 24 hours before digesting. Total Metals (waters)- HNO_3 to pH < 2; Digestion required (SOP MET-005)–6 months Total Metals (solids) – Cool 4°C; Digestion required (SOP MET-004, MET-018)–6 months
DEFINITIONS	See Appendix A for Glossary.
SAFETY	Each employee is directly responsible for complete awareness of all health hazards associated with every chemical that he/she uses. The employee must be aware of these hazards and all associated protective wear and spill clean-up procedures PRIOR TO the use of any chemical. In all cases, the applicable material safety data sheet

(MSDS) and your supervisor or safety officer should be consulted. The bottle labels also provide important information that must be noted. Personnel performing this procedure may be working with flammables, poisons, toxins, carcinogens, teratogens, mutagens, and biohazards. In particular, approved gloves, safety glasses, and lab coats must be worn. In addition to other measures prescribed by the division, solvents must be handled in ventilated hoods.

INTERFERENCES

Several interferences are possible. These include:

1. Spectral Interferences can be categorized as (1) overlap of a spectral line from another element; (2) unresolved overlap of molecular band spectra; (3) background contribution from continuous or recombination phenomena; and (4) background contribution from stray light from the line emission of high concentration elements. The first of these effects can be compensated by utilizing a computer correction of the raw data, requiring the monitoring and measurement of the interfering element. The second effect may require selection of an alternate wavelength. The third and fourth effects can usually be compensated by a background correction adjacent to the analyte line.

   Automatic interference correction for condition (1) above is done by the instrument software. The analyst does not have to manually do the correction. Background correction intervals to correct conditions (3) and (4) have likewise been automatically set up in the instrument software.

2. Physical Interferences are generally considered to be effects associated with the sample nebulization and transport processes. Such properties as change in viscosity and surface tension can cause significant inaccuracies especially in samples that may contain high dissolved solids or acid concentrations. If these types of interferences are present, they must be reduced by diluting the sample, using a peristaltic pump and/or using an internal standard element.

3. Chemical Interferences are characterized by molecular compound formation, ionization effects and solute vaporization effects. Normally these effects are not pronounced with the ICP technique; however, if observed they can be minimized by careful selection of operating conditions (that is, incident power,

observation position, and so forth), by buffering of the sample, by matrix matching, and by standard addition procedures. These types of interferences can be highly dependent on matrix type and the specific analyte element.

APPARATUS

Perkin Elmer 5300DV/4300DV Inductively Coupled Plasma with WinLab 32 software
Perkin Elmer As 90 Autosampler
Peristaltic pump and tubing
Autosampler tubes
Mechanical pipets and pipet tips
Volumetric Flasks - Class A
Argon and compressed air supply with pressure controls

ANALYTE LIST

See Appendix I.

REAGENTS AND STANDARDS

Deionized water from Millipore Synergy UV water polisher - monitored daily.

Concentrated Nitric acid - Trace metals grade, label with date opened and enter into reagent logbook

Concentrated hydrochloric acid – Trace metals grade, label with date opened and enter into reagent logbook

5% Nitric Acid - prepared from the Trace metals grade concentrate

6% Nitric Acid/10% Hydrochloric Acid – Calibration Blank

Stock standard metals solutions (1000 mg/L) - commercially prepared, label with date opened.

Custom mixed standards – commercially prepared, label with date opened.

Calibration standards: A custom made solution for calibrations standards is used. See Table I for the elements included and concentration. Prepare all standards in the 6% Nitric Acid/10% Hydrochloric Acid.

Continuing Calibration Verification (CCV) standard – is prepared using the calibration standard. The CCV includes equal aliquots of the calibration standard and 6% Nitric Acid/10% Hydrochloric Acid.

Second Source Stock Standards – Two, multi-element custom solutions-commercially prepared.

Initial Calibration Verification (ICV) standard - Dilute the appropriate amount of the second source multi-element stock solution to volume with 6% Nitric Acid/10% Hydrochloric Acid. The concentration of the elements in the stock solutions vary in concentration, therefore the analyst should prepare this solution such that the majority of the elements are in the middle of the calibration range.

Interference solution stock standards - available commercially.

Interferent Calibration Solution A (ICSA) - Pipet 8.0 mL of the interferent stock Spex Int. A-1 into a 200 mL volumetric flask and dilute to volume with 6% Nitric Acid/10% Hydrochloric Acid. Final concentrations are: Al, Ca, Mg - 200 mg/L; Fe - 80 mg/L.

Interferent Calibration Solution B (ICSAB) - Pipet 8.00 mL of the interferent stock Spex Int. A-1, 2.0 mL of interferent stock Spex Int. B-1, and 2 mL of interferent stock Spex Int. B-2 standards into a 200 mL volumetric flask and dilute to volume with 3% Nitric Acid/6% Hydrochloric Acid. Final concentrations of interferents are as above; concentrations of minor elements are either 0.500 or 1.00 mg/L.

Internal Standard – 5 mg/L Yttrium, 5 mg/L Scandium

Low-level Calibration Verification Standard composed of two custom-made standards prepared at the reporting limit.

All solutions are prepared in labeled, dedicated glassware. The glassware is rinsed in an acid solution to clean.

All reagents used must be entered in the reagent logbook. Standards prepped are entered into the standard prep logbook.

INSTRUMENT SET-UP

1. Check Argon and compressed air supply.

2. Check wash solution in autosampler flush container. Fill if necessary (5% Nitric Acid).

3. Check drain bottle below instrument. Empty if necessary.

4. Connect the peristaltic pump tubing between the posts on the pump (Sample pump and internal standard pump). Close the platens.

5. Restart the computer. Select the Optima ICON on the Windows Desktop. Select a workspace. Select a method.

6. Select the Plasma ICON. Select "ON" button. Allow Plasma to warm up 45 minutes.

7. Set up bench sheet by filling in the positions with the samples to be analyzed. Include the standard identification numbers for the calibration standards, ICV, ICSA, and ICSAB on the bench sheet (Attachment 1).

8. Load the autosampler by filling the tubes (10 mL will suffice) and inserting them into the positions corresponding to those on the bench sheet. Verify all blank, standard and QC sample tubes are filled.

9. Open a sample information file on the set up window and enter the analytical sequence. <SAVE>. Open a Results file - name by date (YYMMDD).

10. If the torch compartment has been opened, go to Tools pull down menu. Select “Spectrometer Control”. Aspirate a 5mg/L Y solution. Select “Optimize X-Y”. Select “Hg Realign”. Record the Hg intensity in the maintenance log.

11. Go to analyze in the Analysis Control Window.

CALIBRATION AND SAMPLE ANALYSIS

1. Select "Analyze All". Instrument will calibrate and continue with QC and sample analysis. The calibration is at one point with a blank. It is verified with an ICV, LLICV, CCV and CCB. Once data is collected, and instrument QC is evaluated, the data can be posted. This is performed by direct upload of data using LIMSLink Software.
2. SHUT DOWN - If an additional run will not be performed select “auto-shutdown” from the system pull down menu.
3. Samples are diluted if above linear range as described in QC section 12 of this SOP.

4. Replicates are evaluated for all runs. If the RSD is more than 5%, each replicate is evaluated. If an outlier is determined, it may be excluded. This is documented on the metals run log and in the raw data.

REPORTING LIMITS

The following charts indicate reporting limits for EPA 200.7, SW-846 6010, TCLP extracts, SPLP extracts and UTS analyses:

EPA 200.7:

ANALTYE	WATER (mg/L)
Aluminum	0.2
Antimony	0.06
Arsenic	0.01
Barium	0.01
Beryllium	0.005
Boron	1
Cadmium	0.005
Calcium	0.1
Chromium	0.01
Cobalt	0.01
Copper	0.01
Iron	0.1
Lead	0.015
Lithium	0.05
Magnesium	0.1
Manganese	0.015
Molybdenum	0.03
Nickel	0.04
Potassium	0.5
Selenium	0.04
Silver	0.01
Sodium	1
Strontium	0.05
Thallium	0.02
Tin	0.025
Titanium	0.1
Vanadium	0.02
Zinc	0.02
Zirconium	0.01

SW-846, 6010:

ANALTYE	WATER (mg/L)	SOLID (mg/kg)
Aluminum	0.2	8
Antimony	0.06	2.4
Arsenic	0.01	1.6
Barium	0.01	0.4

Beryllium	0.005	0.2
Boron	1	40
Cadmium	0.005	0.2
Calcium	0.1	30
Chromium	0.01	0.4
Cobalt	0.01	0.4
Copper	0.01	0.4
Iron	0.1	4
Lead	0.015	0.6
Lithium	0.05	2
Magnesium	0.1	4
Manganese	0.015	0.6
Molybdenum	0.03	1.2
Nickel	0.04	1.6
Potassium	0.5	20
Selenium	0.04	1.6
Silver	0.01	0.4
Sodium	1	40
Strontium	0.05	0.4
Thallium	0.02	0.8
Tin	0.025	4
Titanium	0.1	4
Vanadium	0.02	0.8
Zinc	0.02	0.8
Zirconium	0.01	0.4

TCLP, UTS, SPLP Extracts:

ANALTYE	TCLP (mg/L)	UTS (mg/L)	SPLP (mg/L)
Aluminum	----	----	0.2
Antimony	0.06	0.1	0.06
Arsenic	0.2	0.14	0.01
Barium	1	1	0.01
Beryllium	0.005	0.01	0.005
Boron	----	----	1
Cadmium	0.01	0.01	0.005
Calcium	----	----	0.1
Chromium	0.05	0.05	0.01
Cobalt	----	----	0.01
Copper	----	----	0.01
Iron	----	----	0.1
Lead	0.1	0.075	0.015
Lithium	----	----	0.05
Magnesium	----	----	0.1
Manganese	----	----	0.015
Molybdenum	----	----	0.03
Nickel	0.04	0.05	0.04
Potassium	----	----	0.5

Selenium	0.1	0.1	0.04
Silver	0.05	0.01	0.01
Sodium	----	----	----
Strontium	----	----	0.05
Thallium	0.02	0.02	0.02
Tin	----	----	0.025
Titanium	----	----	0.1
Vanadium	0.02	0.02	0.02
Zinc	0.02	0.1	0.02
Zirconium	----	----	0.01

NOTE: Reporting limits may vary according to specific project requirements.

QUALITY CONTROL &
DATA ACCEPTANCE CRITERIA

1. The Initial Calibration Verification (ICV) standard recoveries must be 95-105% for 200.7 and 90-110% for 6010. This is performed daily following the initial calibration. The ICV standard should be prepared from an independent (second source) material at or near the mid-range of the calibration curve.

2. Analyze a Initial Calibration Blank (ICB) to verify all concentrations are below the reporting limit. The concentration must be $\leq \pm$ the reporting limit. For DOD projects, concentrations must be less than the LOD. Additional requirements may apply and may be more stringent. See SOP GEN-019.

3. Analyze a Low-level Initial Calibration Verification (LLICV) prepared at or below the project required reporting limit. The recovery for this check standard must be 70-130% for 6010C or 50-150% for 6010B. Project specific limits may be required, see SOP GEN-019. For DOD projects, recoveries must be 80-120%.

4. The ICSA solution is used to monitor the interelement correction factors for the common interferents (Fe, Ca, Mg, Al). This solution is not required in the methods but will be used to evaluate elements that are not spiked in the ICSAB. The concentration for these elements must be $\leq \pm$ LOD for DOD projects. The ICSA concentration must be less than or equal the reporting limit and greater than or equal to -2 times the reporting limit. Additional requirements may apply and may be more stringent. See SOP GEN-019.

5. All elements in the ICSAB solution should have

recoveries of 80-120%. Results falling outside these limits may indicate the need for re-generation of the inter-element correction factors (IECs).

6. Continuing Calibration Verification standards (CCV), Continuing Calibration Blanks (CCB), and for 6010C Low-level Continuing Calibration Verification (LLCCV) are run at the beginning of the analytical run. The first CCV recovery must be 95-105% and all other CCV recoveries for the analytical run must be 90-110% for 200.7. For 6010B and 6010C, the CCV recoveries for all target analytes –90-110% for 6010. For 6010C, the recovery for the LLCCV must be 70-130% for all analytes. The RSD between the replicates should not be greater than 5%. If this is exceeded evaluate to determine if re-analysis is necessary. The CCB concentration should never exceed the reporting limit. If a CCV and/or CCB is outside control limits, re-analyze one time (additional runs are acceptable if a documented reason for the failure is available) and if the values are still outside the control limits, recalibrate and re-run the previous 10 samples. Results are reportable with a narrative if the CCB fails and there are no hits in the associated samples. Additional requirements may apply and may be more stringent. See SOP GEN-019.

7. Method Blank – one Method Blank is prepped with each batch of 20 or fewer samples. The concentration of each element should never exceed the reporting limit for all associated samples. Detected levels of elements in the method blank must be less than the reporting limit or <10% of the sample concentrations for the data to be reported. For DOD projects, the method blank should be less than ½ the reporting limit or <10% of the measured amount in the samples. If the data is reported make a note of the problem in the case narrative. Find the source of the problem and correct and re-analyze if possible. Additional requirements may apply and may be more stringent. See SOP GEN-019.

   NOTE: Blanks (2500) maybe placed prior to a CCV/CCB to complete a block of ten positions before another prep batch is analyzed and to leave positions open for reruns.

8. A Laboratory Control Sample (LCS) and Laboratory Control Sample Duplicate (LCSD-if required for project or if insufficient sample if available for a matrix

duplicate or MS/MSD) is prepped with each batch of 20 or fewer samples. The recovery must be 80 - 120% for 6010B&C waters and solids, 85-115% for 200.7, and 70-130% for 6010B&C organics. The LCS/LCSD RPD should be ≤ 20%. If the LCS recovery is outside the control limits, the sample batch must be re-prepped. Samples may be reported if the LCS fails high with no hits in associated samples. Report with a narrative describing the failure.

9. The Relative Percent Difference (RPD) for matrix duplicates must be ≤ 20%, unless the sample concentration is less than five times the detection limit or the sample matrix is determined to be heterogeneous. Additional requirements may apply and may be more stringent. See SOP GEN-019.

10. Matrix Spike (MS) and Matrix Spike Duplicate (MSD) recoveries must be 75 - 125% for 6010B&C water and solids, 70-130% for 200.7 and 6010B&C organics. The MS/MSD RPD should be ≤ 20%. For DOD projects, the MS control limits are the same as the applicable LCS limits. MSD's are prepped and analyzed if there is sufficient sample. If the recovery is outside these limits, the data should be flagged. A spike is not applicable if the sample concentration is greater than 4 times the spike level. Interference checks shall be performed for samples with spike recoveries outside the control limits. If a TCLP extract spike recovery for a regulated metal is <50% and the sample concentration is within 20% of the regulatory level the sample must be reanalyzed by the method of standard additions. Additional requirements may apply and may be more stringent. See SOP GEN-019.

11. For solid samples that require Antimony analysis – If the MS and MSD recovery for Antimony are outside of the control limits of 75-125%, the data should be flagged. In addition, if the recovery for Antimony is <10%, the samples should be reprepped for Antimony only, using the optional procedure for Antimony found in SOP MET-004. Also, if historical data for a particular sample indicates low recoveries for Antimony, the analyst should proceed directly to the optional steps.

12. Interference checks:

    A. Dilution Test - Perform a 5x dilution on one sample per batch. The concentrations of the elements in

the sample to be diluted should be greater than 50 times the IDL for 200.7 and 10x the LOQ for 6010C for it to be applicable. The neat sample concentration and five times the diluted sample concentration should agree within 10%. If not, a chemical or physical interference should be suspected.

B. Post-Digestion Spike – Analyte is added to a portion of a digested sample, or its dilutions. A post-digestion spike is also performed on all samples with MS/MSD recoveries outside control limits. If the recovery is outside control limits of 80-120% for 6010C, 75-125% for 6010B or 85-115% for 200.7, all data for the batch will be flagged by including a narrative with the data. Internal standardization is utilized therefore the method of standard additions is not required. A post-digestion spike is required for each sample batch. It is usually performed on the sample chosen as the matrix spike.

13. Samples with interferent or analyte concentrations greater than the determined instrument linear range will be diluted and reanalyzed. Target analytes must always be diluted to within the linear range of the instrument. Samples must be diluted for non-target analytes only if that analyte is an interferent for a target analyte. Dilutions for interferents above the linear range should only be performed if a correction factor is in effect for target analytes. Do not over dilute. Perform the minimum dilution possible to dilute within the linear range of the instrument for any analyte. For 200.7, dilute samples with concentrations >90% linear range. Additional requirements may apply and may be more stringent. See SOP GEN-019.

14. Review the Internal standard recovery for each sample. Perkin Elmer recommends recovery limits of 50-150%. Review the data thoroughly before accepting or rejecting data based on these control limits. Determine if high or low recoveries are due to instrument drift by reviewing the internal standard recoveries for CCV’s and CCB’s. This will eliminate performing unnecessary dilutions if the sample is reanalyzed. High recoveries may be the result of a clogged sample uptake tube or an empty sample vial. Extremely high recoveries can result from the presence of the internal standard element in the original

sample. If this is suspected, reanalyze the sample without the internal standard, or re-analyze using a different IS such as scandium. If the analyst determines the recovery is outside the control limits due to a matrix interference, then the sample must be reanalyzed diluted.

15. Determine IEC's semi-annually.

16. Determine linear ranges semi-annually. Spike at historical values. Each metal must be recovered at 90-110%.

17. Determine MDL's annually using the requirements of SOP QA-009. MDL's shall be determined more frequently if there is a change to the method or instrumentation that may alter the sensitivity of the measurement. An MDL study is performed for each instrument. MDL's should be less than ½ the reporting limit, but cannot be higher than the reporting limit. The MDL's are confirmed by the analysis of a lower limit of quantitation check sample (LOD check). The LOD check is prepared like a sample and spiked at 1 – 4 times the MDL. The LOD must be positive to pass. The LOQ's must be spiked at the concentration of the LLICV. Recoveries must be 80-120%.

18. Determine IDLs annually.

MAINTENANCE

1. Clean the nebulizer periodically in a 5% Nitric acid solution. Sonication of the nebulizer in this solution is also helpful in removing deposits or particulate matter.

2. Clean the torch periodically by soaking in 10% HNO_3.

3. Sample pump tubing should be inspected every day and changed when showing signs of wear.

4. The purge window may fog slightly over time. Remove and clean with methanol.

5. Check the water level in the chiller.

6. A Perkin Elmer service engineer performs scheduled periodic maintenance every six months.

7. All other maintenance shall be documented in the instrument maintenance log. If a particular problem

occurs, document the problem and the solution.

CALCULATIONS

1. Sample Concentration –

$$\text{mg/L or mg/kg analyte in sample} = A \frac{Vf}{Vi} \times d$$

A = mg/L analyte in processed sample
Vf = final volume of sample (mL)
Vi = initial volume (mL) or weight (g) of sample
d = dilution factor (if required)

The units may be converted to ug/L or ug/kg

2. Matrix spike and Matrix Spike Duplicate Recovery

$$\% \text{ Recovery} = \frac{(SSR - SR)}{SA} \times 100$$

SSR = spiked sample result
SR = sample result
SA = spike added

3. Matrix Duplicate Relative Percent Difference (RPD)

$$RPD = \frac{SR - SDR}{\frac{(SR+SDR)}{2}} \times 100$$

SR = Sample result
SDR = sample duplicate result
$\frac{(SR+SDR)}{2}$ = average of SR and SDR

TABLE I

ELEMENT	WAVELENGTH 5300DV	WAVELENGTH 4300DV*	CALIBRATION STANDARD CONC mg/L
Ag	328.067	328.072	1.00
Al	308.218	308.219	10.0
As	193.696	193.694	1.00
B	249.672	249.677	5.00
Ba	233.527	233.524	1.00
Be	313.105	313.104	1.00
Ca	315.887	315.887	10.0
Cd	214.438	214.436	1.00

ELEMENT	WAVELENGTH 5300DV	WAVELENGTH 4300DV*	CALIBRATION STANDARD CONC mg/L
Ce	418.660	418.660	1.00
Co	228.613	228.617	1.00
Cr	267.706	267.713	1.00
Cu	324.751	324.753	1.00
Fe	259.938	259.938	10.0
K	766.496	766.526	20.0
Li	670.783	670.813	1.00
Mg	279.078	279.076	10.0
Mn	257.605	257.609	1.00
Mo	202.031	202.032	1.00
Na	589.597	589.622	40.0
Ni	231.605	231.602	1.00
Pb	220.352	220.353	1.00
Sb	206.830	206.834	1.00
Se	196.024	196.026	1.00
Si	251.609	251.612	1.00
Sn	189.928	189.924	1.00
Sr	421.560	421.563	1.00
Ti	337.277	337.277	1.00
Tl	190.800	190.799	1.00
V	290.878	290.881	1.00
Zn	213.857	213.856	1.00
Zr	343.821	343.818	1.00

*Al, Ca, Fe, Na, Li, K, Sr, Mg are analyzed in the radial mode

SOFTWARE TROUBLESHOOTING

All ICP instruments at GCAL utilize Perkin Elmer software WINLAB32 Version 3.1.0.0107 to control the instrument and perform all data calculations. In the event of software malfunction, please contact Perkin Elmer technical support

or GCAL's IT Director for troubleshooting help.

METHOD PERFORMANCE (METHOD 6010)

1) In an EPA round-robin Phase 1 study, seven laboratories applied the ICP technique to acid-distilled water matrices that had been spiked with various metal concentrates. Table 4 of Method 6010 lists the true values; the mean reported values, and the mean percent relative standard deviations.

2) Performance data for aqueous solutions and solid samples from a multi-laboratory study (9) are provided in Tables 5 and 6 of Method 6010.

METHOD PERFORMANCE (METHOD 200.7)

1) Listed in Table 4 of Method 200.7 are typical single laboratory total recoverable MDLs determined for the recommended wavelengths using simultaneous ICP-AES and the operating conditions given in Table 5 of Method 200.7. The MDLs were determined in reagent blank matrix (best case situation). PTFE beakers were used to avoid boron and silica contamination from glassware with the final dilution to 50 mL completed in polypropylene centrifuged tubes. The listed MDLs for solids are estimates and were calculated from the aqueous MDL determinations.

2) Data obtained from single laboratory method testing are summarized in Table 6 of Method 200.7 for five types of water samples consisting of drinking water, surface water, ground water, and two wastewater effluents. The data presented cover all analytes except cerium and titanium. Samples were prepared using the procedure described in Section 11.2. For each matrix, five replicate aliquots were prepared, analyzed and the average of the five determinations used to define the sample background concentration of each analyte. In addition, two pairs of duplicates were fortified at different concentration levels. For each method analyte, the sample background concentration, mean percent recovery, standard deviation of the percent recovery, and relative percent difference between the duplicate fortified samples are listed in Table 6 of Method 200.7. The variance of the five replicate sample background determinations is included in the calculated standard deviation of the percent recovery when the analyte concentration in the sample was greater than the MDL. The tap and well waters were processed in Teflon and quartz beakers and diluted in polypropylene centrifuged tubes. The nonuse of borosilicate glassware is reflected in the precision and recovery data for born and silica in those two sample types.

3) Data obtained from single laboratory method testing are summarized in Table 7 of Method 200.7 for three solid samples consisting of EPA 884 Hazardous Soil, SRM 1645 River Sediment, and EPA 286 Electroplating Sludge. Samples were prepared using the procedure described in Section 11.3. For each method analyte,

the sample background concentration, mean percent recovery of the fortified additions, the standard deviation of the percent recovery, and relative percent difference between duplicate additions were determined as described in Section 13.2. Data presented are for all analytes except cerium, silica and titanium. Limited comparative data to other methods and SRM materials are presented in reference 23 of Section 16.0.

4) Performance data for aqueous solutions independent of sample preparation from a multi-laboratory study are provided in Table 8 of Method 200.7.

5) Listed in Table 9 of Method 200.7 are regression equations for precision and bias for 25 analytes abstracted from EPA Method Study 27, a multi-laboratory validation study of Method 200.7. The equations were developed from data received from 12 laboratories using the total recoverable sample preparation procedure on reagent water, drinking water, surface water and 3 industrial effluents. For a complete review and description of the study see reference 16 of Section 16.0.

POLLUTION PREVENTION See QAPP Section 10.2

WASTE MANAGEMENT See SOP GEN-009

Appendix I

Aluminum
Antimony
Arsenic
Barium
Beryllium
Boron
Cadmium
Calcium
Chromium
Cobalt
Copper
Hardness
Iron
Lead
Lithium
Magnesium
Manganese
Molybdenum
Nickel
Potassium
Selenium
Silicon
Silver
Sodium
Strontium
Thallium
Tin
Titanium
Vanadium
Zinc
Zirconium

APPENDIX A

GLOSSARY

ACCEPTANCE LIMITS – data quality limits specified by the test method or generated by the laboratory. Specified limits placed on an item, process, or service defined in the requirement document.

ACCURACY – a measure of how close a measured value is to a known true value. Accuracy is assessed by means of reference samples and percent recoveries of spiked samples. The degree of agreement between an observed value and an accepted reference value. Accuracy includes combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator.

ALIQUOT – a discrete, measure, or representative portion of a sample taken for analysis.

ANALYTE – the chemical element or compound an analyst seeks to determine; the chemical element of interest.

ANALYTICAL BATCH – the basic unit for analytical quality control, defined as samples that are analyzed together with the same method sequence and the same lots of reagents and with the manipulations common to each sample within the same time period or in continuous sequential time periods. Samples in each batch should be of similar composition (e.g., groundwater, sludge, ash).

ANALYTICAL SAMPLE – any solution or media introduced into an instrument on which an analysis is performed, excluding instrument calibration, initial calibration verification, initial calibration blank, continuing calibration verification, and continuing calibration blank. The following are all analytical samples: undiluted and diluted samples (EPA and non-EPA), predigestion spike samples, duplicate samples, serial dilution samples, analytical spike samples, post digestion spike samples, interference check samples (ICS), CRDL standard for AA(CRA), CRDL standard for ICP(CRI), laboratory control sample(LCS), preparation blank(PB), and linear range analysis sample(LRS).

ANALYST – the designated individual who performs the "hands on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.

AREA UNITS – a term used in gas chromatography that indicates the peak area of a compound exiting a chromatographic column. The size or area of the peak is proportional to the amount of analyte in the sample.

ATOMIC ABSORPTION (AA) – a technique for analyzing metal using an element-specific lamp that emits a characteristic light spectrum. A sample is heated in a flame or graphite furnace and the light beam is passed through it. When the sample absorbs light, an energy loss is detected and is translated into a concentration of metal in the sample. This technique detects one metal at a time.

AUDIT – a systematic check to determine the quality of some function or activity. Two basic types are performance audits and system audits. Perform audits involve a quantitative comparison of the laboratory's results to those of a proficiency sample containing known concentration of analytes. A system audit is a qualitative evaluation that normally consists of an onsite review of a lab's quality assurance system and physical facilities.

BACKGROUND CORRECTION – a technique usually employed relative to metals analysis, which compensates for variable background contribution to the instrument signal in the determination of trace elements.

BATCH – environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A batch is composed of a maximum of twenty environmental samples. A preparation batch is composed of environmental sample of the same matrix, meeting the above-mentioned criteria and with a maximum time between the start of processing the first and last sample in the batch to be 24 hours. An analytical batch is composed of prepared environmental samples (extracts, digestates or concentrates) and/or those samples not requiring preparation, which are analyzed together as a group using the same calibration curve or factor. An analytical batch can include samples originating from various environmental matrices.

BIAS – the deviation of the mean of replicate analytical measurements from a reference analyte concentration. Relative bias is represented by analytical measurement mean minus the reference analyte concentration and the difference divided by the reference analyte concentration. See accuracy and precision.

4-BROMO-FLUOROBENZENE (BFB) – the compound used to check the tuning of the instrument, and is used as a surrogate compound spiked into every sample for volatile analysis. A compound utilized in EPA gas chromatography/mass spectrometry (GC/MS) volatile methods to establish mass spectral instrument performance.

BIOCHEMICAL OXYGEN DEMAND (BOD) – A measure of the amount of oxygen consumed in the biochemical processes that break down organic matter in water. A larger BOD value indicates a greater degree of organic pollution. A related term, BOD5, is the amount of dissolved oxygen consumed in five days.

BIOSEED – the bacterial culture used to inoculate a sample for testing.

BLANK – an artificial sample designed to monitor the introduction of artifacts into the measurement process. For aqueous samples, reagent water is used as a blank matrix. There are several types of blanks, which monitor a variety of processes: 1.)*laboratory blank* is taken through sample preparation and analysis only. It is a test for contamination in sample preparation and analyses. 2.)*storage blank* is stored and analyzed with samples at the laboratory. It is a test for contamination in sample storage as well as sample preparation and analysis. 3.)*trip blank* is shipped to and from the field with the sample containers. It is not opened in the field and, therefore, provides a test for contamination from sample preservation, site conditions, and transport as well as sample storage, preparation, and analysis. It is most commonly used for volatile organics. 4.)*field blank* is opened in the field and tests for contamination from the atmosphere as well as those activities listed under the trip blank.

BNA – base, neutral and acid extractable compounds. The term base, neutral and acid refer to the pH condition of the sample undergoing extraction. Certain compounds extract more efficiently from water under acidic conditions. Such compounds are often referred to as “acid extractables.”

CALIBRATE – to determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter or other device, or the correct value for each setting of a control knob. The levels of the applied calibration standard should bracket the range of planned or expect sample measurements.

CALIBRATION – The systematic determination of the relationship of the response of the measurement system to the concentration of the analyte of interest.

Instrument calibration performed before any samples are analyzed is called the initial calibration. Subsequent checks on the instrument calibration performed throughout analysis are called continuing calibration verification.

CALIBRATION BLANK (CB) – a volume of reagent water in the same matrix as the calibration standards but without the analyte.

CALIBRATION CURVE – the graphical relationship between the known values, such as concentrations, of a series of calibration standards and their analytical response.

CALIBRATION METHOD – a defined technical procedure for performing a calibration.

CALIBRATION STANDARD – a certified material used to calibrate an instrument.

CERTIFIED REFERENCE MATERIAL (CRM) – reference material, one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body. (ISO Guide 30)

CONTINUING CALIBRATION VERIFICATION (CCV) – used to evaluate the performance of the instrument system with respect to a defined set of method criteria. The CCVs are used to verify instrument performance during analysis. The CCV shall be prepared from the same stock standard solution used to prepare the calibration curve.

CHAIN-OF-CUSTODY–Procedures and associated documents designed to trace the custody of a sample from the point of origin to final disposition, with the intent of legally demonstrating that custody remained intact and the tampering or substitutions were precluded.

CHEMICAL OXYGEN DEMAND (COD) – A measure of the oxygen required to oxidize all compounds in water, both organic and inorganic.

COMBINED STANDARD UNCERTAINTY – The standard uncertainty of the analytical measurement result that is the sum in quadrature (square-root-of-the-sum-of-the-squares) of the component standard uncertainties.

CORRECTIVE ACTION – the action taken to eliminate the causes of an existing non-conformity, defect, or other undesirable situation to prevent reoccurrence.

COVERAGE FACTOR – the numerical factor used as a multiplier of the combined standard uncertainty to expand the uncertainty corresponding to a specific level of confidence. The Student's *t*-distribution is used for determining the coverage factor.

DEMONSTRATION OF CAPABILITY (DOC) – a procedure used to establish the ability of the analyst to generate acceptable accuracy.

DEIONIZED WATER (DI) – water from which the majority of ions have been removed. Water that is contaminant free and used in the laboratory, the resistivity should be ≤ 18 mega ohms.

DISSOLVED METALS -- metallic elements determined on a water sample that has been passed through a 0.45-um filter.

DISSOLVED OXYGEN (DO) – the oxygen freely available in water, an indicator of water quality.

DISSOLVED SOLIDS – disintegrated organic and inorganic material contained in water. Excessive amounts make water unfit to drink or use in industrial processes.

DRY WEIGHT – the weight of a sample based on percent solids. The weight of a sample after drying in an oven at a specified temperature.

DUPLICATE MEASUREMENT – a duplicate measurement is a second measurement made on the same or identical sample of material to assist in the evaluation of measurement of variance.

DUPLICATE SAMPLE – two samples taken from the same population and carried through certain stages of sampling and testing. Duplicate sample include field co-located duplicate samples, field-split duplicate samples, and laboratory duplicate subsamples.

EXPANDED UNCERTAINTY – the quantity defining an interval enveloping the analytical measurement that captures a large fraction of the distribution of analyte concentrations that could be attributable to the quantity measured. The combined standard uncertainty is multiplied by the coverage factor to calculate the expanded uncertainty.

EXTERNAL STANDARDS – a method of quantifying chromatographic data in which standards of known concentration are analyzed prior to unknown samples. The chromatographic peak area (or height) of a sample component is compared to a calibration curve of a peak area constructed from the standard data for that component. This comparison allows the concentration of the component in the sample to be determined.

FECAL COLIFORM BACTERIA – bacteria found in mammals' intestinal tracts. Their presence in water or sludge is an indicator of pollution and possible contamination by pathogens.

FLAME IONIZATION DETECTOR (FID) – a gas chromatography detector in which the column effluent gas is mixed with hydrogen and burned in air or oxygen. The ions and electrons produced in the flame generate an electric current proportional to the amount of materials in the detector. The FID responds to nearly all organic compounds, but it does not respond to air and water, which makes it exceptionally suited to environmental analysis.

FLASHPOINT – the lowest temperature at which a flammable liquid gives off sufficient vapor to form an ignitable mixture with air near its surface or within a vessel. Combustion does not continue.

GAS CHROMATOGRAPHY (GC) – a technique for detecting organic compounds by using their physical and chemical properties to separate a mixture. The compounds are identified and quantified with various types of detectors as they exit the chromatograph. Selection of detectors is dependent on the particular compounds of interest.

GAS CHROMATOGRAPHY MASS SPECTROMETRY (GCMS) – a technique in which sample analytes are bombarded with electrons as they exit a gas chromatography column and are fragmented into characteristics ion patterns. The mass spectrometer is the detector. It can determine which fragments are present and therefore the identity of the compounds.

GLUCOSE GLUTAMIC ACID (GGA) – used as a laboratory control standard in BOD procedures.

GRAPHITE FURNACE – a technique used for the analysis of metals. An atomic absorption spectrophotometer heats the sample within a graphite tube using an electrical current. It is also commonly called a flameless furnace and

generally provides greater sensitivity for certain metals than flame or inductively coupled argon plasma techniques.

GRAVIMETRIC - analyses based on the direct or indirect weighing of the analyte in question. This technique usually requires the use of an analytical balance with a sensitivity of 0.1 mg or better.

HALL ELECTROLYTIC CONDUCTIVITY DETECTOR – an element-selective gas chromatography detector primarily intended for trace analysis of organic compounds containing chlorine, nitrogen or sulfur. In operation, this detector pyrolyzes the column effluent gas into soluble electrolytes that are dissolved in a stream of deionized liquid. The observed change in electrical conductivity, proportional to the amount of material present, is measured.

HAZARDOUS WASTE – waste regulated under RCRA that can pose a substantial or potential hazard to human health or the environment when improperly managed. Such wastes possess at least one of four characteristics (ignitability, corrosivity, reactivity, or toxicity) or appear on special EPA hazardous waste lists. The term is not interchangeable with hazardous substances or material.

HEADSPACE - Any area in a container not completely filled by the sample in which gases can collect.

HEAVY METALS – metallic elements with high atomic weights, i.e., mercury, chromium, cadmium, arsenic, and lead. They can damage the health of plants and animals at low concentrations and tend to accumulate in the food chain.

HOLDING TIME – the maximum times that samples may be held before analysis and still be considered valid or not compromised. The storage time allowed between sample collection and sample analysis when the designated preservation and storage techniques are employed.

HYDROCARBONS – chemical compounds that consist entirely of carbon and hydrogen.

ICP – Inductively coupled plasma is a type of instrument used for metals analysis. Because the temperature of the plasma is considerable higher (10,000°K) than the temperature of a flame atomic absorption spectrophotometer, it is especially useful for refractory metals. Some instruments are also capable of performing simultaneous multielement analysis.

ICP-MS - Inductively coupled plasma mass spectrometry (ICP-MS) is a type of mass spectrometry highly sensitive and capable of the determination of a range of metals and several non-metals at concentrations below one part in 10^{12} (part per trillion). It is based on coupling together an inductively coupled plasma as a method of producing ions with a mass spectrometer as a method of separating and detecting the ions. In trace elemental analysis, the method has advantages of high speed, precision and sensitivity.

IGNITABLE – capable of burning or causing a fire.

INORGANIC CHEMICALS – chemical substances of mineral origin, unlike organic chemicals whose structure relies on carbon atoms.

INITIAL CALIBRATION VERIFICATION (ICV) - also referred to as the Independent Calibration Verification for this laboratory. A standard solution used to verify the calibration curve derived from a source independent of the instrument calibration standard. The ICV is use to quantify second source standard variance and bias.

INSTRUMENT CALIBRATION STANDARD - a reference material used to standardize an analytical instrument.

INSTRUMENT DETECTION LIMIT (IDL) - a term utilized in the EPA Inorganic Contract Laboratory Program. The IDL is three times the standard deviation obtained for the analysis of a standard solution (each analyte in reagent water) at a concentration of three to five times that of the IDL on three nonconsecutive days with seven consecutive measurements per day. The IDL is the concentration equivalent to a signal, due to the analyte of interest, which is the smallest signal that can be distinguished from background noise by a particular instrument. The IDL should always be below the method detection limit, and is not used for compliance data reporting, but may be used for statistical data analysis and comparing the attributes of different instruments.

INSTRUMENT PERFORMANCE CHECK - The analyses of one of the ICSs to verified initial and continuing calibration (CCV). The IPC is used to quantify the instrumental testing repeatability variance and bias.

INSTRUMENT TUNING - a technique used in gas chromatography/mass spectrometry procedures to verify that the instrument is properly calibrated to produce reliable mass spectral information. See 4-Bromofluorobenzene under "B".

INTERNAL STANDARDS - compounds added to every standard, blank, matrix spike, matrix spike duplicate, sample (for volatile organics), and sample extract (for semivolatiles) at a known concentration, prior to analysis. Internal standards are used as the basis for quantification of the target compound.

IONIZATION - Utilized in mass spectrometry to fragment analyte molecules into smaller segments. These smaller mass segments are then separated and plotted to form a "mass spectrum" which is used to identify the parent molecule. Electron impact is one example of ionization used in mass spectrometry. In more technical terms. Ionization is the process by which neutral atoms or groups of atoms become electrically charged, either positively or negatively, by the loss or gain of electrons.

ISOMERS - chemical compounds with the same molecular weight and atomic composition by differing molecular structure, e.g., n-pentane and 2-methylbutane.

LABORATORY CONTROL SAMPLE (LCS) - a clean-matrix reference sample spiked with a standard with an established analyte concentration. The LCS is carried through the entire chemical preparation and testing procedures. The LCS is used to quantify the variance and bias of the chemical preparation and instrumental testing stages without matrix interference. Also called a Laboratory fortified blank (LFB).

LABORATORY CONTROL SAMPLE DUPLICATE (LCSD) – a duplicate of the laboratory control sample in a clean matrix that is carried through the entire chemical preparation and testing procedures.

LABORATORY DUPLICATE SAMPLE (LAB DUPLICATE) - a portion of the collected sample that is carried through the chemical preparation and testing. The laboratory duplicate subsample is used to quantify the variance of the chemical preparation and instrumental testing stages with matrix interferences.

LEACHATE - a liquid that results from water collecting contaminants as it trickles through wastes, agricultural pesticides or fertilizers. Leaching may occur in farming areas, feedlots, and landfills, and may result in hazardous substances entering surface water, groundwater or soil.

LDEQ – Louisiana Department of Environmental Quality

LIBRARY SEARCH - a technique in which an unknown mass spectrum of a compound is compared to the mass spectra of compounds contained in a computer library in an

effort to identify the compound. Compounds identified in this manner are referred to as tentatively identified compounds (TICs).

LIMIT OF DETECTION (LOD) – an estimate of the minimum amount of a substance that an analytical process can reliable detect. An LOD is analyte and matrix specific and may be laboratory dependent.

LIMIT OF QUANTIATION (LOQ) – the minimum levels, concentrations, or quantities of a target variable (e.g. target analyte) that can be reported with a specified degree of confidence..

LIMS – laboratory information management system. Horizons is the LIMS used by GCAL.

LINEAR CALIBRATION RANGE – the concentration range over which the instrument response is linear.

LOG-IN - the receipt and initial management of an environmental sample. It generally includes identifying who sent the sample; maintaining chain-of-custody; checking report and invoice information; recording analysis requested, including methodology and special instructions; and assigning a discreet in-lab identification, usually a number or bar code.

MASS SPECTRUM - a plot of ion mass/charge ratio versus intensity. A fragmentation pattern results from the particles whose mass distribution is characteristic of the parent molecule. Qualitative information is provided by a mass spectrum.

MATERIAL SAFETY DATA SHEET (MSDS) - a compilation of information required under the OSHA Communication Standard on the identity of hazardous chemicals and their associated health and physical hazards, exposure limits and precautions.

MATRIX - The physical characteristics or state of a sample – e.g., water, soil, sludge.

MATRIX INTERFERENCE - the influence of the sample matrix or sample components upon the ability of qualitatively identifies and quantitatively measures compounds in environmental samples.

MATRIX MODIFIERS - chemicals added to samples for metals analysis, which are used to lessen the effects of chemical interference, viscosity and surface tension.

MATRIX SPIKE (MS) – aliquot of a sample fortified (spiked) with known quantities of specific compounds and subjected to the entire analytical procedure in order to indicate the appropriateness of the method for the matrix by measuring recovery of the spike. Matrix spiked samples are used to quantify the variance and bias of the chemical preparation and testing stages with matrix interference.

MATRIX SPIKE DUPLICATE (MSD) - a second aliquot of the same matrix as the matrix spike that is spiked to determine the precision of the method.

METHOD DETECTION LIMIT (MDL) - the minimum concentration of compound that can be measured and reported within 99% confidence that the value is above zero and is determined from analysis of a sample in a given matrix containing the analyte.

MUST – denotes a mandatory requirement.

NARRATIVE - in an analytical report, a descriptive documentation of any problems encountered in processing the samples, along with corrective action taken and problem resolution.

NUTRIENT - any substance assimilated by living things that promote growth. The term is generally applied to nitrogen and phosphorus in wastewater, but is also applied to other essential and trace elements.

ORGANIC - generally, any compound that contains carbon bonded to a hydrogen or halogen atom.

OXIDATION - the process in chemistry whereby electrons are removed from a molecule.

PCBs - Polychlorinated biphenyl, a group of toxic persistent chemicals used in transformers and capacitors for insulating purposes and in gas pipeline systems as a lubricant. Sale of PCBs for new uses was banned by law in 1979.

PERCENT RECOVERY - a measure of accuracy that is calculated as the measured value relative to the true value expressed as a percent.

PERFORMANCE AUDIT - a quantitative evaluation of a measurement system that involves the analysis of standard reference samples or materials which are certified as to their chemical composition or physical characteristics.

PROFICIENCY TEST (PT) SAMPLE - a sample of known composition (unknown to the laboratory), provided by an external source, which is used to evaluate lab performance. For certification purposes the PT sample is purchased from an approved provider.

pH - a numerical designation of relative acidity and alkalinity. A pH of 7.0 indicates precise neutrality. Progressively higher values indicate increasing alkalinity and lower values increasing acidity.

POLLUTANT - generally, any substance introduced into the environment that adversely affects the usefulness of a resource.

PRACTICAL QUANTITATION LIMIT (PQL) - the lowest level that can be reliable achieved within specified limits of precision and accuracy routine laboratory operating conditions. The lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value.

PRECISION - a measure of the ability to reproduce analytical results. It is generally determined through the analysis of duplicate samples. The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range in either absolute or relative terms.

PRESERVATIVE - a chemical or reagent added to a sample to prevent or slow decomposition or degradation of a target analyte or a physical process. Physical and chemical preservation may be used in tandem to prevent sample deterioration.

PURGE AND TRAP - a technique used in the analysis of volatile organic where analytes are purged from a sample by means of an inert gas and trapped on a sorbent column. The sorbent is then flashheated and the analytes are transferred onto a gas chromatographic column for separation and identification.

PURGEABLE ORGANIC - an organic compound that is generally less than 20% soluble in water and has a boiling point at or below 200°C. A volatile organic. An organic compound is generally considered to be purgeable if it can be removed from water using the purging process.

QC BASED NESTED APPROACH - a procedure for estimating the uncertainty of measurement using quality control data. The procedure is described in SOP QA-013.

QUALITY ASSURANCE (QA) - all those planned and systematic actions necessary to provide adequate confidence in laboratory results. An integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets the defined standards of quality with a stated level of confidence.

QUALITY ASSURANCE PROGRAM PLAN - a written assembly of management policies, objectives, principle and general procedures that outlines how the laboratory intends to generate data of known and accepted quality.

QUALITY CONTROL (QC) – the overall system of technical activities whose purpose to measure and control the quality of a product or service so that it meets the needs of the users.

QUALITY CONTROL CHART - a graph of analytical measurement results for a specific QC standard plotted sequentially with upper and lower control limits (±3SD). A central line that is the best estimate of the average variable plotted, and upper and lower marginal exceedence limits (±4SD) are usually included in the Quality Control Chart. The chart may also include upper and lower warning limits (±2SD).

QUALITY SYSTEM – a structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items) and services. The quality system provides the framework for planning, implement and assessing work performed by the organization and for carrying out required QA and QC.

r^2 – Correlation Coefficient Squared – paramet6er used to evaluate the fit of linear or quadratic regression curve fit of initial calibration data.

RAW DATA – any original information from a measurement activity or study recorded in a laboratory note book, worksheets, records, memoranda, notes, or exact copies thereof that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data may include photography, microfilm or microfilm copies, computer printouts, magnetic media, including dictated observations, and recorded data from automated instruments.

REACTIVITY - the tendency of a chemical to explode under normal management conditions, to react violently when mixed with water, or to generate toxic gases.

REAGENT WATER - water in which an interference is not observed at or above the minimum quantitation limit of interest.

REFERENCE MATERIAL - a traceable standard with an established analyte concentration. Material or substance whose property values are sufficiently homogenous, stable and well established to be used for the calibration of an apparatus, the assessment of a measurement method or for assigning values to materials (ISO Guide 30)

REFERENCE METHOD – a method of known and documented accuracy and precision issued by an organization recognized as competent to do so.

RELATIVE RETENTION TIME – a measure of the shift in retention time of an analyte when referenced to an internal standard.

RELATIVE RESPONSE FACTOR (RRF) - a measure of the relative mass spectral response of an analyte compared to its internal standard. RRFs are determined by analysis of standards and are used in the calculation of concentrations of analytes in samples.

REPLICATE ANALYSES - two or more results representing the same sample parameter. Replicate analyses are used to quantify the analytical measurement repeatability precision.

RPD – Relative Percent Difference, a relative difference between two analyses calculated by dividing the absolute difference of those two results by the average of their two values, then multiplying by 100.

RESOLUTION - the degree of separation between peaks eluting from a chromatographic column. Sufficient resolution between peaks is required for proper quantitation of unknown analytes.

RETENTION TIME - a term used in gas and liquid chromatography describing the time elapsed from the sample injection until the specific compound elutes or exits the chromatographic column at the detector. Each compound has a characteristics retention time on a specific column; therefore, this information is used to qualitatively identify the compounds in the sample.

SAMPLE – portion of material collect for chemical analysis, identified by a unique number assigned by the LIMS.

SHALL – denotes a requirement that is mandatory whenever the criterion for conformance with the specification requires that there be no deviation. This does not prohibit the use of alternative approaches or methods for implementing the specification so long as the requirement is fulfilled.

SHOULD – denotes a guideline or recommendation whenever noncompliance with the specification is permissible.

SOLID WASTE – non-liquid, non-soluble materials, ranging from municipal garbage to industrial waste, that contain complex, and sometimes hazardous, substances. Solid wastes include sewage sludge, agricultural refuse, demolition wastes, mining residues, and even liquids and gases in containers.

SOLVENT - a substance, usually liquid, capable of dissolving or dispersing one or more other substances.

SPIKE – a known mass of target analyte added to a blank sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.

STANDARD CURVE - a curve that plots concentrations of known analyte standards versus the instrument response to the analyte. Calibration standards are prepared by diluting the stock analyte solution in graduated amounts that cover the expected range of the samples being analyzed. The calibration standards must be prepared by using the same type of acid or solvent at the same concentration as for the samples following sample preparation. This is applicable to organic and inorganic chemical analyses.

STANDARD OPERATING PROCEDURE - a detailed written description of how a laboratory executes a particular procedure or method intended to standardize its performance.

STANDARDIZED REFERENCE MATERIAL (SRM) – a certified reference material produced by the U.S. National Institute of Standards and Technology or other equivalent organization and characterized for absolute content, independent of analytical method.

STANDARD UNCERTAINTY - the analytical measurement uncertainty expressed as a standard deviation. The relative standard deviation represents the relative standard uncertainty.

SURROGATE - an organic compound similar to the analyte of interest in chemical composition, extraction and chromatography, but not normally found in environmental samples. Primarily used in chromatography techniques, the surrogate is spiked into quality control blanks, calibration and check standards, samples (including duplicated and QC reference samples) and spiked samples before analysis. A percent recovery is calculated for each surrogate.

SUSPENDED SOLIDS - small pollutant particles that float on the surface of, or are suspended in, sewage or other liquids. They resist removal by conventional means.

TARGET COMPOUND - specific compounds that are to be quantified in a sample based on a standard list of potential compounds.

TENTATIVELY IDENTIFIED COMPOUNDS (TICs) - compounds detected in samples that are not target compounds, internal standards, system monitoring compounds or surrogates. TICs usually consist of up to 30 peaks that are greater than 10% of the peak areas, or heights, of the nearest internal standard. They are subjected to mass spectral library searches for tentative identification. A client may specify the number of unknown peaks in its samples it wishes the laboratory to tentatively identify.

TOTAL METALS - metallic elements that have been digested prior to analysis.

TYPE A EVALUATION UNCERTAINTY - the method of evaluation of uncertainty by the statistical analysis of a series of test results.

TYPE B EVALUATION OF UNCERTAINTY - the method of evaluation of uncertainty by means other than statistical analysis.

UNCERTAINTY - the parameter associated with the analytical measurement results that characterizes the dispersion of the values that could be reasonable attributed to the quantity measured.

UNCERTAINTY INTERVAL - the range of analyte concentrations that an analytical measurement could represent at a specified level of confidence. The relative standard deviation is used to represent the relative standard uncertainty in the QC-based Nested Approach.

VALIDATION –the process for evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, or contractual specifications. It essentially evaluates performance against predetermined specifications.

VOA - volatile organic analysis

VOA BOTTLE - a vial used to contain samples for volatile organic analysis.

VOLATILE COMPOUNDS - compounds amendable to analysis by purge and trap. Synonymous with purgeable compounds.

VOLATILE ORGANIC COMPOUND (VOC) - any organic compound that participates in atmospheric photochemical reactions, except for those designated by the EPA Administrator as having negligible photochemical reactivity.

WET CHEMISTRY - procedures that involve distillations, colorimetric determinations and titrimetric measurements. Examples are chloride, nitrates, sulfates and biochemical oxygen demand.

STANDARD OPERATING PROCEDURE FOR ICP WATER PREPARATION	REVISION NO. 14

SUBJECT — SCOPE AND APPLICATION

This digestion procedure is designed for the preparation of aqueous samples, TCLP extracts and EPTOX extracts. This is a vigorous digestion with nitric and hydrochloric acid for the determination of total metals by inductively coupled plasma spectroscopy (ICP).

MATRIX — Water

REFERENCES — SW846 3010A

PRESERVATION — Dissolved Metals -- Filtered through a 0.45 µm membrane filter then HNO_3 to pH <2, analyst must wait at least 24 hours before digesting the sample
Total Metals -- HNO_3 to pH <2

SAMPLE COLLECTION — Samples may be collected and stored in plastic or glass containers.

HOLDING TIMES — Dissolved Metals - 6 months
Total Metals - 6 months

DEFINITIONS — See SOP GEN-016

SAFETY — Each employee is directly responsible for complete awareness of all health hazards associated with every chemical that he/she uses. The employee must be aware of these hazards and all associated protective wear and spill clean-up procedures PRIOR TO the use of any chemical. In all cases, the applicable material safety data sheet (MSDS) and your supervisor or safety officer should be consulted. The bottle labels also provide important information that must be noted. Personnel performing this procedure may be working with flammables, poisons, toxins, carcinogens, teratogens, mutagens, and biohazards. In particular, approved gloves, safety glasses, and lab coats must be worn. In addition to other measures prescribed by the division, solvents must be handled in ventilated hoods.

APPARATUS — 250 mL beakers
Ribbed and plain watch glasses
50 mL graduated cylinders
Specimen containers
Hot Plate

CPI Mod Block – Digestion Block
70 mL Digestion Tubes
Mechanical pipet and clear plastic pipet tips
Wide range pH paper

REAGENTS AND STANDARDS

Label all containers and squeeze bottles with reagent ID, lot, and expiration date.
All standards used are pure material or from prepared certified solutions. The certificate of analysis shall be kept on file. Follow manufacturer's instruction for standard expiration and storage. Label all working standards using completed standard labels.
Nitric Acid -- Trace Metal grade
HCl -- Trace Metal grade
Spiking Solution for samples and LCS
GCAL-1: certified custom solution
GCAL-2: certified custom solution
ICP-MS spike: certified custom solution
Deionized water

PROCEDURE

BLOCK DIGESTION SYSTEM

1. Record all sample information in the metals preparation form (attached).

2. Measure 50 mL of a homogenized sample in a 70 mL digestion tube labeled with sample number, date, and prep for all TCLP liquid and aqueous samples. For TCLP organic liquids measure 5mL of sample. Add 1.5 mL concentrated HNO_3 and cover with ribbed watch glass or equivalent.

3. Place tubes in the digestion block. Select Block A or B. Set temperature to the required setting for a temperature of 90-95°C. "B" key for up and "E" key for down. When the desired temperature is reached; Press Enter (C key): 2 hours will show for timer; Press Enter (C key): start time will show; Press Enter (C key): Block will heat to 95°C and maintain heat for 2 hours. Place a thermometer in an uncovered digestion tube to monitor temperature. Record the temperature in the MOD Block Temperature Logbook.

4. Evaporate to about 5 mL without boiling. (Heat may be increased to get a gentle reflux.)

5. Allow sample to cool. Add 1.5 mL of concentrated HNO_3.

6. Reflux and add additional HNO_3 until the reaction is complete. Reaction is completed when it is odorless and clear.

7. Evaporate to small volume, cool and add 5 mL of 1:1 HCl (1mL 1:1 HCl per 10mL of final solution).

8. Reflux 15 minutes.

9. Cool and adjust final volume to 50 mL with DI H_2O.

10. The sample is now ready for analysis. Deliver to the metals laboratory with a copy of the prep log.

QUALITY CONTROL

With each batch twenty or fewer samples, the following will be digested:

a. Method Blank (BLK) - DI + reagents

b. Laboratory Control Sample (LCS) - DI + reagents - add 0.25 mL of GCAL-1 and 0.25 mL of GCAL-2 for analysis by ICP-AES. (Check to be sure all elements requested to be run are contained in the spiking solutions. If not, add them separately from stock solutions.) For ICP-MS add 0.25 mL of ICP-MS standard.

c. Method Blank (extracted blank for TCLP) – TCLP extracts only

d. Duplicate sample

e. Matrix Spike - add 0.25 mL of GCAL-1 and 0.25 mL of GCAL-2 for analysis by ICP-AES. (Check to be sure all requested elements are contained in the spiking solutions. If not, add them separately from stock solutions.) For ICP-MS add 0.25 mL of ICP-MS standard.

f. Matrix Spike Duplicate (performed only if required for a project or requested by the client) - add 0.25 mL of GCAL-1 and 0.25 mL of GCAL-2 for

analysis by ICP-AES. (Check to be sure all requested elements are contained in the spike solutions. If not, add them separately from stock solutions.) For ICP-MS add 0.25 mL of ICP-MS standard.

g. Record the laboratory ID for all standards and reagents in the logbook.

h. Specific projects may require additional or specific QC, and must be followed for applicable samples. See Sop GEN-019.

METHOD PERFORMANCE 3010A
No Data Provided

POLLUTION PREVENTION See QAPP Section 10.2

WASTE MANAGEMENT See SOP GEN-009

STANDARD OPERATING PROCEDURE FOR IGNITIBILITY OF SOLIDS	REVISION NO. 4

GULF COAST ANALYTICAL LABORATORIES, INC.
WET LAB
STANDARD OPERATING PROCEDURE

PROCEDURES: WL-066
PAGES: 1 OF 5
EFFECTIVE DATE: 03/10/11
APPROVED BY:
QA/QC APPROVED:

SUBJECT	SCOPE AND APPLICATION A burn rate mold is used to determine the ignitibility of solids. Soil and solid samples are analyzed by this procedure to determine if the solid waste “when ignited, burns so vigorously and persistently that it creates a hazard”.
SUMMARY	In a preliminary test, the sample is formed into an unbroken strip 250 mm long. A constant flame is directed into the strip. Materials that the flame propagates along 200 mm within the specified time are subject to a burn rate test in which the burning time is measured over a distance of 100 mm.
MATRIX	Solid
REFERENCES	SW846 1030
PRESERVATION	None
HOLDING TIME	None specified
SAMPLE COLLECTION	Sample containers should be completely filled and tightly sealed to preserve the sample integrity.
SAMPLE CHAIN OF CUSTODY	Wet laboratory personnel scan the barcode of the sample out for analysis in the LIMS to transfer internal custody of the sample. When the analysis is complete, Login personnel will scan the samples back to the cooler to complete the internal chain of custody. See QAPP Chapter 8 for more details.
DEFINITIONS	See SOP GEN-016
SAFETY	Use hood, gloves and safety glasses. Have a fire extinguisher available and a container for sample disposal. A small portion (1g or less) of sample should be tested for explosion risk.
INTERFERENCES	Variations in airflow rates, particle size, and moisture

content of the test material can affect the test results. As a result, at least triplicate determinations of the burning rate should be conducted. Also, the analyst should make all efforts to perform triplicate analysis on a homogeneous sample that should yield similar particle sizes and moisture content.

REAGENTS None

APPARATUS
Powder train mold with ceramic tile
Disposal container labeled as flashpoint waste
Torch – Bernzomatic TS2000 – Temperature 3450°C (Method requires at least 1000°C
Propane cylinders
Fire extinguisher
Thermometer to measure room temperature
Anemometer to measure hood flow
Stop Watch
Aluminum pans
Thermolyne model AY589X1 digital thermometer
Thermocouple Model TC-405X2

PROCEDURE PRELIMINARY SCREENING TEST

1. Record the ambient temperature in the logbook. Prior to performing this preliminary screening test, place one gram or less of the sample in an aluminum pan. Pass the torch flame approximately 1 to 1½ inches above the sample to determine if the sample poses an explosion risk. If the sample displays explosivity or extreme flammability, do not conduct this test.

2. Allow the sample to warm to room temperature, then fill the test mold with the material (as received).

3. Place the ceramic tile on the guide pegs on top of the mold with the measuring markings facing down.

4. Place the tile inside a fume hood 20 cm from the front sash perpendicular to the air flow. Confirm that the airflow is approximately 0.7 meters/second or 140 feet/minute.

5. Light the torch. Using the thermocouple, verify that the tip of the flame is a minimum of 1000°C.

6. Apply the tip of the flame to the tip of the test strip. The test time will depend on the sample matrix as follows:

A. If the waste is non-metallic, hold the flame tip on the sample strip until ignition occurs or for a maximum of 2 minutes. If ignition occurs, begin timing and note whether the combustion propagates up to the 20 cm mark within 2 minutes.

B. If the waste is a metal or metal alloy powder, hold the flame tip on the sample strip until ignition occurs or for a maximum of 5 minutes. If ignition occurs, begin timing and note whether the combustion propagates up to the 20 cm mark within 20 minutes.

7. If the waste does not ignite and propagate combustion along 20 cm of sample strip within the 2 or 20 minute test periods, the waste is not considered flammable and no further testing is required.

8. If the waste failed the preliminary screening test by propagating along the 20 cm within the appropriate time period, the burn rate test must be performed.

BURNING RATE TEST – Should be performed in triplicate for all samples that fail the preliminary screening test.

1. Wastes in a powdered or granular state are formed into another mold 25 cm long on the ceramic tile. For pasty wastes, form a rope of sample 25 cm long with a cross-section of 1 cm^2.

2. Position the ceramic tile in the fume hood as done previously.

3. Ignite the torch. Using the thermocouple, verify the tip of the flame is a minimum of 1000^oC. Apply the tip of the flame to one end of the sample strip to ignite the test strip.

4. Record the amount of time it takes for the test strip to burn from the 8 cm mark to the 18 cm mark. Record the time in seconds.

CALCULATIONS

$$\text{Burn Rate mm/sec} = \frac{100 \text{ mm (10 cm)}}{\text{Time (seconds)}}$$

If the burn rate is 2.2 mm/sec, the waste is considered to have a positive result for ignitibility. For metals or metal alloys, a burn rate of 0.17 mm/sec is considered positive.

DETECTION LIMIT Not applicable

QUALITY CONTROL All tests must be conducted on a clean ceramic tile at room temperature. Test conditions must be kept constant, including airflow, ambient temperature, sample position in hood, and torch flame temperature.

Triplicate Analysis – should agree with 25% RPD of the calculated burn rate. Use the average of the 3 results to determine the Pass/Fail criteria. If the 25% RPD criteria are not met across the range of the results, the analyst should review individual results for Pass/Fail criteria. If all 3 results pass the criteria, then the result can be reported as passing. If all three results fail criteria, then the result can be reported as failing; however, if the 3 results are mixed, analysis should be repeated until 3 pass or 3 fail results are obtained.

METHOD PERFORMANCE An independent laboratory validation was conducted on the robustness of the burn rate test procedure. The materials selected for this evaluation included:

1. A 50/50 mixture of metallic silicon and lead dioxide (PbO_2)
2. Excelsior
3. Dextrin (yellow powder)
4. Sulfur (fine yellow powder)
5. Magnesium metal (coarse)
6. Aluminum metal (coarse)
7. Polyethylene high density (granular)
8. Polyethylene low density (fluffy white powder)
9. Scott fertilizer (32-3-10:N-P-K)
10. JP-4 contaminated soil (approximately 5000 ppm)

Of these materials, the 50/50 mixture of metallic silicon and lead dioxide (PbO_2), elemental sulfur, and excelsior were considered to give a positive ignitibility result under the conditions of the test. The remaining materials gave negative results under the conditions of the test. Several test variables including ignition source, ambient temperature, and apparatus orientation were studied using these materials. Partial results of this study are summarized in Table 1 of the method.

In another evaluation of the DOT burn rate test, potentially ignitable finishing wastes from the furniture industry were collected and tested for burning rates. Each waste was

tested in triplicate to establish a mean value for the burning rate. The results for the flammable wastes are summarized in Table 2 of the method.

In order to evaluate the ruggedness of the DOT burn rate test, select ignitable finishing wastes were split and tested by a state laboratory and an independent contract laboratory. The results of this comparison are summarized in Table 3 of the method.

POLLUTION PREVENTION — See QAPP Section 10.2

WASTE MANAGEMENT — See SOP GEN-009

GULF COAST ANALYTICAL LABS
METALS
STANDARD OPERATING PROCEDURE

PROCEDURE: MET-008
PAGE: 1 OF 8
EFFECTIVE DATE: 09/21/10
APPROVED BY:
QA/QC APPROVED:

SUBJECT

SCOPE AND APPLICATION

This procedure is used for the determination of dissolved or total mercury in aqueous samples, TCLP extracts, EPTOX extracts, Industrial Hygiene samples, soils, solids, and domestic and industrial wastes by the cold vapor atomic absorption technique. A digestion procedure is required for all samples and standards.

A prepared sample enters the system and is mixed with a reducing agent (stannous chloride) to form elemental mercury vapor. The mixture flows into a liquid-gas separator where argon is introduced to carry the mercury vapor through the PTFE-Membrane Filter for water vapor removal. The dry vapor enters the optical cell. The mercury lamp delivers a stable source of emission at 254 nm. Absorbance by the mercury cold vapor is measured using a photocell detector with a wide dynamic range.

MATRIX

Water and Solids

REFERENCES

EPA Method 245.1/245.2
SW846 Methods 7470A and 7471B
Perkin Elmer FIMS 400 Instrument Manual

PRESERVATION & HOLDING TIME

Aqueous Samples:
Dissolved Hg - Filtered, HNO_3 to pH <2, 28 days
Total Hg - HNO_3 to pH <2, 28 days

TCLP/EPTOX Hg - 4°C, 28 days from field collection to extraction, 28 days from digestion to analysis

Solid Samples - 4°C, 28 days

SAMPLE COLLECTION

Samples may be collected and stored in plastic or glass containers.

DEFINITIONS

See SOP GEN-016

SAFETY

Each employee is directly responsible for complete awareness of all health hazards associated with every chemical that he/she uses. The employee must be aware of these hazards, and all associated protective wear and spill clean-up procedures PRIOR TO the use of any

chemical. In all cases, the applicable material safety data sheet (MSDS) and your supervisor or safety officer should be consulted. The bottle labels also provide important information that must be noted. Personnel performing this procedure may be working with flammables, poisons, toxins, carcinogens, teratogens, mutagens, and biohazards. In particular, approved gloves, safety glasses, and lab coats must be worn. In addition to other measures prescribed by the division, solvents and chemicals must be handled in ventilated hoods.

APPARATUS

Perkin Elmer FIMS 400 Mercury Analyzer with computer and printer

Pump tubing: sample, drain assembly, reductant, carrier

Autosampler standard cups and sample tubes

100 mL volumetric flasks

INTERFERENCES

1. Sulfide -- Interferences from concentrations as high as 20 mg/L sulfide are eliminated by adding potassium permanganate.

2. Copper can interfere at concentrations above 10 mg/L.

3. High chloride concentrations in seawaters, brines, and industrial effluents require additional permanganate. During the oxidation step, free chlorine is formed and absorbs radiation at 253.7 nm.

4. Certain volatile organic materials absorb at 253.7 nm. Additional permanganate may help to reduce the interference. A smaller sample size may be digested.

REAGENTS AND STANDARDS

10% HCl for rinse bath

Stannous chloride -- 20 g stannous chloride in 5% HCl (trace metal grade) diluted to 2 liter for a 1% solution. Mix well to dissolve the stannous chloride.

Sodium chloride - hydroxylamine sulfate solution:
Dissolve 120g of sodium chloride and 120g of hydroxylamine sulfate in deionized water and dilute to 1 liter.

3% HCl solution for carrier

1000 mg/L stock standard (commercially obtained)

1 mg/L mercury working standard - Add 100 ul of the stock standard to a 100 ul volumetric flask. Dilute to volume with 2% HNO_3. Record this information in the standard preparation logbook. This standard should be prepared every two weeks.

Second source stock standard (commercially obtained) is used to prepare a 1 mg/L standard for independent verification of the calibration standard (ICV).

PROCEDURE

1. Open the FIMS 400 software by double clicking on the AAWINLAB icon. Turn Hg lamp on. Allow the lamp to warm up for at least 30 minutes.

2. Check pump tubing on the motor. Change sample tubing daily. Change reductant, carrier, and waste tubing as needed.

3. Wash and acid rinse the rinse bath and fill with 10% HCl as needed.

4. Place reductant tube into the container of stannous chloride.

5. Place the carrier tube into the container of 3% HCl.

6. Change the filter on the liquid gas separator as needed.

7. Adjust the argon flow to 80-100 psi.

8. Prepare a bench sheet -- record the laboratory ID for the each calibration standard, the ICV, the stannous chloride and the sodium chloride -- hydroxylamine solution. The bench sheet used is attached.

9. Prepare digested standards and samples for analysis by adding 4 mL of sodium chloride-hydroxylamine sulfate solution to reduce the excess permanganate (Decolorize).

10. Add standards to the standards rack. See autosampler layout diagram for positions. Standards and their positions are: 0.0 ug/L (blank)-1; 0.2 ug/L-2; 0.5 ug/L-3; 2.0 ug/L-4; 5.0 ug/L-5; 10.0 ug/L-6.

11. Fill sample tubes with the following quality control samples:

Position	Standard
9	5 ug/L - Independent Source (ICV)
1	0.0 (ICB)
5	CCV
1	CCB

12. Fill sample tubes with samples (3 - 2 inch from top) and place in the position in the rack corresponding to their positions on the bench sheet.

13. To type in sample descriptions for analysis, bring up the sample information file. Type in the sample ID next to the corresponding autosampler location. Autosampler positions available for the Perkin Elmer AS-90 are 17 to 106. Save the sample information file, and then close this window.

14. Open the automated analysis window and select the mercury method to be used. Type in the autosampler locations to be analyzed, and select the result data set to be used.

15. Select the analyze tab at the bottom of the automated analysis window. Click on analyze all to calibrate, and then run samples.

SHUT DOWN PROCEDURE

1. Let instrument run for a few minutes after the last sample is completed.

2. Turn off the lamp.

3. Refill the rinse bath.

4. Dispose of the standard and sample remaining in the tubes. Pour in the metals waste container.

QUALITY CONTROL

1. The correlation coefficient should be >/= 0.9995. If the calibration results are unacceptable, rerun the standards to verify results. Prepare new calibration standards if necessary. When acceptable results are achieved, accept the calibration.

2. The ICV recovery must be 95-105% for EPA methods 245.1/245.2 or 90-110% for SW846 7470A/7471B.

3. A CCV and CCB will be analyzed every 10 samples. The CCV recovery must be 90-110% for EPA methods 245.1/245.2 or 80-120% for SW846 method 7470A/7471B. Please note that for Marathon samples by all methods, the CCV recovery must be 90-110%. If a CCV is outside control limits, the previous ten samples must be reanalyzed. The CCB must be less than 1/2 the reporting limit and >2X the - reporting limit. The results may be reported with a narrative if the associated samples do not have a hit.

4. A Laboratory Control Sample (LCS) is prepped with each batch of 20 samples. A Laboratory Control Sample Duplicate (LCSD) is prepped if required for the project or if insufficient sample is available for a duplicate or MS/MSD. The recovery must be 85-115% for methods EPA 245.1/245.2 or 80-120% for methods SW846 7470A/7471B. The LCS/LCSD RPD should be <20%. If the recovery is outside the control limits, all samples in the batch must be re-digested and re-analyzed.

5. A matrix duplicate is prepped with every 20 samples. A The RPD for duplicates should be <20% unless the sample concentrations are less than five times the detection limit or the sample matrix is nonhomogeneous.

6. Matrix spike (MS) and matrix spike duplicate (MSD- if required for project) recoveries should be 75-125%. For DOD projects, the MS control limits are

the same as the LCS control limit for each applicable method. The MS/MSD RPD should be <20%. If the recovery is outside these limits, the data should be flagged. A spike is not applicable if the sample concentration is greater than 4 times the spike level. If a TCLP extract spike recovery for a regulated metal is <50% and the sample concentration is within 20% of the regulatory level the sample must be reanalyzed by the method of standard additions. Dilutions may be performed to eliminate an interference that may cause unacceptable spike recoveries. If recoveries are improved by the dilution, the original sample must also be diluted. It may also be necessary to re-digest a diluted aliquot of the sample.

7. If the apparent concentration of a sample is greater than the highest calibration standard, the sample should be diluted and rerun.

8. Dilution Test - Perform a 5x dilution on one sample per batch, generally on the sample used for the MS. For the test to be applicable, the concentration should be greater than 50 times the MDL. The neat sample concentration and five times the diluted sample concentration should agree within 10%. If not, a chemical or physical interference should be suspected.

9. Additional project specific criteria may apply to projects and may be more stringent. See SOP GEN-019, and check with project manager for additional guidance.

MAINTENANCE

1. Change reductant and drain tubing as needed.

2. Replace mercury lamp as needed. (Average life -- 4 months to 1 year) A transmittance value of <400,000 for the reference intensity and sample intensity in systems diagnostics indicates a weak lamp.

3. Clean the optical cell and lenses as needed. Relative absorbances of standards may differ significantly from previous calibrations when the cell is dirty.

4. Replace the liquid gas separator every 1-3 years.

5. Record all maintenance in the instrument maintenance logbook.

6. Call Perkin Elmer Service Department for specific troubleshooting guidelines that may require specialized maintenance.

CALCULATIONS

1. For Waters or TCLP extracts --

Sample Concentration in ug/L = instrument reading x d
Sample Concentration in mg/L = A x d

A = ug/L analyte in processed sample/1000
d = dilution factor (if required)

The raw data units are in ug/L - divide by 1000 to convert to mg/L.

2. For Solids

$$\text{Sample Concentration in mg/kg} = 30 \times \frac{A \times d}{W}$$

A = mg/L analyte in processed sample
W = initial weight of sample (g)
d = dilution factor (if required)
30 = final volume (prep)

The raw data units are in ug/L - divide by 1000 to convert to mg/L.

3. Sample concentration -- Industrial Hygiene Samples

Total ug analyte in sample = A x 50 mL x d

A = ug/mL (mg/L) analyte in processed sample
50mL = final volume of sample
d = dilution factor (if required)

4. Matrix spike recovery

$$\% \text{ Recovery} = \frac{(SSR - SR)}{SA} \times 100$$

5. Matrix Duplicate Relative Percent Difference (RPD)

$$RPD = \frac{|SR - SDR|}{} \times 100$$

$$\frac{(SR+SDR)}{2}$$

SR = Sample result
SDR = sample duplicate result
(SR+SDR) = average of SR and SDR

SOFTWARE TROUBLESHOOTING

The Perkin Elmer FIMS 400 Mercury Analyzer utilizes Perkin Elmer software WINLAB32 version 6.0.0.0065 to control the instrument and perform all data calculations. In the event of software malfunction, please contact Perkin Elmer technical support or GCAL's IT Director for troubleshooting help.

REPORTING LIMITS

Waters: 0.0002 mg/L
Solids: 0.01 mg/kg

METHOD PERFORMANCE

1) In a single laboratory (SEWL), using distilled water standards at concentrations of 0.5, 1.0, 2.0, 5.0, 10.0 and 20.0 ug Hg/L, the standard deviations were ±0.04, ±0.07, ±0.09, ±0.020, ±0.40 and ±0.84 ug/L, respectively.

2) In a single laboratory (SEWL), using surface water samples spiked with ten organic mercurials at the 10 ug/L level, recoveries ranged from 87 to 117%. Recoveries of the same ten organic mercurials in distilled water at the 10 ug/L level, ranged from 92% to 125%.

3) The following standard deviations on replicate sediment samples were recorded at the indicated levels; 0.29 ug/G ±0.02 and 0.82 ug/G ±0.03. Recovery of mercury at these levels, added as methyl mercuric chloride, was 97% and 94%, respectively.

POLLUTION PREVENTION

See QAPP Section 10.2

WASTE MANAGEMENT

See SOP GEN-009

STANDARD OPERATING PROCEDURE FOR SAMPLE PREPARATION - MERCURY	REVISION NO. 19

GULF COAST ANALYTICAL LABS
METALS
STANDARD OPERATING PROCEDURE

PROCEDURE: MET-006
PAGE: 1 OF 6
EFFECTIVE DATE: 05/19/10
APPROVED BY:
QA/QC APPROVED:

SUBJECT	SCOPE AND APPLICATION
	These digestion procedures are used for the preparation of aqueous samples, TCLP extracts, EPTOX extracts, soils, solids, and domestic and industrial wastes for mercury analysis.
MATRIX	Water and Solid
REFERENCES	EPA-245.1/245.2 SW846-7470A/7471B
PRESERVATION & HOLDING TIME	Aqueous Samples: Dissolved Hg - Filtered, HNO_3 to pH <2, 28 days Total Hg - HNO_3 to pH <2, 28 days TCLP/EPTOX Hg - 4°C, 28 days from field collection to extraction, 28 days from digestion to analysis Solid Samples - 4°C, 28days
SAMPLE COLLECTION	Samples may be collected and stored in plastic or glass containers.
DEFINITIONS	See SOP GEN-016
SAFETY	Each employee is directly responsible for complete awareness of all health hazards associated with every chemical that he/she uses. The employee must be aware of these hazards, and all associated protective wear and spill clean-up procedures PRIOR TO the use of any chemical. In all cases, the applicable material safety data sheet (MSDS) and your supervisor or safety officer should be consulted. The bottle labels also provide important information that must be noted. Personnel performing this procedure may be working with flammables, poisons, toxins, carcinogens, teratogens, mutagens, and biohazards. In particular, approved gloves, safety glasses, and lab coats must be worn. In addition to other measures prescribed by the division, solvents and chemicals must be handled in ventilated hoods.

REAGENTS AND STANDARDS

Deionized water - monitored daily
Concentrated Sulfuric Acid (H_2SO_4) - trace metals grade
Concentrated Nitric Acid (HNO_3) - trace metals grade
Concentrated Hydrochloric Acid (HCl)
Aqua Regia: Prepare immediately before use by carefully adding three volumes of concentrated Hydrochloric acid to one volume of Nitric acid.
5% Potassium Permanganate - dissolve 5g of Potassium Permanganate in 100mL of DI water
5% Potassium Persulfate - dissolve 5g of Potassium Persulfate in 100mL of DI water
1 mg/L Hg working standard - prepared by the metals laboratory monthly
0.1 mg/L Mercury working standard - prepared by the metals laboratory daily

APPARATUS

70 mL Digestion tubes
Mechanical pipette - clear, plastic pipette tips, accuracy of 2%
50 mL graduated cylinder
CPI Mod Block - Digestion block
Electronic balance capable of weighing to 0.01g
Teflon boiling beads (or equivalent)

PROCEDURE

Aqueous, TCLP extracts, EPTOX extracts (except organic samples)

1. Prepare a page in the metals preparation sheet. Record sample ID's.
2. Label each digestion tube with sample ID, date, and matrix.
3. Shake sample well and measure 20 mL of homogenized sample in the digestion tube. Prepare all QC samples as listed in the Quality Control Section.
4. Add 1.0 mL of H_2SO_4 and 0.5 mL concentrated HNO_3 mixing after each addition.
5. Add 3 mL of 5% Potassium Permanganate solution. Shake and let stand for 15 minutes to ensure the purple color persists. Add additional Potassium Permanganate solution if necessary and record additional volume on prep log.
6. Add 2 mL Potassium Persulfate solution and heat at 95°C for 2 hours.
7. Perform steps #1-#6 for 20 mL aliquots of a blank (deionized water), 10 µg/L, 5 µg/L, 2 µg/L, 0.5 µg/L, and 0.2 µg/L calibration standards and a 5

µg/L independent calibration verification standard. Calibration standards are prepared using a 0.1 ppm stock solution which is prepared fresh on the day the calibration curve is digested.

The mercury calibration curve is prepared as follows:

	0.2 µg/L	: 40 µL	0.1 ppm	calibration standard
	0.5 µg/L	: 100 µL	0.1 ppm	calibration standard
	2.0 µg/L	: 400 µL	0.1 ppm	calibration standard
	5.0 µg/L	: 1000 µL	0.1 ppm	calibration standard
	10.0 µg/L	: 2000 µL	0.1 ppm	calibration standard
ICV	5.0 µg/L	: 1000 µL	0.1 ppm	independent standard

Dilute these solutions to 20 mL with deionized water.
Multiple aliquots of each standard may be prepared.

8. Release sample to the metals laboratory. Sodium Chloride-hydroxylamine sulfate will be added in the analytical laboratory.

Solids, Soils, Domestic and Industrial Wastes (except organic samples)

1. Prepare a page in the metals preparation sheet. Record sample ID's.
2. Label each digestion tube with sample ID, date and matrix.
3. Homogenize sample by pouring the contents of the sample onto a piece of butcher paper, chop and mix with a tongue depressor or spatula. Remove any foreign object such as sticks, leaves, or rocks. Weigh 0.50g - 0.60g of the homogenized sample and place in the digestion tube. A minimum weight may be required to meet the project required detection limit. Check with the metals supervisor or project manager to determine if a minimum weight is required. Record the weight to the nearest 0.01 g in the prep sheet. Prepare QC samples as listed in the quality control section.
4. Add 5 mL of DI water and add 5 mL of Aqua Regia. Cap digestion tube and use a small knife to cut a slit in the cap.
5. Heat the sample at 95°C for 2 minutes.
6. Cool and add 30 mL DI water and 15 mL 5% Potassium Permanganate solution, mix thoroughly. Add

additional Potassium Permanganate as needed to maintain purple color. Record additional volume added on prep sheet.

7. Digest the sample for 30 minutes at 95°C.
8. Perform steps 4-7 for 30 mL aliquots of blank (deionized water), 10 µg/L, 5 µg/L, 2 µg/L, 0.5 µg/L, and 0.2 µg/L calibration standards and a 5µg/L independent calibration verification standard. Calibration standards are prepared using a 0.1 ppm solution which is prepared fresh on the day the calibration curve is digested.

   The mercury calculation curve is prepared as follows:

	0.2 µg/L	: 60 µL	0.1 ppm calibration standard
	0.5 µg/L	: 150 µL	0.1 ppm calibration standard
	2.0 µg/L	: 600 µL	0.1 ppm calibration standard
	5.0 µg/L	:1500 µL	0.1 ppm calibration standard
	10.0 µg/L	:3000 µL	0.1 ppm calibration standard
ICV	5.0 µg/L	:1500 µL	0.1 ppm independent standard

   Dilute these solutions to 30 mL with deionized water. Multiple aliquots of each standard may be prepared.

9. Release samples to the metals laboratory. Sodium Chloride-hydroxylamine sulfate will be added in the analytical laboratory.

Organic samples including TCLP Liquid extracts and UTS Liquid extracts: The procedure has been modified to more thoroughly digest samples of this matrix type.

1. Prepare a page in the metals preparation sheet. Record sample ID's.
2. Label each digestion tube with sample ID, date, and matrix.
3. Weigh 0.5 - 0.6g (Total Hg), 0.5 mL (TCLP or UTS Hg) of well-mixed sample and place in digestion tube. Record sample weight to the nearest 0.01g in prep sheet. Prepare QC samples as listed in the Quality Control Section.
4. Add 5 mL of concentrated HNO_3 and 5 mL of concentrated HCl. Cap digestion tube and use a small knife to cut a slit in the cap.
5. Heat in the Mod Block until the fumes are clear or unchanging. Additional acid may be added to complete the digestion.

6. Add 30 mL of deionized water.
7. Add 15 mL Potassium Permanganate solution and mix thoroughly.
8. Digest 30 minutes at 95°C.
9. Remove from the digestion block and allow to cool.
10. These will be analyzed using calibration standards prepared by the solid digestion procedure.
11. Release sample to the metals laboratory. Sodium Chloride-hydroxylamine sulfate will be added in the analytical laboratory.

QUALITY CONTROL

1. Batches will be defined by sample matrix:
   Aqueous
   TCLP extracts
   EPTOX extracts
   Soils/Sludges
   Oily wastes
   Client specific batch

2. Prepare a reagent blank with each batch of samples (20 or fewer samples). A method blank using filtered deionized water (liquid TCLP) or the appropriate extraction fluid is used for extracts. Reagent blanks for solids prepare by weighing approximately 0.6 g of Teflon boiling beads. Document the exact weight.

3. Prepare a matrix duplicate for every 20 samples.

4. Prepare a matrix spike (MS) for every 20 samples. A matrix spike duplicate (MSD) will be prepared if required for the project.

   Aqueous/extracts - add 100 µL of the 1 mg/L Hg standard (5 µg/L)

   Non-Aqueous - add 150 µL of the 1 mg/L Hg standard (5 µg/L in solution)

5. Prepare a laboratory control standard (LCS) with every 20 samples. A laboratory control standard duplicate (LCSD) will be prepared if required for the project or if insufficient sample is available for a matrix duplicate or MS/MSD.

   Aqueous/extracts
   Add 100 µL of the 1 mg/L working standard (5

µg/L)

A LCS prepared with filtered deionized water or the appropriate extraction fluid is used for extracts.

Non-aqueous

Weigh approximately 0.6 g of Teflon boiling beads, document exact weight on prep sheet. Add 150 µL of the 1 mg/L working standard (5 µg/L in solution)

6. Record the laboratory ID of the standard and reagents in the prep sheet.

METHOD PERFORMANCE

1) In a single laboratory (SEWL), using distilled water standards at concentrations of 0.5, 1.0, 2.0, 5.0, 10.0 and 20.0 µg Hg/L, the standard deviations were ±0.04, ±0.07, ±0.09, ±0.020, ±0.40 and ±0.84 µg/L, respectively.

2) In a single laboratory (SEWL), using surface water samples spiked with ten organic mercurials at the 10 µg/L level, recoveries ranged from 87 to 117%. Recoveries of the same ten organic mercurials in distilled water at the 10 µg/L level, ranged from 92% to 125%.

3) The following standard deviations on replicate sediment samples were recorded at the indicated levels; 0.29 µg/G ±0.02 and 0.82 µg/G ±0.03. Recovery of mercury at these levels, added as methyl mercuric chloride, was 97% and 94%, respectively.

POLLUTION PREVENTION See QAPP Section 10.2

WASTE MANAGEMENT See SOP GEN-009

GULF COAST ANALYTICAL LABORATORIES, INC
METALS
STANDARD OPERATING PROCEDURE

PROCEDURE: MET-021
PAGE: 1 of 14
EFFECTIVE DATE: 08/24/2012
APPROVED BY:
QA/QC APPROVED:

SUBJECT	SCOPE AND APPLICATION This method covers the operation of the Agilent 7700 ICP-MS for analysis of low-level concentrations of metals in water samples, waste extracts, or digests. The procedure is applicable for the analysis of aqueous samples, soils, solids, and domestic or industrial wastes for Total metals, after preparation by the appropriate EPA or SW846, procedure. Dissolved metals, filtered and acid preserved prior to analysis may be analyzed without digestion. Elements currently analyzed using these methods are listed in Table I.
MATRIX	Water and Solid
REFERENCES	EPA 200.8 - Determination of Trace Elements in Waters and Wastes by Inductively Coupled Plasma - Mass Spectrometry, Revision 5.4 (EMMC Version) SW846 6020A Agilent Instrument Manuals Software Guide
SAMPLE COLLECTION	Samples may be collected and stored in plastic or glass containers.
HOLDING TIME & PRESERVATION	Dissolved Metals (waters) – Filtered through a 0.45 um membrane filter then HNO_3 to pH < 2; for 200.8 adjust the pH to less than 2 with HNO_3 then hold for a minimum of 16 hours. Total Metals (waters) - HNO_3 to pH < 2; for 200.8 adjust the pH to less than 2 with HNO_3 then hold for a minimum of 16 hours. Digestion required (SOP MET-005)–6 months; Total Metals (solids) – Cool 4°C; Digestion required (SOP MET-004, MET-018)–6 months
DEFINITIONS	See SOP GEN-016
SAFETY	Each employee is directly responsible for complete awareness of all health hazards associated with every

chemical that he/she uses. The employee must be aware of these hazards and all associated protective wear and spill clean-up procedures PRIOR TO the use of any chemical. In all cases, the applicable material safety data sheet (MSDS) and your supervisor or safety officer should be consulted. The bottle labels also provide important information that must be noted. Personnel performing this procedure may be working with flammables, poisons, toxins, carcinogens, teratogens, mutagens, and biohazards. In particular, approved gloves, safety glasses, and lab coats must be worn. In addition to other measures prescribed by the division, solvents must be handled in ventilated hoods.

INTERFERENCES

Several interferences are possible. These include:

1. Isobaric elemental interference caused by isotopes of different elements which form singly or doubly charged ions of the same nominal mass-to-charge ratio and cannot be resolved or corrected for by the mass spectrometer in use. These interferences are addressed by the instrument operating conditions, correction equations, and careful selection and monitoring of mass-to-charge ratios. In general, all direct isobaric interferences are avoided by choosing an interference-free isotope. In some cases this may result in a loss in sensitivity.
2. Physical Interferences are generally considered to be effects associated with the sample nebulization and transport processes. Properties such as change in viscosity and surface tension can cause significant inaccuracies especially in samples that may contain high dissolved solids or acid concentrations. If these types of interferences are present, they must be reduced by diluting the sample. Dissolved solids greater than 0.2% w/v causes interferences and clogging of the pump. Internal standards are used to identify this type of interference.
3. Isobaric polyatomic ion interferences are caused by ions consisting of more than one atom with the same nominal charge-to-mass ratio of the ions of interest. Proper tuning of the plasma and torch conditions to reduce the formation of oxides reduces this interference. In addition the use of a collision cell reduces or eliminates this interference in most matrices.
4. Signals from relatively abundant isotopes can coalesce at the wings of relatively less abundant isotopes leading to loss of resolution and poor quantitation.
5. Memory interferences of isotopes from previous sample runs.

APPARATUS

Agilent 7700 ICP-MS
Agilent ASX-500 Autosampler
Edwards Vacuum Pump Model E2M18
Peristaltic pump and tubing
Autosampler tubes
Mechanical pipets and pipet tips
Volumetric Flasks - Class A
Graduated centrifuge tubes
Eppendorfs
Argon and Helium supply with pressure controls
Compressed air

REAGENTS AND STANDARDS

1. Deionized water - monitored each day of use for resistivity. Must be 10MΩ-cm or greater.

2. Concentrated Nitric acid - Trace metals grade, label with date opened and enter into reagent logbook

3. Concentrated hydrochloric acid – Trace metals grade, label with date opened and enter into reagent logbook

4. 5% Nitric Acid/2% Hydrochloric Acid - prepared from the Trace metals grade concentrate

5. 2% Nitric Acid/0.5% Hydrochloric Acid – Calibration Blank

6. Stock standard metals solutions (1000 mg/L) - commercially prepared, label with date opened.

7. Custom mixed standards – commercially prepared, label with date opened.

8. Calibration standards: A custom made solution for calibrations standards is used. See Table I for the elements included and concentration. Prepare all standards in the 2% Nitric Acid/0.5% Hydrochloric Acid.

9. Continuing Calibration Verification (CCV) standard – is prepared using the calibration standard. The CCV includes equal aliquots of the calibration standard and 2% Nitric Acid/0.5% Hydrochloric Acid.

10. Second Source Stock Standards – Two, multi-element custom solutions-commercially prepared.

11. Initial Calibration Verification (ICV) standard and QCS

standard - Dilute the appropriate amount of the second source multi-element stock solution to volume with 2% Nitric Acid/0.5% Hydrochloric Acid. The concentration of the elements in the stock solutions vary in concentration, therefore the analyst should prepare this solution such that the majority of the elements are in the middle of the calibration range. This solution must be prepared at least quarterly or more frequently if precipitation is noted. Trace metals must be spiked at ≤ 100ug/L. The QCS is prepped in the same manner of samples and is used for the demonstration of capability.

12. Interference solution stock standards - available commercially.

13. Interferent Calibration Solution A (ICSA) - Pipet 50uL of the interferent stock Agilent ICS-A into a 50mL graduated centrifuge tube and dilute to volume with 2% Nitric Acid/0.5% Hydrochloric Acid. Final concentrations are: Ca-3000ug/L, Fe and Na-2500ug/L, Mg, Al, and K-1000ug/L, and Ti and Mo-20ug/L.

14. Interferent Calibration Solution B (ICSAB) - Pipet 50uL of the interferent stock Agilent ICS-A, and 50uL of interferent stock Agilent ICS-B into a 50mL graduated centrifuge tube and dilute to volume with 2% Nitric Acid/0.5% Hydrochloric Acid. Final concentrations of interferents are as in (13) above; concentrations of minor elements are 20, 10, or 5ug/L. Check solution frequently for signs of precipitation and take corrective action when noted.

15. Internal Standard – 1ug/mL of ^{45}Sc, ^{103}Rh, ^{115}In, ^{159}Tb, ^{175}Lu, and ^{209}Bi

16. Low-level Calibration Verification Standard analyzed at 0.5ug/L of trace elements.

17. All solutions are prepared in labeled, graduated centrifuge tube.

18. All reagents used must be entered in the reagent logbook, except for water, which is monitored by the QA/QC Department. Standards prepped are entered into the standard prep logbook. See SOP GEN-006 for additional information and documentation requirements.

19. Argon >99.99% purity

20. Helium

INSTRUMENT SET-UP

1. Check Argon, Helium, and compressed air supply.
2. Check wash solution in autosampler flush container. Fill if necessary (2% Nitric Acid, 0.5% Hydrochloric Acid).
3. Check drain bottle below instrument. Empty if necessary.
4. Connect the peristaltic pump tubing between the posts on the pump (Sample pump and internal standard pump). Close the platens.
5. Start the computer. Select the ICP-MS Top icon on the Windows Desktop.
6. Select the Plasma ICON. Select "ON" button. Allow Plasma to warm up 45 minutes.
7. Set up sequence by filling in the positions with the samples to be analyzed. Include the standard identification numbers for the tune, calibration standards, ICV, ICSA, and ICSAB on the bench sheet (Attachment 1). Print sequence.
8. Load the autosampler by filling the tubes (10 mL will suffice) and inserting them into the positions corresponding to those on the bench sheet. Verify all blank, standard and QC sample tubes are filled.
9. Save sequence using the date as YYMMDD.
10. Select Load and Run sequence in the ICP-MS window.

CALIBRATION AND SAMPLE ANALYSIS

1. The instrument must first pass the mass calibration, resolution, and stability checks or tune check. The mass calibration cannot drift by more than 0.1 amu from the true value. The resolution must be verified to be less than 0.75 amu full width at 5% peak height. A minimum of five replicates are acquired with an RSD of $\leq$5%. If these criteria are not achieved, perform instrument maintenance and/or tuning. Calibration and sample analysis cannot begin until acceptable mass calibration and resolution are demonstrated.

2. After verifying that tune passes, continue with initial calibration. Instrument will calibrate and continue with QC and sample analysis. The calibration is a multi-point calibration (minimum of three points) with a blank. It is verified with an ICSA, ICSAB, ICV, LLICV, CCV, LLCCV and CCB. Once data is collected, and instrument QC is evaluated, the data can be posted. This is performed by direct upload of data to the intranet ICP-MS uploader. In ICP Data Analysis window and select tools. Upload selected samples as a csv file.
3. Document all runs on a batch log using the ICP file maker program available on the metals workstation. On each batch sheet document the analyst, date, time, standard identification, dilutions, and reviews. An example sheet is attached.
4. Go to the intranet ICPMS uploader and browse for specific CSV file. Enter the HBN and select import. Select samples to be posted and select export.
5. SHUT DOWN - If an additional run will not be performed add a TERM block and an ERRTERM block at the end of the sequence.
6. Samples are diluted if the detected concentration is ≥90% of the high-level standard as described in QC section of this SOP for E200.8 or above the high-level standard for samples analyzed by SW6020A.
7. Three replicates are determined for all sample, calibration, and QC analysis. If the RSD of the replicates is more than 5%, each replicate is evaluated. Note that an RSD of >5% may be typical for low concentrations and data should not be rejected based solely on the RSD. The average of the three replicates is reported.
8. Rinse for a minimum of one minute between sample analyses.

REPORTING LIMITS

The following charts indicate typical reporting limits for EPA 200.8, and SW-846 6020A. Lower limits may be achievable. Limits may also be adjusted higher if they meet the clients requirements due to LLCCV or LOQ performance.

EPA 200.8:

ANALTYE	WATER (ug/L)
Aluminum	10
Antimony	0.5
Arsenic	0.5

Barium	0.5
Beryllium	0.5
Cadmium	0.5
Chromium	0.5
Cobalt	0.5
Copper	0.5
Lead	0.5
Manganese	0.5
Molybdenum	0.5
Nickel	0.5
Selenium	1.0
Silver	0.5
Thallium	0.5
Vanadium	0.5
Zinc	10.0

SW-846, 6020A:

ANALTYE	WATER (ug/L)	SOLID (ug/kg)
Aluminum	10	400
Antimony	0.5	20
Arsenic	0.5	20
Barium	0.5	20
Beryllium	0.5	20
Cadmium	0.5	20
Calcium	50	2000
Chromium	0.5	20
Cobalt	0.5	20
Copper	0.5	20
Iron	50	2000
Lead	0.5	20
Magnesium	50	2000
Manganese	0.5	20
Molybdenum	0.5	20
Nickel	0.5	20
Potassium	50	2000
Selenium	1	40
Silver	0.5	20
Sodium	50	2000
Strontium	0.5	20
Thallium	0.5	20
Tin	0.5	NA
Titanium	0.5	20
Vanadium	0.5	20
Zinc	10	400
Zirconium	0.5	20

QUALITY CONTROL &
DATA ACCEPTANCE CRITERIA

1. The initial calibration consists of the initial calibration blank and a minimum of three contiguous non-zero points. The lowest non-zero point for each analyte must be at or less than the LOQ. To be considered acceptable the correlation coefficient (r) must be ≥0.998 for each analyte. Additional points may be analyzed to better define the linear range and the lower limit of quantitation. In addition the high or low points may be removed from a multi-point curve as long as a minimum of three points remain and the reporting limit is adjusted if the low point is removed. Silver is not calibrated above 100ug/L.
2. The Initial Calibration Verification (ICV) standard recoveries must be 90-110%. This is performed daily following the initial calibration. The ICV standard should be prepared from an independent (second source) material at or near the mid-range of the calibration curve.
3. The Initial Calibration Blank (ICB) is used to verify all concentrations are below the client defined reporting limit. The concentration must be ≤ ± the reporting limit. For DOD projects, concentrations must be less than the LOD. Additional requirements may apply and may be more stringent. See SOP GEN-019. The internal standard response from the ICB is used to calculate drift for all samples in the analytical batch. An ICB cannot be reanalyzed after the calibration to "re-set" the internal standard responses. If for any reason the ICB must be reanalyzed, it must be followed by an ICAL.
4. Analyze a Low-level Initial Calibration Verification (LLICV) prepared at or below the project required reporting limit. The recovery for this check standard must be 70-130% for 6020A. Project specific limits may be required, see SOP GEN-019.
5. The ICSA solution is used to monitor correction factors for the common interferents. This solution will be used to evaluate elements that are not spiked in the ICSAB. The concentration for these elements must be ≤ ± the reporting limit. The ICSA

concentration must be less than or equal the reporting limit and greater than or equal to –2X the reporting limit. The ICSA is analyzed before sample analysis or every 12 hours, whichever is more frequent. Additional requirements may apply and may be more stringent. See SOP GEN-019.

6. All elements in the ICSAB solution should have recoveries of 80-120%. Results falling outside these limits may indicate the need for re-evaluation of correction equations. The ICSAB is analyzed before sample analysis or every 12 hours, whichever is more frequent.

7. Continuing Calibration Verification standards (CCV), Continuing Calibration Blanks (CCB), and for 6020A Low-level Continuing Calibration Verification (LLCCV) are run every 10 samples and at the end of the analytical run. The CCV recovery must be 90-110%. For 6020A, the recovery for the LLCCV must be 70-130% for all analytes. The RSD between the replicates should not be greater than 5%. If this is exceeded evaluate the replicates to determine if re-analysis is necessary. The CCB concentration should never exceed the reporting limit. If a CCV, LLCCV, and/or CCB is outside control limits, re-analyze one time (additional runs are acceptable if a documented reason for the failure is available) and if the values are still outside the control limits, recalibrate and re-run the previous 10 samples. Results are reportable with a narrative if the CCB fails and there are no hits in the associated samples. Additional requirements may apply and may be more stringent. See SOP GEN-019.

8. Method Blank – one Method Blank is prepped with each batch of 20 or fewer samples. The concentration of each element should never exceed the reporting limit for all associated samples. Detected levels of elements in the method blank must be less than 10% of the regulatory limit or the sample concentrations for the data to be reported. For DOD projects, the method blank should be less than ½ the reporting limit. If the data is reported make a note of the problem in the case narrative. Find the source of the problem and correct and re-analyze if possible. Additional requirements may apply and may be more stringent. See SOP GEN-019.

9. A Laboratory Control Sample (LCS) and Laboratory Control Sample Duplicate (LCSD-if required for project or if insufficient sample if available for a

matrix duplicate or MS/MSD) is prepped with each batch of 20 or fewer samples. The recovery must be 85-115% for 200.8 and 80-120% for 6020A. The LCS/LCSD RPD should be ≤ 20%. If the LCS recovery is outside the control limits, the sample batch must be re-prepped. Samples may be reported if the LCS fails high with no hits in associated samples. Report with a narrative describing the failure.

10. A low-level quality control sample (LOQ) is prepped at the same level as the LLICV with initial set-up and quarterly. The sample recovery must be within 70-130% of the true value. If this sample does not fall within these criteria, evaluate the reason for the failure, perform recalibration and maintenance as necessary and reprep the sample. If the sample continues to fall outside of acceptance criteria it may be necessary to increase the reporting limit to a level that falls within this criteria.

11. The Relative Percent Difference (RPD) for matrix duplicates must be ≤ 20%, unless the sample concentration is less than five times the detection limit or the sample matrix is determined to be heterogeneous. Additional requirements may apply and may be more stringent. See SOP GEN-019.

12. Matrix Spike (MS) and Matrix Spike Duplicate (MSD) recoveries must be 75 - 125% for 6020A water and solids, 70-130% for 200.8. The MS/MSD RPD should be ≤ 20%. For DOD projects, the MS control limits are the same as the applicable LCS limits. MSD's are prepped and analyzed if there is sufficient sample. If the recovery is outside these limits, the data should be flagged. A spike is not applicable if the spike amount is less than 30% of the concentration in the native sample. MS/MSD is performed at a minimum of 10% (1 in 10) of samples.

13. For solid samples that require Antimony analysis – If the MS and MSD recovery for Antimony are outside of the control limits of 75-125%, the data should be flagged. In addition, if the recovery for Antimony is <10%, the samples should be reprepped for Antimony only, using the optional procedure for Antimony found in SOP MET-004. Also, if historical data for a particular sample indicates low recoveries for Antimony, the analyst should proceed directly to the optional steps.

14. Interference checks to be performed for 6020A if the MS/MSD fails for any target compound or if requested

by the client:

A. Post-Digestion Spike –A post-digestion spike is performed on all samples with MS/MSD recoveries outside control limits. A spike is added to a portion of digested sample or its dilution and should be recovered at 80-120% of the known value. If the recovery is outside control limits perform the dilution test.
B. Dilution Test - Perform a 5x dilution on one sample per batch. The concentrations of the elements in the sample to be diluted should be greater than 50 times the MDL. The neat sample concentration and five times the diluted sample concentration should agree within 10%. If not, a chemical or physical interference should be suspected.

15. Samples with interferent or analyte concentrations ≥ 90% of the high level ICAL standard will be diluted and reanalyzed for samples reported by E200.8. Samples reported by SW6020A shall be diluted for any compound greater than the high level calibration standard. Dilute so that the expected concentration is approximately in the mid-level of the curve. Report multiple dilutions if requested by the client.

16. Review the internal standard drift as compared to the calibration blank. The absolute value of any one internal standard must not deviate by more than 70-120% of the original response in the calibration blank. Determine if high or low recoveries are due to instrument drift by reviewing the internal standard recoveries for CCV's and CCB's. This will eliminate performing unnecessary dilutions if the sample is reanalyzed. High recoveries may be the result of a clogged sample uptake tube or an empty sample vial. Extremely high recoveries can result from the presence of the internal standard element in the original sample. If this is suspected, re-analyze using a different IS. If the analyst determines the recovery is outside the control limits due to matrix interference, then the sample must be reanalyzed diluted.

17. Determine linear ranges semi-annually. Spike at historical values. Each metal must be recovered at 90-110%.

18. Determine MDLs annually using the requirements of SOP QA-009. MDL's shall be determined more frequently if there is a change to the method or

instrumentation that may alter the sensitivity of the measurement. An MDL study is performed for each instrument. MDLs should be less than ½ the reporting limit, but cannot be higher than the reporting limit.

19. Determine IDLs annually.

MAINTENANCE

1. Clean the nebulizer periodically in a 2% Nitric acid solution. Sonication of the nebulizer in this solution is also helpful in removing deposits or particulate matter.
2. Clean the torch periodically by soaking in 2% HNO_3.
3. Sample pump tubing should be inspected every day and changed when showing signs of wear.
4. Clean sample cone and/or skimmer cone periodically.
5. Check the water level in the chiller.
6. An Agilent service engineer performs scheduled periodic maintenance every six months.
7. All other maintenance shall be documented in the instrument maintenance log. If a particular problem occurs, document the problem and the solution. For additional information on instrument maintenance and documentation requirements see GCAL SOP GEN-012.

CALCULATIONS

1. Sample Concentration –

$$\text{mg/L or mg/kg analyte in sample} = A \frac{Vf}{Vi} \times d$$

A = mg/L analyte in processed sample
Vf = final volume of sample (mL)
Vi = initial volume (mL) or weight (g) of sample
d = dilution factor (if required)

The units may be converted to ug/L or ug/kg

2. Matrix spike and Matrix Spike Duplicate Recovery

$$\% \text{ Recovery} = \frac{(SSR - SR)}{SA} \times 100$$

SSR = spiked sample result
SR = sample result
SA = spike added

3. Matrix Duplicate Relative Percent Difference (RPD)

$$RPD = \frac{SR - SDR}{\frac{(SR+SDR)}{2}} \times 100$$

SR = Sample result
SDR = sample duplicate result
$\frac{(SR+SDR)}{2}$ = average of SR and SDR

TABLE I

ELEMENT	Selected Isotope	Type	Assigned ISTD
Ag	107	Target	115
Al	27	Target	45
As	75	Target	45
Ba	137	Target	103
Be	9	Target	45
Bi	209	INST	
Ca	44	Target	45
Cd	111	Target	103
Co	59	Target	45
Cr	52	Target	45
Cu	63	Target	45
Fe	57	Target	45
In	115	INST	
K	39	Target	45
Li	6	INST	
Lu	175	INST	
Mg	24	Target	45
Mn	55	Target	45
Mo	95	Target	103
Na	23	Target	45
Ni	60	Target	45

ELEMENT	Selected Isotope	Type	Assigned ISTD
Pb	208	Target	209
Rh	103	INST	
Sb	121	Target	159
Sc	45	INST	
Se	78	Target	45
Sn	120	Target	115
Sr	88	Target	103
Tb	159	INST	
Ti	47	Target	45
Tl	205	Target	209
V	51	Target	45
Zn	66	Target	45
Zr	90	Target	103

SOFTWARE TROUBLESHOOTING

The ICP-MS uses Mass Hunter to control the instrument and perform all data calculations. In the event of software malfunction, please contact Agilent technical support or GCAL's IT Director for troubleshooting help.

METHOD PERFORMANCE (METHOD 6020A)

1) Method Performance is described in Section 13.0 of SW-846 6020A. This includes descriptions of a multi-laboratory study for aqueous and solid matrices. Results of the study are summarized in the reference method Table 3 and Table 4.

METHOD PERFORMANCE (METHOD 200.8)

1) Method Performance is described in Section 13.0 of EPA 200.8 Revision 5.4 (EMMC Version). Method performance including typical IDLs, MDLs, method precision and bias is described and detailed in the referenced Tables for total and dissolved metal determinations for each matrix.

POLLUTION PREVENTION See QAPP Section 10.2

WASTE MANAGEMENT See SOP GEN-009

APPENDIX 1

GLOSSARY

ACCEPTANCE LIMITS – data quality limits specified by the test method or generated by the laboratory. Specified limits placed on an item, process, or service defined in the requirement document.

ACCURACY – a measure of how close a measured value is to a known true value. Accuracy is assessed by means of reference samples and percent recoveries of spiked samples. The degree of agreement between an observed value and an accepted reference value. Accuracy includes combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator.

ALIQUOT – a discrete, measure, or representative portion of a sample taken for analysis.

ANALYTE – the chemical element or compound an analyst seeks to determine; the chemical element of interest.

ANALYTICAL BATCH – the basic unit for analytical quality control, defined as samples that are analyzed together with the same method sequence and the same lots of reagents and with the manipulations common to each sample within the same time period or in continuous sequential time periods. Samples in each batch should be of similar composition (e.g., groundwater, sludge, ash).

ANALYTICAL SAMPLE – any solution or media introduced into an instrument on which an analysis is performed, excluding instrument calibration, initial calibration verification, initial calibration blank, continuing calibration verification, and continuing calibration blank. The following are all analytical samples: undiluted and diluted samples (EPA and non-EPA), predigestion spike samples, duplicate samples, serial dilution samples, analytical spike samples, post digestion spike samples, interference check samples (ICS), CRDL standard for AA(CRA), CRDL standard for ICP(CRI), laboratory control sample(LCS), preparation blank(PB), and linear range analysis sample(LRS).

ANALYST – the designated individual who performs the "hands on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.

AREA UNITS – a term used in gas chromatography that indicates the peak area of a compound exiting a chromatographic column. The size or area of the peak is proportional to the amount of analyte in the sample.

ATOMIC ABSORPTION (AA) – a technique for analyzing metal using an element-specific lamp that emits a characteristic light spectrum. A sample is heated in a flame or graphite furnace and the light beam is passed through it. When the sample absorbs light, an energy loss is detected and is translated into a concentration of metal in the sample. This technique detects one metal at a time.

AUDIT – a systematic check to determine the quality of some function or activity. Two basic types are performance audits and system audits. Perform audits involve a quantitative comparison of the laboratory's results to those of a proficiency sample containing known concentration of analytes. A

system audit is a qualitative evaluation that normally consists of an onsite review of a lab's quality assurance system and physical facilities.

BACKGROUND CORRECTION – a technique usually employed relative to metals analysis, which compensates for variable background contribution to the instrument signal in the determination of trace elements.

BATCH – environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A batch is composed of a maximum of twenty environmental samples. A preparation batch is composed of environmental sample of the same matrix, meeting the above-mentioned criteria and with a maximum time between the start of processing the first and last sample in the batch to be 24 hours. An analytical batch is composed of prepared environmental samples (extracts, digestates or concentrates) and/or those samples not requiring preparation, which are analyzed together as a group using the same calibration curve or factor. An analytical batch can include samples originating from various environmental matrices.

BIAS – the deviation of the mean of replicate analytical measurements from a reference analyte concentration. Relative bias is represented by analytical measurement mean minus the reference analyte concentration and the difference divided by the reference analyte concentration. See accuracy and precision.

4-BROMO-FLUOROBENZENE (BFB) – the compound used to check the tuning of the instrument, and is used as a surrogate compound spiked into every sample for volatile analysis. A compound utilized in EPA gas chromatography/mass spectrometry (GC/MS) volatile methods to establish mass spectral instrument performance.

BIOCHEMICAL OXYGEN DEMAND (BOD) – A measure of the amount of oxygen consumed in the biochemical processes that break down organic matter in water. A larger BOD value indicates a greater degree of organic pollution. A related term, BOD5, is the amount of dissolved oxygen consumed in five days.

BIOSEED – the bacterial culture used to inoculate a sample for testing.

BLANK – an artificial sample designed to monitor the introduction of artifacts into the measurement process. For aqueous samples, reagent water is used as a blank matrix. There are several types of blanks, which monitor a variety of processes: 1.)*laboratory blank* is taken through sample preparation and analysis only. It is a test for contamination in sample preparation and analyses. 2.)*storage blank* is stored and analyzed with samples at the laboratory. It is a test for contamination in sample storage as well as sample preparation and analysis. 3.)*trip blank* is shipped to and from the field with the sample containers. It is not opened in the field and, therefore, provides a test for contamination from sample preservation, site conditions, and transport as well as sample storage, preparation, and analysis. It is most commonly used for volatile organics. 4.)*field blank* is opened in the field and tests for contamination from the atmosphere as well as those activities listed under the trip blank.

BNA – base, neutral and acid extractable compounds. The term base, neutral and acid refer to the pH condition of the sample undergoing extraction. Certain compounds extract more efficiently from water under acidic conditions. Such compounds are often referred to as "acid extractables."

CALIBRATE – to determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter or other device, or the correct value for each setting of a control knob. The levels of the applied calibration standard should bracket the range of planned or expect sample measurements.

CALIBRATION – The systematic determination of the relationship of the response of the measurement system to the concentration of the analyte of interest. Instrument calibration performed before any samples are analyzed is called the initial calibration. Subsequent checks on the instrument calibration performed throughout analysis are called continuing calibration verification.

CALIBRATION BLANK (CB) – a volume of reagent water in the same matrix as the calibration standards but without the analyte.

CALIBRATION CURVE – the graphical relationship between the known values, such as concentrations, of a series of calibration standards and their analytical response.

CALIBRATION METHOD – a defined technical procedure for performing a calibration.

CALIBRATION STANDARD – a certified material used to calibrate an instrument.

CERTIFIED REFERENCE MATERIAL (CRM) – reference material, one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body. (ISO Guide 30)

CONTINUING CALIBRATION VERIFICATION (CCV) – used to evaluate the performance of the instrument system with respect to a defined set of method criteria. The CCVs are used to verify instrument performance during analysis. The CCV shall be prepared from the same stock standard solution used to prepare the calibration curve.

CHAIN-OF-CUSTODY–Procedures and associated documents designed to trace the custody of a sample from the point of origin to final disposition, with the intent of legally demonstrating that custody remained intact and the tampering or substitutions were precluded.

CHEMICAL OXYGEN DEMAND (COD) – A measure of the oxygen required to oxidize all compounds in water, both organic and inorganic.

COMBINED STANDARD UNCERTAINTY – The standard uncertainty of the analytical measurement result that is the sum in quadrature (square-root-of-the-sum-of-the-squares) of the component standard uncertainties.

CORRECTIVE ACTION – the action taken to eliminate the causes of an existing non-conformity, defect, or other undesirable situation to prevent reoccurrence.

COVERAGE FACTOR – the numerical factor used as a multiplier of the combined standard uncertainty to expand the uncertainty corresponding to a specific level of confidence. The Student's *t*-distribution is used for determining the coverage factor.

DEMONSTRATION OF CAPABILITY (DOC) – a procedure used to establish the ability of the analyst to generate acceptable accuracy.

DEIONIZED WATER (DI) – water from which the majority of ions have been removed. Water that is contaminant free and used in the laboratory, the resistivity should be ≤ 18 mega ohms.

DISSOLVED METALS –- metallic elements determined on a water sample that has been passed through a 0.45-um filter.

DISSOLVED OXYGEN (DO) – the oxygen freely available in water, an indicator of water quality.

DISSOLVED SOLIDS – disintegrated organic and inorganic material contained in water. Excessive amounts make water unfit to drink or use in industrial processes.

DRY WEIGHT – the weight of a sample based on percent solids. The weight of a sample after drying in an oven at a specified temperature.

DUPLICATE MEASUREMENT – a duplicate measurement is a second measurement made on the same or identical sample of material to assist in the evaluation of measurement of variance.

DUPLICATE SAMPLE – two samples taken from the same population and carried through certain stages of sampling and testing. Duplicate sample include field co-located duplicate samples, field-split duplicate samples, and laboratory duplicate subsamples.

EXPANDED UNCERTAINTY – the quantity defining an interval enveloping the analytical measurement that captures a large fraction of the distribution of analyte concentrations that could be attributable to the quantity measured. The combined standard uncertainty is multiplied by the coverage factor to calculate the expanded uncertainty.

EXTERNAL STANDARDS – a method of quantifying chromatographic data in which standards of known concentration are analyzed prior to unknown samples. The chromatographic peak area (or height) of a sample component is compared to a calibration curve of a peak area constructed from the standard data for that component. This comparison allows the concentration of the component in the sample to be determined.

FECAL COLIFORM BACTERIA – bacteria found in mammals' intestinal tracts. Their presence in water or sludge is an indicator of pollution and possible contamination by pathogens.

FLAME IONIZATION DETECTOR (FID) – a gas chromatography detector in which the column effluent gas is mixed with hydrogen and burned in air or oxygen. The ions and electrons produced in the flame generate an electric current proportional to the amount of materials in the detector. The FID responds to nearly all organic compounds, but it does not respond to air and water, which makes it exceptionally suited to environmental analysis.

FLASHPOINT – the lowest temperature at which a flammable liquid gives off sufficient vapor to form an ignitable mixture with air near its surface or within a vessel. Combustion does not continue.

GAS CHROMATOGRAPHY (GC) – a technique for detecting organic compounds by using their physical and chemical properties to separate a mixture. The compounds are identified and quantified

with various types of detectors as they exit the chromatograph. Selection of detectors is dependent on the particular compounds of interest.

GAS CHROMATOGRAPHY MASS SPECTROMETRY (GCMS) – a technique in which sample analytes are bombarded with electrons as they exit a gas chromatography column and are fragmented into characteristics ion patterns. The mass spectrometer is the detector. It can determine which fragments are present and therefore the identity of the compounds.

GLUCOSE GLUTAMIC ACID (GGA) – used as a laboratory control standard in BOD procedures.

GRAPHITE FURNACE – a technique used for the analysis of metals. An atomic absorption spectrophotometer heats the sample within a graphite tube using an electrical current. It is also commonly called a flameless furnace and generally provides greater sensitivity for certain metals than flame or inductively coupled argon plasma techniques.

GRAVIMETRIC - analyses based on the direct or indirect weighing of the analyte in question. This technique usually requires the use of an analytical balance with a sensitivity of 0.1 mg or better.

HALL ELECTROLYTIC CONDUCTIVITY DETECTOR – an element-selective gas chromatography detector primarily intended for trace analysis of organic compounds containing chlorine, nitrogen or sulfur. In operation, this detector pyrolyzes the column effluent gas into soluble electrolytes that are dissolved in a stream of deionized liquid. The observed change in electrical conductivity, proportional to the amount of material present, is measured.

HAZARDOUS WASTE – waste regulated under RCRA that can pose a substantial or potential hazard to human health or the environment when improperly managed. Such wastes possess at least one of four characteristics (ignitability, corrosivity, reactivity, or toxicity) or appear on special EPA hazardous waste lists. The term is not interchangeable with hazardous substances or material.

HEADSPACE - Any area in a container not completely filled by the sample in which gases can collect.

HEAVY METALS – metallic elements with high atomic weights, i.e., mercury, chromium, cadmium, arsenic, and lead. They can damage the health of plants and animals at low concentrations and tend to accumulate in the food chain.

HOLDING TIME – the maximum times that samples may be held before analysis and still be considered valid or not compromised. The storage time allowed between sample collection and sample analysis when the designated preservation and storage techniques are employed.

HYDROCARBONS – chemical compounds that consist entirely of carbon and hydrogen.

ICP – Inductively coupled plasma is a type of instrument used for metals analysis. Because the temperature of the plasma is considerable higher (10,000^{o}K) than the temperature of a flame atomic absorption spectrophotometer, it is especially useful for refractory metals. Some instruments are also capable of performing simultaneous multielement analysis.

ICP-MS - Inductively coupled plasma mass spectrometry (ICP-MS) is a type of mass spectrometry highly sensitive and capable of the determination of a range of metals and several non-metals at concentrations below one part in 10^{12} (part per trillion). It is based on coupling together an inductively coupled plasma as a method of producing ions with a mass spectrometer as a method of separating and detecting the ions. In trace elemental analysis, the method has advantages of high speed, precision and sensitivity.

IGNITABLE – capable of burning or causing a fire.

INORGANIC CHEMICALS – chemical substances of mineral origin, unlike organic chemicals whose structure relies on carbon atoms.

INITIAL CALIBRATION VERIFICATION (ICV) - also referred to as the Independent Calibration Verification for this laboratory. A standard solution used to verify the calibration curve derived from a source independent of the instrument calibration standard. The ICV is use to quantify second source standard variance and bias.

INSTRUMENT CALIBRATION STANDARD - a reference material used to standardize an analytical instrument.

INSTRUMENT DETECTION LIMIT (IDL) - a term utilized in the EPA Inorganic Contract Laboratory Program. The IDL is three times the standard deviation obtained for the analysis of a standard solution (each analyte in reagent water) at a concentration of three to five times that of the IDL on three nonconsecutive days with seven consecutive measurements per day. The IDL is the concentration equivalent to a signal, due to the analyte of interest, which is the smallest signal that can be distinguished from background noise by a particular instrument. The IDL should always be below the method detection limit, and is not used for compliance data reporting, but may be used for statistical data analysis and comparing the attributes of different instruments.

INSTRUMENT PERFORMANCE CHECK - The analyses of one of the ICSs to verified initial and continuing calibration (CCV). The IPC is used to quantify the instrumental testing repeatability variance and bias.

INSTRUMENT TUNING - a technique used in gas chromatography/mass spectrometry procedures to verify that the instrument is properly calibrated to produce reliable mass spectral information. See 4-Bromofluorobenzene under “B”.

INTERNAL STANDARDS - compounds added to every standard, blank, matrix spike, matrix spike duplicate, sample (for volatile organics), and sample extract (for semivolatiles) at a known concentration, prior to analysis. Internal standards are used as the basis for quantification of the target compound.

IONIZATION - Utilized in mass spectrometry to fragment analyte molecules into smaller segments. These smaller mass segments are then separated and plotted to form a “mass spectrum” which is used to identify the parent molecule. Electron impact is one example of ionization used in mass spectrometry. In more technical terms. Ionization is the process by which neutral atoms or groups of atoms become electrically charged, either positively or negatively, by the loss or gain of electrons.

ISOMERS - chemical compounds with the same molecular weight and atomic composition by differing molecular structure, e.g., n-pentane and 2-methylbutane.

LABORATORY CONTROL SAMPLE (LCS) - a clean-matrix reference sample spiked with a standard with an established analyte concentration. The LCS is carried through the entire chemical preparation and testing procedures. The LCS is used to quantify the variance and bias of the chemical preparation and instrumental testing stages without matrix interference. Also called a Laboratory fortified blank (LFB).

LABORATORY CONTROL SAMPLE DUPLICATE (LCSD) – a duplicate of the laboratory control sample in a clean matrix that is carried through the entire chemical preparation and testing procedures.

LABORATORY DUPLICATE SAMPLE (LAB DUPLICATE) - a portion of the collected sample that is carried through the chemical preparation and testing. The laboratory duplicate subsample is used to quantify the variance of the chemical preparation and instrumental testing stages with matrix interferences.

LEACHATE - a liquid that results from water collecting contaminants as it trickles through wastes, agricultural pesticides or fertilizers. Leaching may occur in farming areas, feedlots, and landfills, and may result in hazardous substances entering surface water, groundwater or soil.

LDEQ – Louisiana Department of Environmental Quality

LIBRARY SEARCH - a technique in which an unknown mass spectrum of a compound is compared to the mass spectra of compounds contained in a computer library in an effort to identify the compound. Compounds identified in this manner are referred to as tentatively identified compounds (TICs).

LIMIT OF DETECTION (LOD) – an estimate of the minimum amount of a substance that an analytical process can reliable detect. An LOD is analyte and matrix specific and may be laboratory dependent.

LIMIT OF QUANTIATION (LOQ) – the minimum levels, concentrations, or quantities of a target variable (e.g. target analyte) that can be reported with a specified degree of confidence..

LIMS – laboratory information management system. Horizons is the LIMS used by GCAL.

LINEAR CALIBRATION RANGE – the concentration range over which the instrument response is linear.

LOG-IN - the receipt and initial management of an environmental sample. It generally includes identifying who sent the sample; maintaining chain-of-custody; checking report and invoice information; recording analysis requested, including methodology and special instructions; and assigning a discreet in-lab identification, usually a number or bar code.

MASS SPECTRUM - a plot of ion mass/charge ratio versus intensity. A fragmentation pattern results from the particles whose mass distribution is characteristic of the parent molecule. Qualitative information is provided by a mass spectrum.

MATERIAL SAFETY DATA SHEET (MSDS) - a compilation of information required under the OSHA Communication Standard on the identity of hazardous chemicals and their associated health and physical hazards, exposure limits and precautions.

MATRIX - The physical characteristics or state of a sample – e.g., water, soil, sludge.

MATRIX INTERFERENCE - the influence of the sample matrix or sample components upon the ability of qualitatively identifies and quantitatively measures compounds in environmental samples.

MATRIX MODIFIERS - chemicals added to samples for metals analysis, which are used to lessen the effects of chemical interference, viscosity and surface tension.

MATRIX SPIKE (MS) – aliquot of a sample fortified (spiked) with known quantities of specific compounds and subjected to the entire analytical procedure in order to indicate the appropriateness of the method for the matrix by measuring recovery of the spike. Matrix spiked samples are used to quantify the variance and bias of the chemical preparation and testing stages with matrix interference.

MATRIX SPIKE DUPLICATE (MSD) - a second aliquot of the same matrix as the matrix spike that is spiked to determine the precision of the method.

METHOD DETECTION LIMIT (MDL) - the minimum concentration of compound that can be measured and reported within 99% confidence that the value is above zero and is determined from analysis of a sample in a given matrix containing the analyte.

MUST – denotes a mandatory requirement.

NARRATIVE - in an analytical report, a descriptive documentation of any problems encountered in processing the samples, along with corrective action taken and problem resolution.

NUTRIENT - any substance assimilated by living things that promote growth. The term is generally applied to nitrogen and phosphorus in wastewater, but is also applied to other essential and trace elements.

ORGANIC - generally, any compound that contains carbon bonded to a hydrogen or halogen atom.

OXIDATION - the process in chemistry whereby electrons are removed from a molecule.

PCBs - Polychlorinated biphenyl, a group of toxic persistent chemicals used in transformers and capacitors for insulating purposes and in gas pipeline systems as a lubricant. Sale of PCBs for new uses was banned by law in 1979.

PERCENT RECOVERY - a measure of accuracy that is calculated as the measured value relative to the true value expressed as a percent.

PERFORMANCE AUDIT - a quantitative evaluation of a measurement system that involves the analysis of standard reference samples or materials which are certified as to their chemical composition or physical characteristics.

PROFICIENCY TEST (PT) SAMPLE - a sample of known composition (unknown to the laboratory), provided by an external source, which is used to evaluate lab performance. For certification purposes the PT sample is purchased from an approved provider.

pH - a numerical designation of relative acidity and alkalinity. A pH of 7.0 indicates precise neutrality. Progressively higher values indicate increasing alkalinity and lower values increasing acidity.

POLLUTANT - generally, any substance introduced into the environment that adversely affects the usefulness of a resource.

PRACTICAL QUANTITATION LIMIT (PQL) - the lowest level that can be reliable achieved within specified limits of precision and accuracy routine laboratory operating conditions. The lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value.

PRECISION - a measure of the ability to reproduce analytical results. It is generally determined through the analysis of duplicate samples. The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range in either absolute or relative terms.

PRESERVATIVE - a chemical or reagent added to a sample to prevent or slow decomposition or degradation of a target analyte or a physical process. Physical and chemical preservation may be used in tandem to prevent sample deterioration.

PURGE AND TRAP - a technique used in the analysis of volatile organic where analytes are purged from a sample by means of an inert gas and trapped on a sorbent column. The sorbent is then flashheated and the analytes are transferred onto a gas chromatographic column for separation and identification.

PURGEABLE ORGANIC - an organic compound that is generally less than 20% soluble in water and has a boiling point at or below 200^{o}C. A volatile organic. An organic compound is generally considered to be purgeable if it can be removed from water using the purging process.

QC BASED NESTED APPROACH - a procedure for estimating the uncertainty of measurement using quality control data. The procedure is described in SOP QA-013.

QUALITY ASSURANCE (QA) - all those planned and systematic actions necessary to provide adequate confidence in laboratory results. An integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets the defined standards of quality with a stated level of confidence.

QUALITY ASSURANCE PROGRAM PLAN - a written assembly of management policies, objectives, principle and general procedures that outlines how the laboratory intends to generate data of known and accepted quality.

QUALITY CONTROL (QC) – the overall system of technical activities whose purpose to measure and control the quality of a product or service so that it meets the needs of the users.

QUALITY CONTROL CHART - a graph of analytical measurement results for a specific QC standard plotted sequentially with upper and lower control limits (±3SD). A central line that is the best estimate of the average variable plotted, and upper and lower marginal exceedence limits (±4SD) are usually included in the Quality Control Chart. The chart may also include upper and lower warning limits (±2SD).

QUALITY SYSTEM – a structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items) and services. The quality system provides the framework for planning, implement and assessing work performed by the organization and for carrying out required QA and QC.

r^2 – Correlation Coefficient Squared – paramet6er used to evaluate the fit of linear or quadratic regression curve fit of initial calibration data.

RAW DATA – any original information from a measurement activity or study recorded in a laboratory note book, worksheets, records, memoranda, notes, or exact copies thereof that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data may include photography, microfilm or microfilm copies, computer printouts, magnetic media, including dictated observations, and recorded data from automated instruments.

REACTIVITY - the tendency of a chemical to explode under normal management conditions, to react violently when mixed with water, or to generate toxic gases.

REAGENT WATER - water in which an interference is not observed at or above the minimum quantitation limit of interest.

REFERENCE MATERIAL - a traceable standard with an established analyte concentration. Material or substance whose property values are sufficiently homogenous, stable and well established to be used for the calibration of an apparatus, the assessment of a measurement method or for assigning values to materials (ISO Guide 30)

REFERENCE METHOD – a method of known and documented accuracy and precision issued by an organization recognized as competent to do so.

RELATIVE RETENTION TIME – a measure of the shift in retention time of an analyte when referenced to an internal standard.

RELATIVE RESPONSE FACTOR (RRF) - a measure of the relative mass spectral response of an analyte compared to its internal standard. RRFs are determined by analysis of standards and are used in the calculation of concentrations of analytes in samples.

REPLICATE ANALYSES - two or more results representing the same sample parameter. Replicate analyses are used to quantify the analytical measurement repeatability precision.

RPD – Relative Percent Difference, a relative difference between two analyses calculated by dividing the absolute difference of those two results by the average of their two values, then multiplying by 100.

RESOLUTION - the degree of separation between peaks eluting from a chromatographic column. Sufficient resolution between peaks is required for proper quantitation of unknown analytes.

RETENTION TIME - a term used in gas and liquid chromatography describing the time elapsed from the sample injection until the specific compound elutes or exits the chromatographic column at the detector. Each compound has a characteristics retention time on a specific column; therefore, this information is used to qualitatively identify the compounds in the sample.

SAMPLE – portion of material collect for chemical analysis, identified by a unique number assigned by the LIMS.

SHALL – denotes a requirement that is mandatory whenever the criterion for conformance with the specification requires that there be no deviation. This does not prohibit the use of alternative approaches or methods for implementing the specification so long as the requirement is fulfilled.

SHOULD – denotes a guideline or recommendation whenever noncompliance with the specification is permissible.

SOLID WASTE – non-liquid, non-soluble materials, ranging from municipal garbage to industrial waste, that contain complex, and sometimes hazardous, substances. Solid wastes include sewage sludge, agricultural refuse, demolition wastes, mining residues, and even liquids and gases in containers.

SOLVENT - a substance, usually liquid, capable of dissolving or dispersing one or more other substances.

SPIKE – a known mass of target analyte added to a blank sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.

STANDARD CURVE - a curve that plots concentrations of known analyte standards versus the instrument response to the analyte. Calibration standards are prepared by diluting the stock analyte solution in graduated amounts that cover the expected range of the samples being analyzed. The calibration standards must be prepared by using the same type of acid or solvent at the same concentration as for the samples following sample preparation. This is applicable to organic and inorganic chemical analyses.

STANDARD OPERATING PROCEDURE - a detailed written description of how a laboratory executes a particular procedure or method intended to standardize its performance.

STANDARDIZED REFERENCE MATERIAL (SRM) – a certified reference material produced by the U.S. National Institute of Standards and Technology or other equivalent organization and characterized for absolute content, independent of analytical method.

STANDARD UNCERTAINTY - the analytical measurement uncertainty expressed as a standard deviation. The relative standard deviation represents the relative standard uncertainty.

SURROGATE - an organic compound similar to the analyte of interest in chemical composition, extraction and chromatography, but not normally found in environmental samples. Primarily used in chromatography techniques, the surrogate is spiked into quality control blanks, calibration and check

standards, samples (including duplicated and QC reference samples) and spiked samples before analysis. A percent recovery is calculated for each surrogate.

SUSPENDED SOLIDS - small pollutant particles that float on the surface of, or are suspended in, sewage or other liquids. They resist removal by conventional means.

TARGET COMPOUND - specific compounds that are to be quantified in a sample based on a standard list of potential compounds.

TENTATIVELY IDENTIFIED COMPOUNDS (TICs) - compounds detected in samples that are not target compounds, internal standards, system monitoring compounds or surrogates. TICs usually consist of up to 30 peaks that are greater than 10% of the peak areas, or heights, of the nearest internal standard. They are subjected to mass spectral library searches for tentative identification. A client may specify the number of unknown peaks in its samples it wishes the laboratory to tentatively identify.

TOTAL METALS - metallic elements that have been digested prior to analysis.

TYPE A EVALUATION UNCERTAINTY - the method of evaluation of uncertainty by the statistical analysis of a series of test results.

TYPE B EVALUATION OF UNCERTAINTY - the method of evaluation of uncertainty by means other than statistical analysis.

UNCERTAINTY - the parameter associated with the analytical measurement results that characterizes the dispersion of the values that could be reasonable attributed to the quantity measured.

UNCERTAINTY INTERVAL - the range of analyte concentrations that an analytical measurement could represent at a specified level of confidence. The relative standard deviation is used to represent the relative standard uncertainty in the QC-based Nested Approach.

VALIDATION –the process for evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, or contractual specifications. It essentially evaluates performance against predetermined specifications.

VOA - volatile organic analysis

VOA BOTTLE - a vial used to contain samples for volatile organic analysis.

VOLATILE COMPOUNDS - compounds amendable to analysis by purge and trap. Synonymous with purgeable compounds.

VOLATILE ORGANIC COMPOUND (VOC) - any organic compound that participates in atmospheric photochemical reactions, except for those designated by the EPA Administrator as having negligible photochemical reactivity.

WET CHEMISTRY - procedures that involve distillations, colorimetric determinations and titrimetric measurements. Examples are chloride, nitrates, sulfates and biochemical oxygen demand.

STANDARD OPERATING PROCEDURE FOR 3050 METALS DIGESTION	REVISION NO. 14

SUBJECT — SCOPE AND APPLICATION

This digestion procedure is designed for the preparation of sediment, sludge and soil samples for determination of total metals by furnace atomic absorption or by ICP.

MATRIX — Solid

REFERENCE — SW846 Method 3050B

SAMPLE COLLECTION — Samples may be collected and stored in plastic or glass containers.

HOLDING TIME — 6 months

DEFINITIONS — See SOP GEN-016

SAFETY — Each employee is directly responsible for complete awareness of all health hazards associated with every chemical that he/she uses. The employee must be aware of these hazards, and all associated protective wear and spill clean-up procedures PRIOR TO the use of any chemical. In all cases, the applicable material safety data sheet (MSDS) and your supervisor or safety officer should be consulted. The bottle labels also provide important information that must be noted. Personnel performing this procedure may be working with flammables, poisons, toxins, carcinogens, teratogens, mutagens, and biohazards. In particular, approved gloves, safety glasses, and lab coats must be worn. In addition to other measures prescribed by the division, solvents and chemicals must be handled in ventilated hoods.

APPARATUS & REAGENTS

70 mL digestion vessels
250 mL glass digestion flasks
Watch glasses - ribbed
100 mL graduated cylinders
Specimen container
Nitric Acid -- Trace Metal grade
Hydrochloric Acid -- Trace Metal grade
30% Hydrogen Peroxide
DI grade water
CPI Mod Block – Digestion Block

Hot plate
Balance accurate to 0.01g
Teflon boiling beads (or equivalent)

STANDARDS

GCAL 1 MIX – 4000 mg/L Na; 2000 mg/L K; 1000 mg/L Al, Ca, Fe, Mg; 100 mg/L Ag, As, Ba, Be, Cd, Co, Cr, Cu, Li, Mn, Ni, P, Pb, Se, Sr, Tl, V, Zn

GCAL 2 MIX – 500 mg/L b; 100 mg/L Mo, Sb, Sn,

GFAA spiking solution – 4.0 mg/L As, Se, Tl prepared by the metals laboratory
ICP-MS spike – 100mg/L Na, Ca, Fe, Mg, K; 20mg/L Al, Zn; 10mg/L trace.

PROCEDURE

1. Homogenize the wet sample by mixing well. The sample may be removed from the container and placed on butcher paper to allow for mixture of the whole sample. Weigh 1.25g ± 0.1g of a homogenized sample into a labeled 70 mL digestion vessel. A minimum weight may be required to meet the project required detection limit. Check with the metals supervisor or project manager to determine if a minimum weight is required. Record the weight to the nearest 0.01g. Prepare QC samples as required in the quality control section.

2. Add 5 mL of 1:1 HNO_3 and mix.

3. Set Mod Block to the required setting for temperature of 90-95°C. Allow 15 minutes for the block to stabilize at the appropriate temperature.

4. Place the digestion vessels in the block, cover with a watch glass and reflux the samples for 15 minutes without boiling.

5. Cool and add 2.5 mL of concentrated HNO_3 to each sample, replace the watch glasses and reflux for 30 minutes.

6. If brown fumes are generated, indicating oxidation of the sample by the HNO_3, repeat step 5 over and over until no brown fumes are given off by the sample indicating the reaction is complete.

7. Cool. Add 1 mL DI H_2O and 1.5 mL 30% of H_2O_2 (peroxide) and cover with the watch glass.

8. On low heat, warm the sample to start the H_2O_2 reaction and heat until effervescence subsides. Continue adding 30% H_2O_2 in 1 mL aliquots (up to a maximum total of 5 mL of 30% H_2O_2) until the reaction is minimal.

9. Cover the sample with the watch glass and heat at 95°C for 2 hours or until the sample volume is about 5mL.

10. For ICP and ICP-MS preparation only, add 5 mL of concentrated HCl, cover with a watch glass and reflux at 95°C for 15 minutes.

11. Cool and adjust final volume to 50 mL with DI H_2O.

12. Document digestion by completing prep sheet (attached).

13. Filter through Whatman 41 (or this can be done in the lab) prior to analysis.

    Most liquid organic samples are digested on a hot plate due to the extended digestion time.

HOT PLATE PROCEDURE

1. Homogenize the sample by mixing well. Mix in a well-ventilated area. Weigh 1.25g ± 0.1g of a homogenized sample into a labeled 250 mL glass digestion vessel. A minimum weight may be required to meet the project required detection limit. Check with the metals supervisor or project manager to determine if a minimum weight is required. Record the weight to the nearest 0.01g. Prepare QC samples as required in the quality control section.

2. Add 5 mL of HNO_3 and mix.

3. Set hot plate to the required setting for temperature of 90-95°C. Allow 15 minutes for the hot plate to stabilize at the appropriate temperature.

4. Place the digestion flasks on the hot plate, cover with a watch glass and reflux the samples for 15 minutes without boiling.

5. Cool and add 2.5 mL of concentrated HNO_3 to each sample, replace the watch glasses and reflux for 30 minutes.

6. If brown fumes are generated, indicating oxidation of the sample by the HNO_3, repeat step 5 over and over until no brown fumes are given off by the sample indicating the reaction is complete. For concentrated organic samples, this step is performed many times and therefore the digestion may take several days.

7. Cover with watch glass. Heat at 95°C for 2 hours or until the sample volume is about 5 mL.

8. Cool. Add 1 mL DI H_2O and 1.5 mL 30% of H_2O_2 (peroxide) and cover with the watch glass.

9. On low heat, warm the sample to start the H_2O_2 reaction and heat until effervescence subsides. Continue adding 30% H_2O_2 in 1 mL aliquots (up to a maximum total of 5 mL of 30% H_2O_2) until the reaction is minimal.

10. Cover the sample with the watch glass and heat at 95°C for 2 hours or until the sample volume is about 5mL.

11. For ICP and ICP-MS preparation only, add 5 mL of concentrated HCl, cover with a watch glass and reflux at 95°C for 15 minutes.

12. Filter through Whatman 41 (or this can be done in the lab).

13. Cool and adjust final volume to 50 mL with DI H_2O.

14. Document digestion by completing prep sheet (attached).

OPTIONAL PROCEDURE
FOR ANTIMONY (Solid)

The following procedure may be used to improve the solubility and recovery of Antimony when necessary. These steps are optional and are not required on a routine basis.

1. Weigh 1.25g of sample in digestion tube (same as original prep).

2. Add 1.5mL concentrated HNO3 and 5 mL concentrated HCl.

3. Set Mod Block to the required setting for temperature of 95°C ±5°C. Allow 15 minutes for the block to stabilize at the appropriate temperature.

4. Place the digestion vessel in the block, cover with watch glass and reflux for 15 minutes.

5. Filter the digestate through Whatman #41 filter paper (or equivalent) and collect filtrate in another labeled 70mL digestion vessel. While still in funnel, rinse the filter paper with no more than 2.5 mL of hot HCl (~95 ^{o}C), then with 10mL of hot (~95 ^{o}C) reagent water. Collect washings in same digestion vessel as the filtrate.

6. Remove filter and residue from funnel and place in original digestion vessel. Add 2.5 mL concentrated HCl, place vessel back in block with watch glass and sides of digestion vessel with reagent water. Filter the residue into the sample digestion vessel as above.

7. Allow sample to cool* and bring to volume, 50 mL.

* If precipitation occurs in digestion tube upon cooling of the primary or secondary filtrate do not bring up to volume. Instead, add up to 5mL of concentrated HCl to dissolve precipitate. Once precipitate is dissolved, bring to volume (5o mL) with reagent water.

QUALITY CONTROL ICP and ICP-MS

With each batch of samples, the following will be digested:

a. Prepare one method blank (MB)(approximately 1.25g of boiling beads, document exact weight) with each batch of twenty or fewer samples.

b. Prepare one Laboratory Control Sample (LCS) (approximately 1.25g of boiling beads, document exact weight) with each batch of twenty or fewer samples. Add 0.25 mL of GCAL-1 & GCAL-2 for ICP-AES. (Check to be sure all target elements are contained in spike solutions. If not, add them separately from stock solutions). For ICP-MS add 0.25mL of ICP-MS spike.

c. Duplicate one sample with each batch of twenty or fewer samples.

d. Prepare one matrix spike sample (MS) with each batch of twenty or fewer samples. Add 0.25 mL of GCAL-1 & GCAL-2 for ICP-AES. (Check to be sure all target elements are contained in spike solutions. If not, add them separately from stock solutions). Matrix spike duplicates may be performed if required for a

specific project. For ICP-MS add 0.25mL of ICP-MS spike.

e. Record the laboratory ID for all standards and reagents in the prep sheet.

GRAPHITE FURNACE

With each batch of samples, the following will be digested:

a. Prepare one method blank (MB)(approximately 1.25g of boiling beads, document exact weight) with each batch of twenty or fewer samples.

b. Prepare one Laboratory Control Sample (LCS) (approximately 1.25g of boiling beads, document exact weight) with each batch of twenty or fewer samples. Add 0.5 mL of GFAA spiking solution.

c. Duplicate one sample with each batch of twenty or fewer samples.

d. Prepare one matrix spike sample (MS) with each batch of twenty or fewer samples. Add 0.5 mL GFAA spiking solution. Matrix spike duplicates may be performed if required for a specific project.

e. Record the laboratory ID for all standards and reagents in the prep sheet.

METHOD PERFORMANCE

In a single laboratory, the recoveries of the three matrices presented in Table 2 of Method 3050 were obtained using the digestion procedure outlined for samples prior to analysis by FLAA and ICP-AES. The spiked samples were analyzed in duplicate. Tables 3-5 of Method 3050 represents results of analysis of NIST Standard Reference Materials that were obtained using both atmospheric pressure microwave digestion techniques and hot-plate digestion procedures.

POLLUTION PREVENTION

See QAPP Section 10.2

WASTE MANAGEMENT

See SOP GEN-009

GULF COAST ANALYTICAL LABS
GC - PESTICIDES METHOD 8081
STANDARD OPERATING PROCEDURE

PROCEDURES: GC-013
PAGES: 1 OF 14
EFFECTIVE DATE: 10/1/11
APPROVED BY:
QA/QC APPROVED:

SUBJECT	SCOPE AND APPLICATION This method provides gas chromatographic procedures for the detection of ppb levels of certain Organochlorine pesticides. Prior to the use of this method, appropriate extraction techniques must be used. The extraction is described in EXT-002 for solid samples and EXT-010 for aqueous samples. An aliquot of the sample extract is injected into a GC equipped with an ECD detector.
MATRIX	Water and Solid
REFERENCE	SW-846 Method 8081B, 8000C, 3550C, 3510C For North Carolina and South Carolina projects SW-846 8000B must be used instead of SW-846 8000C.
PRESERVATIVE	Cool 4°C, protect from light
HOLDING TIME	Water – From collection to extraction – 7 days From extraction to analysis – 40 days Solid – From collection to extraction – 14 days From extraction to analysis – 40 days
DEFINITIONS	See Appendix A for Glossary.
SAFETY	Each employee is directly responsible for complete awareness of all health hazards associated with every chemical that he/she uses. The employee must be aware of these hazards, and all associated protective wear and spill clean-up procedures PRIOR TO the use of any chemical. In all cases, the applicable material safety data sheet (MSDS) and your supervisor or safety officer should be consulted. The bottle labels also provide important information that must be noted. Personnel performing this procedure may be working with flammables, poisons, toxins, carcinogens, teratogens, mutagens, and biohazards. In particular, approved gloves, safety glasses, and lab coats must be worn. In addition to other measures prescribed by the division, solvents must be handled in ventilated hoods. The electron capture detectors employed in this method must have a wipe test performed twice a year. In accordance with the federally mandated, state administered programs, the wipes are checked for degradation of the radionuclide foil by a contracted nuclear counting firm.
INTERFERENCES	Solvents, reagents, glassware, and other sample artifacts may interfere with sample analysis. Interferences are monitored by the analysis of a method blank performed with each batch.
INSTRUMENTATION	Gas Chromatograph should be suitable for split-less or on-column injection. The system should be equipped with an

electron capture detector. The instruments used are Agilent Technology 6890N GC/ECD.

The data system must be capable of time stamping, all data produced, with the correct date and time. The data system employed is Target.

COLUMNS

Recommended Columns are
XLB or similar phase 30m X 0.32mm ID
35MS or similar phase 30m X 0.32mm ID

REAGENTS

Hexane-pesticide grade. Store away from sources of Phthalates.

STANDARDS

1. Purchasing Standards: All standards shall be purchased from a certified vendor. The ICV shall be from a secondary source.

2. The 8081 stock standard is a certified standard containing all single component analytes at varying concentrations for calibration. Add 625uL and dilute to 50mL with Hexane to make the working standard.

3. The Toxaphene stock standard is purchased certified to contain 5000ug/mL. A working standard of 5000ug/L is prepared by spiking 50uL of the stock standard and diluting to 50mL in Hexane.

4. The Technical Chlordane stock standard is purchased certified to contain 1000 ug/mL. A working standard of 400 ug/L is prepared by spiking 20 uL of the stock standard and diluting to 50mL in Hexane.

5. Surrogate stock standard is purchased certified and contains Decachlorobiphenyl and Tetrachloro-m-xylene at 400ug/mL. Dilute 25uL of stock standard to 50mL in Hexane to make a 200ug/L solution. All prepared QC and samples are already spiked, and no additional surrogates are added. The analytical lab must spike all calibration standards.

6. ICV Standard: Stock standard solution containing all single component analytes of interest prepared from a source independent of the calibration standards. Dilute 3uL to 50mL with hexane to make a 60ug/L solution for the single component compounds. An ICV standard for Toxaphene and Chlordane is prepared when the analytes are requested.

7. Degradation (DEG) stock standard containing 4,4'-DDT and Endrin at 200ug/mL. A working standard of 80ug/L is prepared by spiking 20uL of the stock standard and diluting to 50mL in Hexane.

8. Standard Storage: Stock Standards can be stored for up to one year. All other working standards can be kept for up to 6 months or until stock standard it was made from expires, whichever is sooner. Standards must be replaced sooner if suspected of degrading or concentrating. All standards shall be kept at 4°C when

not in use. Store standards in amber glass with PTFE-lined caps and protect from light.

Preparing Calibration Standards:

1. The calibration standards are prepared by diluting stock solutions into 6 working levels. The following chart indicates the compounds and concentrations.

Table 1 Concentrations (µg/L)

	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	LEVEL 6
ALPHA-BHC	2.5	5	20	60	80	100
GAMMA-BHC	2.5	5	20	60	80	100
4,4'-DDT	5.0	10	40	120	160	200
4,4'-DDD	5.0	10	40	120	160	200
DIELDRIN	5.0	10	40	120	160	200
ENDOSULFAN I	2.5	5	20	60	80	100
ENDRIN	5.0	10	40	120	160	200
HEPTACHLOR	2.5	5	20	60	80	100
METHOXYCHLOR	25	50	200	600	800	1000
ALDRIN	2.5	5	20	60	80	100
BETA-BHC	2.5	5	20	60	80	100
DELTA-BHC	2.5	5	20	60	80	100
a-CHLORDANE	2.5	5	20	60	80	100
g-CHLORDANE	2.5	5	20	60	80	100
4,4'-DDE	10	10	40	120	160	200
ENDOSULFAN II	5.0	10	40	120	160	200
ENDOSULFAN SULFATE	5.0	10	40	120	160	200
ENDRIN ALDEHYDE	5.0	10	40	120	160	200
ENDRIN KETONE	5.0	10	40	120	160	200
HEPTACHLOR EPOXIDE	2.5	5	20	60	80	100
TOXAPHENE*	-	-	-	-	-	5000
TECHNICAL CHLORDANE*	-	-	-	-	-	400

2. *Multi-component compounds require a single calibration standard.

RETENTION TIME STUDY

1. For all analytes and surrogates a retention time study is performed over approximately 72 hours whenever a new

column is installed, after major maintenance, or during initial set-up. The standard deviation (SD) is calculated based on this study using at least three determinations, measured to 0.001 minutes. The width of the retention time window is three times the SD for each of the analytes. Alternatively, if the calculated SD is less than 0.01 minutes, a default window of ± 0.03 minutes shall be employed.

2. The daily retention time window for the analyte is equal to the retention time of the analyte in the first CCV of the day, ± 3 times the standard deviation.

DEGRADATION STANDARD

1. A degradation check standard must be analyzed each day prior to analyzing samples and once every 12-hours the instrument continues to analyze samples. Inject 1 uL of the 80ppb DEG working standard.

2. The degradation standard contains 4,4'-DDT and Endrin and is used to determine their breakdown components. 4,4'-DDT breaks down to 4,4'-DDD and DDE, Endrin breaks down to Endrin Aldehyde and Endrin Ketone.

3. The breakdown standard insures the instrument is maintained properly and will not cause breakdown of DDT and Endrin.

4. The degradation of either 4,4-DDT or Endrin cannot exceed 15% individually.

   Breakdown DDT =

$$\frac{Ac + Ad}{At + Ac + Ad} \times 100$$

   At = Peak Area of DDT
   Ac = Peak Area of DDE
   Ad = Peak Area of DDD

   Breakdown of Endrin =

$$\frac{Aa + Ak}{Ac + Aa + Ak} \times 100$$

   Ac = Peak Area of Endrin
   Aa = Peak Area of Endrin Aldehyde
   Ak = Peak Area of Endrin Ketone

5. If the degradation standard fails to meet this criteria take appropriate corrective action (clean injector, replace insert, septa, ferrules, trim column, re-prep. standard, clean syringe, etc.). The degradation standard must meet criteria prior to analyzing samples.

INITIAL CALIBRATION

The initial calibration consists of a series of standards analyzed at the concentration noted in Table 1. An initial calibration curve for each single component target analyte must

be analyzed and evaluated before any peak for that analyte can be quantitated. For multi-component analytes, Technical Chlordane and Toxaphene, a single point is analyzed for the ICAL.

1. The calibration range is defined as the on-column concentration range adjusted for sample prep. Because six calibration standards are used, the analyst has the option of eliminating one of the points using the criteria below. Within the following requirements the analyst may select the points that improve linearity, obtain the calibration range needed for a specific project, or maintain the default calibration range (5.0 – 100 ug/mL). Typically, alpha-BHC is the only compound reported in the Level 1 standard. For DOD projects and other projects that do not require lower detection limits, levels 2 through 6 are used on a regular basis and alpha-BHC is left on in level 1 at all times for RECAP projects.

    a) At least five contiguous points must be used.
    b) Calibration acceptance criteria must be met as described below.
    c) The lowest calibration point must support the lowest reporting limit needed in the associated samples.
    d) The QC spike amount must be within the calibration range.

2. Replacing points in the middle of a curve is not allowed unless the analyst can document a technical issue at the time of analysis or spiking of the standard. The new point must be analyzed in the same analytical batch. If the problem appears to be associated with a single standard, that one standard may be reanalyzed. Replacing the standard may be necessary in some cases.

3. The calibration curve is now ready for analysis.

4. The acceptance criteria for initial calibration must be satisfied before analysis of samples begin. Select projects may have additional or more stringent criteria that must be achieved for the applicable samples. See SOP GEN-019.

5. Additionally one of the following options must be met. Always attempt to meet calibration criteria using the average response factor. If the average response factor does not pass, options B and C are evaluated, but do not need to be evaluated in the order listed (if historical results indicate that quadratic fits are appropriate for a particular analyte, that option may be selected without evaluating linear). The calibration options and requirements are as follows:

    A. Average Response Factor Calibration. For each of the standards, calculate the response factor of each compound. Calculate the average of a minimum of five response factors and the standard deviation across the selected five response factors. Use the average RF and the standard deviation to calculate the percent relative standard deviation (%RSD). All equations can be found in the Calculation section. When the five (or more) response factors of the standards demonstrate

less than 20% RSD for all analytes, linearity through the origin can be assumed. If the RSD for any analyte is greater than 20%, the analyst may wish to review the results for those analytes to ensure that the problem is not associated with just one of the initial calibration standards.

B. For those compounds that the RSD exceeds 20%, a linear regression equation that is not forced through the origin may be used. The coefficient of determination must be at least 0.990 for the curve to be acceptable. As part of the evaluation, check the y-intercept (b) and any negative factors (b or M). Negative factors may result in false negatives and positives. Large shifts in the y-intercept from zero will impact the data. If the intercept is greater than half the reporting limit, this option shall not be used. Check the required reporting limit and any impacts on the data. False positives shall be indicated in the case narrative.

C. A quadratic curve fit may be used if the coefficient of determination $r^2 \geq 0.990$. A minimum of a six-point calibration is used if this option is chosen and the curve shall not be forced through zero. As part of the evaluation, check the y-intercept (b) and any negative factors (b or M). Negative factors may result in false negatives and positives. Large shifts in the y-intercept from zero will impact the data. If the intercept is greater than half the reporting limit, this option shall not be used. Check the required reporting limit and any impacts on the data. False positives shall be indicated in the case narrative. For South Carolina projects, quadratic curve fits are not allowed.

6. Determine the response factor for a multicomponent compound by calculating the average area count of the four major peaks. For Technical Chlordane and Toxaphene, the analyst should choose four peaks from the pattern for use in quantitation. These peaks should be chosen as discrete peaks and ones that have a sufficient response in the pattern. These same four peaks will be used for quantitation of all samples.

INITIAL CALIBRATION VERIFICATION

Immediately following the initial calibration procedure or before sample analysis, the analyst shall perform initial calibration verification (ICV). This will consist of a solution containing all single component target analytes prepared from a standard that is independent from the initial calibration.

The ICV must be analyzed following the initial calibration. The ICV recovery must be 85-115%. Specific project criteria may apply that must be achieved for the associated samples. See SOP GEN-019. For DOD projects, the ICV recovery must be 80-120%.

If any target analyte recovery is outside the control

limits, corrective action must be taken. This may include instrument maintenance, re-analysis of the ICV or initial calibration, or re-preparation of the standards involved. If holding time or agreed project due dates will not be met because of ICV failure, the client must be contacted and approve of proceeding with the analysis. Note all failures in the case narrative.

CONTINUING CALIBRATION VERIFICATION STANDARDS

1. The calibration verification standards are the mid-level standard of the six-point calibration. The calibration verification standards are analyzed to verify that the calibration curve and retention time windows are still valid.

2. The calibration verification standard is analyzed at the beginning of each 12-hour shift. The shift begins with the injection of the calibration verification standard and ends after the completion of analysis of the last sample or standard injected within 12 hours of the beginning of shift. A calibration verification standard must also be injected every 10 samples and at the end of the analytical sequence.

3. The criterion for the calibration verification standard is that all analytes must be ± 20 percent difference (%D) from the initial calibration. For each CCV, each compound must fall within the retention time window.

4. If the average of the responses for all analytes are within 20%, then the calibration has been verified; however, the % difference cannot exceed 30% for an individual analyte. Include the failure in the report narrative. This option is not allowed for some projects including, but not limited to, DOD, AFCEE, Marathon LLC, and projects from or reported to South Carolina. Check with the project manager if this option is used. See SOP GEN-019.

5. If the calibration verification standard fails to meet these criteria, repeat the injection of the standard. If the standard continues to fail, take appropriate corrective action (inspection of GC, re-prep, standard, etc.) If these criteria cannot be met, a new calibration curve shall be prepared.

6. If the calibration verification standard analyzed after a group of samples has a response for an analyte >20% and the analyte was not detected in any of the previous samples during the analytical shift, then the samples do not need to be re-analyzed. If an analyte was not detected in the sample and the standard response is more than 20% below the initial calibration response, then re-injection is necessary. For DOD projects, a QC exception will be requested from the client before using this option.

SAMPLE ANALYSIS

1. Up to 10 samples (not including MB, LCS/LCSD) can be analyzed after the calibration verification standard.

2. All samples are evaluated on a primary column then a secondary column if an analyte above detection limit was detected. The secondary column confirms the presence of that analyte.

3. If the analyte falls within the retention time window on both the primary and secondary analysis, then calculate the concentration present. The higher value of the two analyses is reported. (The lower value maybe reported if required by the project.) If the difference between the two results, calculated as an RPD, is greater than 40%, narrate the sample results. The results are flagged in the report. For DOD projects, the analyst should use project specific requirements for reporting if available. Otherwise, report the result from the primary column and flag results where the confirmation result is greater than 40% RPD.

SAMPLE RE-EXTRACTION

Samples are to be re-extracted due to failed QC or due to the sample results. When a MB, LCS, or LCSD fails to meet criteria, the entire batch is sent to extractions for re-extraction. If the MS, MSD, or surrogates fail criteria, only the affected samples are sent to extractions. Particular samples may be re-extracted if the sample results do not match historical values, if a sample and a duplicate do not match, or if physical differences are noted in samples. If samples are re-extracted outside of method specified holding times, both analyses are reported. To request sample/batch re-extraction, do the following:

1. If the extract has been analyzed, process the file and load to LIMS.
2. Enter the code "RP" into the analysis code; this will schedule new sample prep.
3. Complete the Re-extraction Request and Tracking Form (attached) and submit a copy to extraction supervisor.
4. When new extracts are brought to the lab, complete the original Re-extraction Request and Tracking Form and report the data appropriately.
5. If additional sample is not available to re-prep, check with project manager to determine appropriate action to report the available data.
6. If two sets of data will be reported, see login to obtain a re-extracted sample number.

CALCULATION

1. $$\text{MS \% REC} = \frac{\text{MS Concentration-Sample Concentration}}{\text{spike added}} \times 100$$

2. $$\text{MSD \% REC} = \frac{\text{MSD Concentration-Sample Concentration}}{\text{spike added}} \times 100$$

3. $$\text{\% RPD} = \frac{\text{MS-MSD}}{(\text{MS+MSD})/2} \times 100$$

LCS/LCSD results are substituted to calculate %RPD between LCS and LCSD. Results are calculated using the concentration (not percent recovery).

4. Response Factor = A_s/C_s

   As = Peak Area of analyte or surrogate
   Cs = Concentration of the analyte or surrogate

5. Surrogate/LCS Recovery = $\frac{\text{Concentration Found}}{\text{Concentration Added}} \times 100$

6. Concentration using RF:

   Concentration (µg/L) = $\frac{(A_s)(D)(V_t)}{(RF)(V_s)}$

   Concentration (µg/kg) = $\frac{(A_s)(D)(V_t)}{(RF)(W_s)}$

   A_s = Area of peak for the analyte in sample
   D = Dilution factor
   RF = Mean Response factor from initial calibration
   W_s = Weight of sample extracted in g
   V_t = Total volume of concentrated extract in µL
   V_s = Volume of aqueous sample extracted in mL

7. Concentration using linear curve fit:

   Concentration (µg/L) = $[m(A_S)+b]D$

   Concentration (mg/kg) = $[m(A_S)+b]D(5/W_S)$

   m = Inverse of slope
   A_s = Area of peak for the analyte in sample
   b = Intercept of the y-axis
   D = Dilution factor
   W_s = Weight of sample extracted

8. Concentration using a quadratic curve fit:

   Concentration (mg/L) = $[b + a(A_S) + a_2(A_S)^2]D(5/V_S)$

   Concentration (mg/kg) = $[b + a(A_S) + a_2(A_S)^2]D(5/W_S)$

9. % Difference = $[(RF_I - RF_C) / RF_I\} \times 100$

   RF_I = Average response factor from initial calibration
   RF_C = Response factor from current verification check standard

10. % Drift = $\frac{\text{Calculated Conc. – Theoretical Conc.}}{\text{Theoretical Conc.}} * 100$

11. % RSD = (SD/X) X 100

    RSD = Relative Standard Deviation
    X = mean of initial RF's for a compound
    SD = Standard Deviation of average RF's for a compound

QUALITY CONTROL

METHOD BLANK

1. The method blank (extraction blank) is analyzed to demonstrate the extraction procedure did not introduce contamination.

2. No target analytes should be detected in the method blank above ½ the reporting limit. If any target analytes are detected, data may not be reported and samples must be re-extracted and re-analyzed unless the following apply:

   A. If a target analyte is detected above ½ the reporting limit, data may be reported if the concentration is not greater than 5% of the measured concentration in associated samples. Include a narrative with the data.
   B. If a target analyte is detected in the method blank but there are no hits in the samples, the data may be reported with a narrative.
   C. Additional project criteria may apply. See SOP GEN-019.

SURROGATES

1. The surrogate is used to verify that each sample was properly extracted. A surrogate is a non-target compound that is chemically similar to the analytes. The surrogates used are Decachlorobiphenyl (DCB) and 2,4,5,6-Tetrachloro-m-xylene (TCMX).

2. If a surrogate recovery fails below the lower control limit, re-extract and re-analyze the sample. If the surrogate is outside QC limits in the re-extract sample, then indicate in the case narrative and state that the recovery was outside the control limits due to sample matrix. If re-extraction cannot be performed due to insufficient sample, report the data with a narrative.

3. If the surrogate recovery is above the control limits and the sample results are less than the reporting limit, the data may be reported with a narrative.

Surrogate	Rec. Limits % Water	Rec. Limits % Soil
TCMX	49-137%	58-140
DCB	30-139%	55-139

4. Project specific limits may apply and may be more stringent; project limits are listed in the LIMS. See SOP GEN-019.

LABORATORY CONTROL STANDARD (LCS/LCSD)

1. A LCS and LCSD (if required) are included in each batch to demonstrate the system is in control. Routinely the LCS/LCSD will be spiked with a full list of the single component analytes.

2. All recoveries should be within the control limits listed in Table 2 below. If the full list of target

analytes is spiked, a small percentage of sporadic failures will be allowed. See Table 3 for the number of allowable failures. The failures are noted in the case narrative. If a recovery is above the upper control limit and the sample results are below the reporting limit, the data may be reported with a narrative. For South Carolina projects, LCS/LCSD recoveries must be 70-130% to report data. For South Carolina, no sporadic marginal failures are allowed.

Table 2: LCS Control Limits 8081B

Compound	% Recovery Water	RPD Water	% Recovery Solid	RPD Solid
alpha-BHC	70-131	40	57-145	40
Gamma-BHC	70-130	40	58-137	40
4,4-DDT	58-130	40	46-137	40
4,4-DDD	67-135	40	58-142	40
Dieldrin	70-134	40	61-142	40
Endosulfan I	30-130	40	30-130	40
Endrin	67-136	40	60-143	40
Heptachlor	65-130	40	61-149	40
Methoxychlor	56-135	40	44-142	40
Aldrin	59-130	40	63-141	40
beta-BHC	70-130	40	56-145	40
delta-BHC	70-132	40	59-146	40
alpha-Chlordane	70-141	40	62-151	40
gamma-Chlordane	63-130	40	54-133	40
4,4-DDE	66-130	40	59-140	40
Endosulfan II	41-130	40	43-130	40
Endosulfan sulfate	65-139	40	57-147	40
Endrin aldehyde	61-130	40	52-130	40
Endrin ketone	68-138	40	56-148	40
Heptachlor epoxide	69-130	40	61-137	40

3. If a recovery is below the lower control limit or precision fails, the batch must be re-extracted and re-analyzed. If a re-extraction is not possible due to insufficient sample volume, report the data with a narrative.

TABLE 3: Number of Allowable Failures

Number of Analytes	Failures Allowed
0-11	0
11-30	1

4. Project specific recovery and precision limits may apply and may be more stringent; project limits are listed in the LIMS. See SOP GEN-019.

MATRIX SPIKES (MS/MSD)

1. The purpose of the MS/MSD is to assess the performance of the method for a particular sample matrix. The recoveries for each spike compound should be within the control limits specified in Table 2.

2. Whenever the MS and/or MSD recoveries are outside the control limits, review data to verify that a lab error has not occurred (wrong spike amount, not spiked) before automatically identifying a failure as matrix interference.

3. If recoveries for the MS and/or MSD are outside the control limits and the recoveries are similar, the data is reportable with a narrative stating the LCS recoveries were acceptable. The failure is attributed to sample matrix.

4. If precision is outside of control limits, re-extract the parent, MS, and MSD. If the failure is repeated, check that the samples are homogenous. Narrate the sample results including corrective action and sample appearance if applicable.

5. Native sample concentrations may be high in comparison to the spiking concentration and therefore an accurate recovery cannot be calculated. Document this in the case narrative.

6. Spikes may be diluted out in the analysis process. Document this in the case narrative.

7. Project specific recovery and precision limits may apply and may be more stringent; project limits are listed in the LIMS. See SOP GEN-019.

REPORTING LIMIT

Table 4 lists default-reporting limits for Pesticides. Reporting limits may be lowered by altering the prep and, when allowable, calibrating lower. The reporting limit should be no lower than 2X the verified MDL. Some projects may have different criteria for setting reporting limits. Check SOP GEN-019 and with the project manager.

Table 4 Reporting Limits

COMPOUND	WATER (ug/L)	SOLID (ug/kg)
alpha-BHC	0.05	2
beta-BHC	0.05	2
delta-BHC	0.05	2
gamma-BHC	0.05	2
Heptachlor	0.05	2
Aldrin	0.05	2
Heptachlor Epoxide	0.05	2
Endosulfan I	0.05	2
Dieldrin	0.10	4
4,4'-DDE	0.10	4
Endrin	0.10	4
Endosulfan II	0.10	4
4,4'-DDD	0.10	4
Endosulfan Sulfate	0.10	4
4,4'-DDT	0.10	4
Methoxychlor	0.50	20
Endrin Ketone	0.10	4
Endrin Aldehyde	0.10	4
alpha-Chlordane	0.05	2
gamma-Chlordane	0.05	2
Toxaphene	5.00	200
Technical Chlordane	0.25	10

MANUAL INTEGRATIONS

Perform and document manual integrations as described in SOP QA-010.

DATA REVIEW

For data review procedures and checklist, please see SOP QA-002.

SOFTWARE TROUBLESHOOTING

The Agilent GC utilizes Agilent software GC Chemstation Version A.10.02 to control the instrument and transfer data acquisition to Target Data Integration software. Target software is utilized to calculate all data. In the event of software malfunction for the GC Chemstation, please contact Agilent technical support for troubleshooting help. In the event of software malfunction when using Target, please contact GCAL's IT Director for troubleshooting help.

METHOD PERFORMANCE

1) The method detection limit (MDL) is defined in Chapter One of the 8081B method. A laboratory should develop its own matrix-specific MDLs using the guidance found in Chapter One of the 8081B method.

2) The chromatographic separations in this method have been tested in a single laboratory by using clean hexane and liquid and solid waste extracts that were spiked with the test compounds at three concentrations. Single-operator

precision, overall precision, and method accuracy were found to be related to the concentration of the compound and the type of matrix.

3) This method has been applied in a variety of commercial laboratories for environmental and waste matrices. Performance data were obtained for a limited number of target analytes spiked into sewage sludge and Dichloroethene still-bottoms at high concentrations. These data are provided in Tables 9 and 10 of the 8081B method.

4) The accuracy and precision obtainable with this method depend on the sample matrix, sample preparation technique, optional cleanup techniques, and calibration procedures used.

5) Tables 9 and 10 of the 8081B method contain precision and recovery data generated for sewage sludge and Dichloroethane still-bottoms. Table 11 of the 8081B method contains recovery data for a clay soil, taken from Reference 10. The spiking concentration was for the clay soil was 500 ug/kg. The spiking solution mixed into the soil and then immediately transferred to the extraction device and immersed in the extraction solvent. The spiked sample was then extracted by Method 3541 (Automated Soxhlet). The data represent a single determination. Analysis was by capillary column gas chromatography/electron capture detector following Method 8081 for the Organochlorine Pesticides.

POLLUTION PREVENTION	See QAPP Section 10.2
WASTE MANAGEMENT	See SOP GEN-009
IDOC	See SOP QA-014
MDL	See SOP QA-009

GLOSSARY

ACCEPTANCE LIMITS – data quality limits specified by the test method or generated by the laboratory. Specified limits placed on an item, process, or service defined in the requirement document.

ACCURACY – a measure of how close a measured value is to a known true value. Accuracy is assessed by means of reference samples and percent recoveries of spiked samples. The degree of agreement between an observed value and an accepted reference value. Accuracy includes combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator.

ALIQUOT – a discrete, measure, or representative portion of a sample taken for analysis.

ANALYTE – the chemical element or compound an analyst seeks to determine; the chemical element of interest.

ANALYTICAL BATCH – the basic unit for analytical quality control, defined as samples that are analyzed together with the same method sequence and the same lots of reagents and with the manipulations common to each sample within the same time period or in continuous sequential time periods. Samples in each batch should be of similar composition (e.g., groundwater, sludge, ash).

ANALYTICAL SAMPLE – any solution or media introduced into an instrument on which an analysis is performed, excluding instrument calibration, initial calibration verification, initial calibration blank, continuing calibration verification, and continuing calibration blank. The following are all analytical samples: undiluted and diluted samples (EPA and non-EPA), predigestion spike samples, duplicate samples, serial dilution samples, analytical spike samples, post digestion spike samples, interference check samples (ICS), CRDL standard for AA(CRA), CRDL standard for ICP(CRI), laboratory control sample(LCS), preparation blank(PB), and linear range analysis sample(LRS).

ANALYST – the designated individual who performs the "hands on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.

AREA UNITS – a term used in gas chromatography that indicates the peak area of a compound exiting a chromatographic column. The size or area of the peak is proportional to the amount of analyte in the sample.

ATOMIC ABSORPTION (AA) – a technique for analyzing metal using an element-specific lamp that emits a characteristic light spectrum. A sample is heated in a flame or graphite furnace and the light beam is passed through it. When the sample absorbs light, an energy loss is detected and is translated into a concentration of metal in the sample. This technique detects one metal at a time.

AUDIT – a systematic check to determine the quality of some function or activity. Two basic types are performance audits and system audits. Perform audits involve a quantitative comparison of the laboratory's results to those of a proficiency sample containing known concentration of analytes. A

system audit is a qualitative evaluation that normally consists of an onsite review of a lab's quality assurance system and physical facilities.

BACKGROUND CORRECTION – a technique usually employed relative to metals analysis, which compensates for variable background contribution to the instrument signal in the determination of trace elements.

BATCH – environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A batch is composed of a maximum of twenty environmental samples. A preparation batch is composed of environmental sample of the same matrix, meeting the above-mentioned criteria and with a maximum time between the start of processing the first and last sample in the batch to be 24 hours. An analytical batch is composed of prepared environmental samples (extracts, digestates or concentrates) and/or those samples not requiring preparation, which are analyzed together as a group using the same calibration curve or factor. An analytical batch can include samples originating from various environmental matrices.

BIAS – the deviation of the mean of replicate analytical measurements from a reference analyte concentration. Relative bias is represented by analytical measurement mean minus the reference analyte concentration and the difference divided by the reference analyte concentration. See accuracy and precision.

4-BROMO-FLUOROBENZENE (BFB) – the compound used to check the tuning of the instrument, and is used as a surrogate compound spiked into every sample for volatile analysis. A compound utilized in EPA gas chromatography/mass spectrometry (GC/MS) volatile methods to establish mass spectral instrument performance.

BIOCHEMICAL OXYGEN DEMAND (BOD) – A measure of the amount of oxygen consumed in the biochemical processes that break down organic matter in water. A larger BOD value indicates a greater degree of organic pollution. A related term, BOD5, is the amount of dissolved oxygen consumed in five days.

BIOSEED – the bacterial culture used to inoculate a sample for testing.

BLANK – an artificial sample designed to monitor the introduction of artifacts into the measurement process. For aqueous samples, reagent water is used as a blank matrix. There are several types of blanks, which monitor a variety of processes:1.) *laboratory blank* is taken through sample preparation and analysis only. It is a test for contamination in sample preparation and analyses. 2.) *storage blank* is stored and analyzed with samples at the laboratory. It is a test for contamination in sample storage as well as sample preparation and analysis. 3.) *trip blank* is shipped to and from the field with the sample containers. It is not opened in the field and, therefore, provides a test for contamination from sample preservation, site conditions, and transport as well as sample storage, preparation, and analysis. It is most commonly used for volatile organics. 4.) *field blank* is opened in the field and tests for contamination from the atmosphere as well as those activities listed under the trip blank.

BNA – base, neutral and acid extractable compounds. The term base, neutral and acid refer to the pH condition of the sample undergoing extraction. Certain compounds extract more efficiently from water under acidic conditions. Such compounds are often referred to as "acid extractables."

CALIBRATE – to determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter or other device, or the correct value for each setting of a control knob. The levels of the applied calibration standard should bracket the range of planned or expect sample measurements.

CALIBRATION – The systematic determination of the relationship of the response of the measurement system to the concentration of the analyte of interest. Instrument calibration performed before any samples are analyzed is called the initial calibration. Subsequent checks on the instrument calibration performed throughout analysis are called continuing calibration verification.

CALIBRATION BLANK (CB) – a volume of reagent water in the same matrix as the calibration standards but without the analyte.

CALIBRATION CURVE – the graphical relationship between the known values, such as concentrations, of a series of calibration standards and their analytical response.

CALIBRATION METHOD – a defined technical procedure for performing a calibration.

CALIBRATION STANDARD – a certified material used to calibrate an instrument.

CERTIFIED REFERENCE MATERIAL (CRM) – reference material, one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body. (ISO Guide 30)

CONTINUING CALIBRATION VERIFICATION (CCV) – used to evaluate the performance of the instrument system with respect to a defined set of method criteria. The CCVs are used to verify instrument performance during analysis. The CCV shall be prepared from the same stock standard solution used to prepare the calibration curve.

CHAIN-OF-CUSTODY–Procedures and associated documents designed to trace the custody of a sample from the point of origin to final disposition, with the intent of legally demonstrating that custody remained intact and the tampering or substitutions were precluded.

CHEMICAL OXYGEN DEMAND (COD) – A measure of the oxygen required to oxidize all compounds in water, both organic and inorganic.

COMBINED STANDARD UNCERTAINTY – The standard uncertainty of the analytical measurement result that is the sum in quadrature (square-root-of-the-sum-of-the-squares) of the component standard uncertainties.

CORRECTIVE ACTION – the action taken to eliminate the causes of an existing non-conformity, defect, or other undesirable situation to prevent reoccurrence.

COVERAGE FACTOR – the numerical factor used as a multiplier of the combined standard uncertainty to expand the uncertainty corresponding to a specific level of confidence. The Student's *t*-distribution is used for determining the coverage factor.

DEMONSTRATION OF CAPABILITY (DOC) – a procedure used to establish the ability of the analyst to generate acceptable accuracy.

DEIONIZED WATER (DI) – water from which the majority of ions have been removed. Water that is contaminant free and used in the laboratory, the resistivity should be ≤ 18 megaohms.

DISSOLVED METALS –- metallic elements determined on a water sample that has been passed through a 0.45-um filter.

DISSOLVED OXYGEN (DO) – the oxygen freely available in water, an indicator of water quality.

DISSOLVED SOLIDS – disintegrated organic and inorganic material contained in water. Excessive amounts make water unfit to drink or use in industrial processes.

DRY WEIGHT – the weight of a sample based on percent solids. The weight of a sample after drying in an oven at a specified temperature.

DUPLICATE MEASUREMENT – a duplicate measurement is a second measurement made on the same or identical sample of material to assist in the evaluation of measurement of variance.

DUPLICATE SAMPLE – two samples taken from the same population and carried through certain stages of sampling and testing. Duplicate sample include field co-located duplicate samples, field-split duplicate samples, and laboratory duplicate subsamples.

EXPANDED UNCERTAINTY – the quantity defining an interval enveloping the analytical measurement that captures a large fraction of the distribution of analyte concentrations that could be attributable to the quantity measured. The combined standard uncertainty is multiplied by the coverage factor to calculate the expanded uncertainty.

EXTERNAL STANDARDS – a method of quantifying chromatographic data in which standards of known concentration are analyzed prior to unknown samples. The chromatographic peak area (or height) of a sample component is compared to a calibration curve of a peak area constructed from the standard data for that component. This comparison allows the concentration of the component in the sample to be determined.

FECAL COLIFORM BACTERIA – bacteria found in mammals' intestinal tracts. Their presence in water or sludge is an indicator of pollution and possible contamination by pathogens.

FLAME IONIZATION DETECTOR (FID) – a gas chromatography detector in which the column effluent gas is mixed with hydrogen and burned in air or oxygen. The ions and electrons produced in the flame generate an electric current proportional to the amount of materials in the detector. The FID responds to nearly all organic compounds, but it does not respond to air and water, which makes it exceptionally suited to environmental analysis.

FLASHPOINT – the lowest temperature at which a flammable liquid gives off sufficient vapor to form an ignitable mixture with air near its surface or within a vessel. Combustion does not continue.

GAS CHROMATOGRAPHY (GC) – a technique for detecting organic compounds by using their physical and chemical properties to separate a mixture. The compounds are identified and quantified with various types of detectors as they exit the chromatograph. Selection of detectors is dependent on the particular compounds of interest.

GAS CHROMATOGRAPHY MASS SPECTROMETRY (GCMS) – a technique in which sample analytes are bombarded with electrons as they exit a gas chromatography column and are fragmented into characteristics ion patterns. The mass spectrometer is the detector. It can determine which fragments are present and therefore the identity of the compounds.

GLUCOSE GLUTAMIC ACID (GGA) – used as a laboratory control standard in BOD procedures.

GRAPHITE FURNACE – a technique used for the analysis of metals. An atomic absorption spectrophotometer heats the sample within a graphite tube using an electrical current. It is also commonly called a flameless furnace and generally provides greater sensitivity for certain metals than flame or inductively coupled argon plasma techniques.

GRAVIMETRIC - analyses based on the direct or indirect weighing of the analyte in question. This technique usually requires the use of an analytical balance with a sensitivity of 0.1 mg or better.

HALL ELECTROLYTIC CONDUCTIVITY DETECTOR – an element-selective gas chromatography detector primarily intended for trace analysis of organic compounds containing chlorine, nitrogen or sulfur. In operation, this detector pyrolyzes the column effluent gas into soluble electrolytes that are dissolved in a stream of deionized liquid. The observed change in electrical conductivity, proportional to the amount of material present, is measured.

HAZARDOUS WASTE – waste regulated under RCRA that can pose a substantial or potential hazard to human health or the environment when improperly managed. Such wastes possess at least one of four characteristics (ignitability, corrosivity, reactivity, or toxicity) or appear on special EPA hazardous waste lists. The term is not interchangeable with hazardous substances or material.

HEADSPACE - Any area in a container not completely filled by the sample in which gases can collect.

HEAVY METALS – metallic elements with high atomic weights, i.e., mercury, chromium, cadmium, arsenic, and lead. They can damage the health of plants and animals at low concentrations and tend to accumulate in the food chain.

HOLDING TIME – the maximum times that samples may be held before analysis and still be considered valid or not compromised. The storage time allowed between sample collection and sample analysis when the designated preservation and storage techniques are employed.

HYDROCARBONS – chemical compounds that consist entirely of carbon and hydrogen.

ICP – Inductively coupled plasma is a type of instrument used for metals analysis. Because the temperature of the plasma is considerable higher ($10{,}000^{o}K$) than the temperature of a flame atomic

absorption spectrophotometer, it is especially useful for refractory metals. Some instruments are also capable of performing simultaneous multielement analysis.

ICP-MS - Inductively coupled plasma mass spectrometry (ICP-MS) is a type of mass spectrometry highly sensitive and capable of the determination of a range of metals and several non-metals at concentrations below one part in 10^{12} (part per trillion). It is based on coupling together an inductively coupled plasma as a method of producing ions with a mass spectrometer as a method of separating and detecting the ions. In trace elemental analysis, the method has advantages of high speed, precision and sensitivity.

IGNITABLE – capable of burning or causing a fire.

INORGANIC CHEMICALS – chemical substances of mineral origin, unlike organic chemicals whose structure relies on carbon atoms.

INITIAL CALIBRATION VERIFICATION (ICV) - also referred to as the Independent Calibration Verification for this laboratory. A standard solution used to verify the calibration curve derived from a source independent of the instrument calibration standard. The ICV is use to quantify second source standard variance and bias.

INSTRUMENT CALIBRATION STANDARD - a reference material used to standardize an analytical instrument.

INSTRUMENT DETECTION LIMIT (IDL) - a term utilized in the EPA Inorganic Contract Laboratory Program. The IDL is three times the standard deviation obtained for the analysis of a standard solution (each analyte in reagent water) at a concentration of three to five times that of the IDL on three nonconsecutive days with seven consecutive measurements per day. The IDL is the concentration equivalent to a signal, due to the analyte of interest, which is the smallest signal that can be distinguished from background noise by a particular instrument. The IDL should always be below the method detection limit, and is not used for compliance data reporting, but may be used for statistical data analysis and comparing the attributes of different instruments.

INSTRUMENT PERFORMANCE CHECK - The analyses of one of the ICSs to verified initial and continuing calibration (CCV). The IPC is used to quantify the instrumental testing repeatability variance and bias.

INSTRUMENT TUNING - a technique used in gas chromatography/mass spectrometry procedures to verify that the instrument is properly calibrated to produce reliable mass spectral information. See 4-Bromofluorobenzene under "B".

INTERNAL STANDARDS - compounds added to every standard, blank, matrix spike, matrix spike duplicate, sample (for volatile organics), and sample extract (for semivolatiles) at a known concentration, prior to analysis. Internal standards are used as the basis for quantification of the target compound.

IONIZATION - Utilized in mass spectrometry to fragment analyte molecules into smaller segments. These smaller mass segments are then separated and plotted to form a "mass spectrum" which is used to identify the parent molecule. Electron impact is one example of ionization used in mass

spectrometry. In more technical terms. Ionization is the process by which neutral atoms or groups of atoms become electrically charged, either positively or negatively, by the loss or gain of electrons.

ISOMERS - chemical compounds with the same molecular weight and atomic composition by differing molecular structure, e.g., n-pentane and 2-methylbutane.

LABORATORY CONTROL SAMPLE (LCS) - a clean-matrix reference sample spiked with a standard with an established analyte concentration. The LCS is carried through the entire chemical preparation and testing procedures. The LCS is used to quantify the variance and bias of the chemical preparation and instrumental testing stages without matrix interference. Also called a Laboratory fortified blank (LFB).

LABORATORY CONTROL SAMPLE DUPLICATE (LCSD) – a duplicate of the laboratory control sample in a clean matrix that is carried through the entire chemical preparation and testing procedures.

LABORATORY DUPLICATE SAMPLE (LAB DUPLICATE) - a portion of the collected sample that is carried through the chemical preparation and testing. The laboratory duplicate subsample is used to quantify the variance of the chemical preparation and instrumental testing stages with matrix interferences.

LEACHATE - a liquid that results from water collecting contaminants as it trickles through wastes, agricultural pesticides or fertilizers. Leaching may occur in farming areas, feedlots, and landfills, and may result in hazardous substances entering surface water, groundwater or soil.

LDEQ – Louisiana Department of Environmental Quality

LIBRARY SEARCH - a technique in which an unknown mass spectrum of a compound is compared to the mass spectra of compounds contained in a computer library in an effort to identify the compound. Compounds identified in this manner are referred to as tentatively identified compounds (TICs).

LIMIT OF DETECTION (LOD) – an estimate of the minimum amount of a substance that an analytical process can reliable detect. An LOD is analyte and matrix specific and may be laboratory dependent.

LIMIT OF QUANTIATION (LOQ) – the minimum levels, concentrations, or quantities of a target variable (e.g. target analyte) that can be reported with a specified degree of confidence..

LIMS – laboratory information management system. Horizons is the LIMS used by GCAL.

LINEAR CALIBRATION RANGE – the concentration range over which the instrument response is linear.

LOG-IN - the receipt and initial management of an environmental sample. It generally includes identifying who sent the sample; maintaining chain-of-custody; checking report and invoice information; recording analysis requested, including methodology and special instructions; and assigning a discreet in-lab identification, usually a number or bar code.

MASS SPECTRUM - a plot of ion mass/charge ratio versus intensity. A fragmentation pattern results from the particles whose mass distribution is characteristic of the parent molecule. Qualitative information is provided by a mass spectrum.

MATERIAL SAFETY DATA SHEET (MSDS) - a compilation of information required under the OSHA Communication Standard on the identity of hazardous chemicals and their associated health and physical hazards, exposure limits and precautions.

MATRIX - The physical characteristics or state of a sample – e.g., water, soil, sludge.

MATRIX INTERFERENCE - the influence of the sample matrix or sample components upon the ability of qualitatively identifies and quantitatively measures compounds in environmental samples.

MATRIX MODIFIERS - chemicals added to samples for metals analysis, which are used to lessen the effects of chemical interference, viscosity and surface tension.

MATRIX SPIKE (MS) – aliquot of a sample fortified (spiked) with known quantities of specific compounds and subjected to the entire analytical procedure in order to indicate the appropriateness of the method for the matrix by measuring recovery of the spike. Matrix spiked samples are used to quantify the variance and bias of the chemical preparation and testing stages with matrix interference.

MATRIX SPIKE DUPLICATE (MSD) - a second aliquot of the same matrix as the matrix spike that is spiked to determine the precision of the method.

METHOD DETECTION LIMIT (MDL) - the minimum concentration of compound that can be measured and reported within 99% confidence that the value is above zero and is determined from analysis of a sample in a given matrix containing the analyte.

MUST – denotes a mandatory requirement.

NARRATIVE - in an analytical report, a descriptive documentation of any problems encountered in processing the samples, along with corrective action taken and problem resolution.

NUTRIENT - any substance assimilated by living things that promote growth. The term is generally applied to nitrogen and phosphorus in wastewater, but is also applied to other essential and trace elements.

ORGANIC - generally, any compound that contains carbon bonded to a hydrogen or halogen atom.

OXIDATION - the process in chemistry whereby electrons are removed from a molecule.

PCBs - Polychlorinated biphenyl, a group of toxic persistent chemicals used in transformers and capacitors for insulating purposes and in gas pipeline systems as a lubricant. Sale of PCBs for new uses was banned by law in 1979.

PERCENT RECOVERY - a measure of accuracy that is calculated as the measured value relative to the true value expressed as a percent.

PERFORMANCE AUDIT - a quantitative evaluation of a measurement system that involves the analysis of standard reference samples or materials which are certified as to their chemical composition or physical characteristics.

PROFICIENCY TEST (PT) SAMPLE - a sample of known composition (unknown to the laboratory), provided by an external source, which is used to evaluate lab performance. For certification purposes the PT sample is purchased from an approved provider.

pH - a numerical designation of relative acidity and alkalinity. A pH of 7.0 indicates precise neutrality. Progressively higher values indicate increasing alkalinity and lower values increasing acidity.

POLLUTANT - generally, any substance introduced into the environment that adversely affects the usefulness of a resource.

PRACTICAL QUANTITATION LIMIT (PQL) - the lowest level that can be reliable achieved within specified limits of precision and accuracy routine laboratory operating conditions. The lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value.

PRECISION - a measure of the ability to reproduce analytical results. It is generally determined through the analysis of duplicate samples. The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range in either absolute or relative terms.

PRESERVATIVE - a chemical or reagent added to a sample to prevent or slow decomposition or degradation of a target analyte or a physical process. Physical and chemical preservation may be used in tandem to prevent sample deterioration.

PURGE AND TRAP - a technique used in the analysis of volatile organic where analytes are purged from a sample by means of an inert gas and trapped on a sorbent column. The sorbent is then flashheated and the analytes are transferred onto a gas chromatographic column for separation and identification.

PURGEABLE ORGANIC - an organic compound that is generally less than 20% soluble in water and has a boiling point at or below 200^{o}C. A volatile organic. An organic compound is generally considered to be purgeable if it can be removed from water using the purging process.

QC BASED NESTED APPROACH - a procedure for estimating the uncertainty of measurement using quality control data. The procedure is described in SOP QA-013.

QUALITY ASSURANCE (QA) - all those planned and systematic actions necessary to provide adequate confidence in laboratory results. An integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets the defined standards of quality with a stated level of confidence.

QUALITY ASSURANCE PROGRAM PLAN - a written assembly of management policies, objectives, principle and general procedures that outlines how the laboratory intends to generate data of known and accepted quality.

QUALITY CONTROL (QC) – the overall system of technical activities whose purpose to measure and control the quality of a product or service so that it meets the needs of the users.

QUALITY CONTROL CHART - a graph of analytical measurement results for a specific QC standard plotted sequentially with upper and lower control limits (±3SD). A central line that is the best estimate of the average variable plotted, and upper and lower marginal exceedence limits (±4SD) are usually included in the Quality Control Chart. The chart may also include upper and lower warning limits (±2SD).

QUALITY SYSTEM – a structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items) and services. The quality system provides the framework for planning, implement and assessing work performed by the organization and for carrying out required QA and QC.

r^2 – Correlation Coefficient Squared – paramet6er used to evaluate the fit of linear or quadratic regression curve fit of initial calibration data.

RAW DATA – any original information from a measurement activity or study recorded in a laboratory note book, worksheets, records, memoranda, notes, or exact copies thereof that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data may include photography, microfilm or microfilm copies, computer printouts, magnetic media, including dictated observations, and recorded data from automated instruments.

REACTIVITY - the tendency of a chemical to explode under normal management conditions, to react violently when mixed with water, or to generate toxic gases.

REAGENT WATER - water in which an interference is not observed at or above the minimum quantitation limit of interest.

REFERENCE MATERIAL - a traceable standard with an established analyte concentration. Material or substance whose property values are sufficiently homogenous, stable and well established to be used for the calibration of an apparatus, the assessment of a measurement method or for assigning values to materials (ISO Guide 30)

REFERENCE METHOD – a method of known and documented accuracy and precision issued by an organization recognized as competent to do so.

RELATIVE RETENTION TIME – a measure of the shift in retention time of an analyte when referenced to an internal standard.

RELATIVE RESPONSE FACTOR (RRF) - a measure of the relative mass spectral response of an analyte compared to its internal standard. RRFs are determined by analysis of standards and are used in the calculation of concentrations of analytes in samples.

REPLICATE ANALYSES - two or more results representing the same sample parameter. Replicate analyses are used to quantify the analytical measurement repeatability precision.

RPD – Relative Percent Difference, a relative difference between two analyses calculated by dividing the absolute difference of thos two results by the average of therir two values, then multiplying by 100.

RESOLUTION - the degree of separation between peaks eluting from a chromatographic column. Sufficient resolution between peaks is required for proper quantitation of unknown analytes.

RETENTION TIME - a term used in gas and liquid chromatography describing the time elapsed from the sample injection until the specific compound elutes or exits the chromatographic column at the detector. Each compound has a characteristics retention time on a specific column; therefore, this information is used to qualitatively identify the compounds in the sample.

SAMPLE – portion of material collect for chemical analysuis, identified by a unique number assigned by the LIMS.

SHALL – denotes a requirement that is mandatory whenever the criterion for conformance with the specification requires that there be no deviation. This does not prohibit the use of alternative approaches or methods for implementing the specification so long as the requirement is fulfilled.

SHOULD – denotes a guideline or recommendation whenever noncompliance with the specification is permissible.

SOLID WASTE – non-liquid, non-soluble materials, ranging from municipal garbage to industrial waste, that contain complex, and sometimes hazardous, substances. Solid wastes include sewage sludge, agricultural refuse, demolition wastes, mining residues, and even liquids and gases in containers.

SOLVENT - a substance, usually liquid, capable of dissolving or dispersing one or more other substances.

SPIKE – a known mass of target analyte added to a blank sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.

STANDARD CURVE - a curve that plots concentrations of known analyte standards versus the instrument response to the analyte. Calibration standards are prepared by diluting the stock analyte solution in graduated amounts that cover the expected range of the samples being analyzed. The calibration standards must be prepared by using the same type of acid or solvent at the same concentration as for the samples following sample preparation. This is applicable to organic and inorganic chemical analyses.

STANDARD OPERATING PROCEDURE - a detailed written description of how a laboratory executes a particular procedure or method intended to standardize its performance.

STANDARDIZED REFERENCE MATERIAL (SRM) – a certified reference material produced by the U.S. National Institute of Standards and Technology or other equivalent organization and characterized for absolute content, independent of analytical metho9d.

STANDARD UNCERTAINTY - the analytical measurement uncertainty expressed as a standard deviation. The relative standard deviation represents the relative standard uncertainty.

SURROGATE - an organic compound similar to the analyte of interest in chemical composition, extraction and chromatography, but not normally found in environmental samples. Primarily used in chromatography techniques, the surrogate is spiked into quality control blanks, calibration and check standards, samples (including duplicated and QC reference samples) and spiked samples before analysis. A percent recovery is calculated for each surrogate.

SUSPENDED SOLIDS - small pollutant particles that float on the surface of, or are suspended in, sewage or other liquids. They resist removal by conventional means.

TARGET COMPOUND - specific compounds that are to be quantified in a sample based on a standard list of potential compounds.

TENTATIVELY IDENTIFIED COMPOUNDS (TICs) - compounds detected in samples that are not target compounds, internal standards, system monitoring compounds or surrogates. TICs usually consist of up to 30 peaks that are greater than 10% of the peak areas, or heights, of the nearest internal standard. They are subjected to mass spectral library searches for tentative identification. A client may specify the number of unknown peaks in its samples it wishes the laboratory to tentatively identify.

TOTAL METALS - metallic elements that have been digested prior to analysis.

TYPE A EVALUATION UNCERTAINTY - the method of evaluation of uncertainty by the statistical analysis of a series of test results.

TYPE B EVALUATION OF UNCERTAINTY - the method of evaluation of uncertainty by means other than statistical analysis.

UNCERTAINTY - the parameter associated with the analytical measurement results that characterizes the dispersion of the values that could be reasonable attributed to the quantity measured.

UNCERTAINTY INTERVAL - the range of analyte concentrations that an analytical measurement could represent at a specified level of confidence. The relative standard deviation is used to represent the relative standard uncertainty in the QC-based Nested Approach.

VALIDATION –the process for evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, or contractual specifications. It essentially evaluates performance against predetermined specifications.

VOA - volatile organic analysis

VOA BOTTLE - a vial used to contain samples for volatile organic analysis.

VOLATILE COMPOUNDS - compounds amendable to analysis by purge and trap. Synonymous with purgeable compounds.

VOLATILE ORGANIC COMPOUND (VOC) - any organic compound that participates in atmospheric photochemical reactions, except for those designated by the EPA Administrator as having negligible photochemical reactivity.

WET CHEMISTRY - procedures that involve distillations, colorimetric determinations and titrimetric measurements. Examples are chloride, nitrates, sulfates and biochemical oxygen demand.

GULF COAST ANALYTICAL LABS
GC - CHLORINATED HERBICIDES
STANDARD OPERATING PROCEDURE

PROCEDURES: GC-011
PAGE: 1 OF 12
EFFECTIVE DATE: 10/1/11
APPROVED BY:
QA/QC APPROVED:

SUBJECT

SCOPE AND APPLICATION

This method provides gas chromatographic procedures for the detection of ppb levels of certain chlorinated herbicides. Prior to the use of this method, appropriate extraction techniques must be used. An aliquot of the sample extract is injected into a GC equipped with an ECD detector.

This SOP provides for the analysis of single component analytes. The QC requirements vary depending upon which analysis is being performed. Analysts should carefully read the SOP in order that requirements are not confused.

MATRIX

Water and Solid

REFERENCE

SW846 Method 8151A, 8000C

PRESERVATIVE

Cool 4°C

HOLDING TIME

Water – From collection to extraction – 7 days
From extraction to analysis – 40 days
Solid – From collection to extraction – 14 days
From extraction to analysis – 40 days

DEFINITIONS

See Appendix A for Glossary.

SAFETY

Each employee is directly responsible for complete awareness of all health hazards associated with every chemical that he/she uses. The employee must be aware of these hazards and all associated protective wear and spill clean-up procedures PRIOR TO the use of any chemical. In all cases, the applicable material safety data sheet (MSDS) and your supervisor or safety officer should be consulted. The bottle labels also provide important information that must be noted. Personnel performing this procedure may be working with flammables, poisons, toxins, carcinogens, teratogens, mutagens, and biohazards. In particular, approved gloves, safety glasses, and lab coats must be worn. In addition to other measures prescribed by the division, solvents must be handled in ventilated hoods.

The electron capture detectors employed in this method must have a wipe test performed twice a year. In accordance with the federally mandated, state administered programs, the wipes are checked for degradation of the radionuclide foil by a contracted nuclear counting firm.

INTERFERENCES

Solvents, reagents, glassware, and other sample artifacts may interfere with sample analysis.

Interferences are monitored by the analysis of a method blank performed with each batch.

INSTRUMENTATION

Gas Chromatograph should be suitable for splitless or on-column injection. The system should be equipped with an electron capture detector. The instruments used are Agilent Technology 6890N GC/ECD.
The data system must be capable of time stamping, all data produced, with the correct date and time. The data system used for acquisition is Target.

COLUMNS

Recommended Columns are

XLB or similar phase 30m X 0.32mm ID
35MS or similar phase 30m X 0.32mm ID

REAGENTS

Hexane-pesticide grade. Store away from sources of phthalates.

STANDARDS

1. Standards: All standards are purchased certified standards in sealed ampules. The stock standards are prepared in MtBE or Hexane. The standards are stored at 4°C until the manufacturer's expiration date. The stock standards are the methyl esters.

2. ICV Standard: Stock standard solution containing all analytes of interest prepared from a source independent of the calibration standards.

PREPARING CALIBRATION STANDARDS

1. The calibration standards are prepared by diluting the stock solution into 5 or 6 working levels. The standards are prepared prior to use. The following chart indicates the compounds and concentrations.

TABLE 1
Concentrations (µg/L)

Compound	Level 1 µg/L	Level 2 µg/L	Level 3 µg/L	Level 4 µg/L	Level 5 µg/L	Level 6 µg/L
2,4-D	11.8	23.6	47.2	94.3	188.7	70.8
2,4,5-T	11.8	23.6	47.2	94.3	188.7	70.8
2,4,5-TP (Silvex)	11.8	23.6	47.2	94.3	188.7	70.8
2,4-DB	11.8	23.6	47.2	94.3	188.7	70.8
3,5-Dichlorobenzoic Acid	11.8	23.6	47.2	94.3	188.7	70.8

Acifluorfen	11.8	23.6	47.2	94.3	188.7	70.8
Bentazon	11.8	23.6	47.2	94.3	188.7	70.8
Chloramben	11.8	23.6	47.2	94.3	188.7	70.8
Dalapon	11.8	23.6	47.2	94.3	188.7	70.8
DCPA	11.8	23.6	47.2	94.3	188.7	70.8
Dicamba	11.8	23.6	47.2	94.3	188.7	70.8
Dichloroprop	11.8	23.6	47.2	94.3	188.7	70.8
Dinoseb	11.8	23.6	47.2	94.3	188.7	70.8
MCPA	1179	2360	4717	9434	18868	7080
MCPP	1179	2360	4717	9434	18868	7080
4-Nitrophenol*	11.8	23.6	47.2	94.3	188.7	70.8
Pentachlorophenol**	11.8	23.6	47.2	94.3	188.7	70.8
Picloram	11.8	23.6	47.2	94.3	188.7	70.8
DCAA	11.8	23.6	47.2	94.3	188.7	70.8

*methyl derivative of 4-Nitroanisole (name on certificate of analysis)
**methyl derivative of Pentachloroanisole (name on certificate of analysis)

2. All calibration standards reflect concentrations adjusted for molecular weight of the methyl ester versus the acid herbicide.

3. All standards should be made with Pesticide Grade Hexane.

RETENTION TIME STUDY

1. For all analytes and surrogates a retention time study is performed over approximately 72 hours whenever a new column is installed, after major maintenance, or during initial set-up. The standard deviation (SD) is calculated based on this study using at least three determinations, measured to 0.001 minutes. The width of the retention time window is three times the SD for each of the analytes. Alternatively, if the calculated SD is less than 0.01 minutes, a default window of ± 0.03 minutes shall be employed.

2. The daily retention time window for the analyte is equal to the retention time of the analyte in the first CCV of the day, ± 3 times the standard deviation.

INITIAL CALIBRATION CURVE

The initial calibration consists of a series of standards analyzed at the concentration noted in Table 1. An initial calibration curve for each target analyte must be analyzed and evaluated before any peak for that analyte can be quantitated.

The calibration range is defined as the on-column concentration range adjusted for sample prep. If more than five calibration standards are used, the analyst has the option of eliminating one of the points using the criteria below. Within the following requirements the

analyst may select the points that improve linearity, obtain the calibration range needed for a specific project, or maintain the default calibration range:

a) At least five continuous points must be used (six if a quadratic curve fit is employed).
b) Calibration acceptance criteria must be met as described below.
c) The lowest calibration point must support the lowest reporting limit needed in the associated samples.
d) The QC spike amount must be within the calibration range.

Replacing points in the middle of a curve is not allowed unless the analyst can document a technical issue at the time of analysis or spiking of the standard. The new point must be analyzed in the same analytical batch. If the problem appears to be associated with a single standard, that one standard may be reanalyzed. Replacing the standard may be necessary in some cases.

The calibration curve is now ready for analysis.

The acceptance criteria for initial calibration must be satisfied before analysis of samples begin. Select projects may have additional or more stringent criteria that must be achieved for the applicable samples. See SOP GEN-019.

1. Additionally one of the following options must be met. Always attempt to meet calibration criteria using the average response factor. If the average response factor does not pass, options B and C are evaluated, but do not need to be evaluated in the order listed (if historical results indicate that quadratic fits are appropriate for a particular analyte, that option may be selected without evaluating linear). The calibration options and requirements are as follows:

   A. Average Response Factor Calibration. For each of the standards, calculate the response factor of each compound. Calculate the average of a minimum of five response factors and the standard deviation across the selected five response factors. Use the average RF and the standard deviation to calculate the percent relative standard deviation (%RSD). All equations can be found in the Calculation section. When the five (or more) response factors of the standards demonstrate less than 20% RSD for a target analytes, linearity through the origin can be assumed. If the RSD for any analyte is greater than 20%, the analyst may wish to review the results for those analytes to ensure that the problem is not associated with just one of the initial calibration standards.

   B. For those compounds that the RSD exceeds 20%, a linear regression equation that is not forced through the origin may be used. The coefficient of determination must be at least 0.995 for the curve to be acceptable. As part of the evaluation, check

the y-intercept (b) and any negative factors (b or M). Negative factors may result in false negatives and positives. Large shifts in the y-intercept from zero will impact the data. If the intercept is greater than half the reporting limit, this option shall not be used. Check the required reporting limit and any impacts on the data. False positives shall be indicated in the case narrative.

C. A quadratic curve fit may be used if the coefficient of determination $r^2 \geq 0.990$. A minimum of a six-point calibration is used if this option is chosen and the curve shall not be forced through zero. As part of the evaluation, check the y-intercept (b) and any negative factors (b or M). Negative factors may result in false negatives and positives. Large shifts in the y-intercept from zero will impact the data. If the intercept is greater than half the reporting limit, this option shall not be used. Check the required reporting limit and any impacts on the data. False positives shall be indicated in the case narrative.

INITIAL CALIBRATION VERIFICATION

Immediately following the initial calibration procedure or before sample analysis, the analyst shall perform initial calibration verification (ICV). This will consist of a solution containing all target analytes prepared from a standard that is independent from the initial calibration.

The ICV must be analyzed following the initial calibration. The ICV recovery must be 85-115%. Specific project criteria may apply that must be achieved for the associated samples. See SOP GEN-019. For DOD projects, the ICV must be recovered between 80-120% for each target compound.

If any target analyte recovery is outside the control limits, corrective action must be taken. This may include instrument maintenance, re-analysis of the ICV or initial calibration, or re-preparation of the standards involved. If holding time or agreed project due dates will not be met because of ICV failure, the client must be contacted and approve of proceeding with the analysis. Note all failures in the case narrative.

CONTINUING CALIBRATION VERIFICATION STANDARDS

1. The calibration verification standards is the Level III standard of the calibration. The calibration verification standards are analyzed to verify that the calibration curve and retention time windows are still valid.

2. The calibration verification standard is analyzed at the beginning of each 12-hour shift. The shift begins with the injection of the calibration verification standard and ends after the completion of analysis of the last sample or standard injected

within 12 hours of the beginning of shift. A calibration verification standard must also be injected every 10 samples.

3. The criteria for the calibration verification standard is that all analytes must be ± 20 Percent Difference (%D) from the initial calibration. For each CCV, each compound must fall within the retention time window.

4. If the calibration verification standard fails to meet these criteria, repeat the injection of the standard. If the standard continues to fail, take appropriate corrective action (inspection of GC, re-prep, standard, etc.) If these criteria cannot be met, a new calibration curve shall be prepared.

5. If the calibration verification standard analyzed after a group of samples has a response for an analyte >20% and the analyte was not detected in any of the previous samples during the analytical shift, then the samples do not need to be re-analyzed. If an analyte was not detected in the sample and the standard response is less than 20% below the initial calibration response, then re-injection is necessary. For DOD projects, this option may not be used without first obtaining a QC exception from the client.

SAMPLE ANALYSIS

1. Up to 10 samples (not including MB, LCS/LCSD) can be analyzed after the calibration verification standard.

2. All samples are evaluated on a primary column then a secondary column if an analyte above detection limit was detected. The secondary column confirms the presence of that analyte.

3. If the analyte falls within the retention time window on both the primary and secondary analysis, then calculate the concentration present. The higher value of the two analyses is reported unless apparent coelution is present. (The lower value maybe reported if required by the project.) If the difference between the two results, calculated as an RPD, is greater than 40%, narrate the sample results. The results are flagged in the report. For DOD projects, the analyst should use project specific requirements for reporting if available. Otherwise, report the result from the primary column and flag results where the confirmation result is grater than 40% RPD.

SAMPLE RE-EXTRACTION

Samples are to be re-extracted due to failed QC or due to the sample results. When a MB, LCS, or LCSD fails to meet criteria, the entire batch is sent to extractions for re-extraction. If the MS, MSD, or surrogates fail criteria, only the affected samples are sent to extractions. Particular samples may be re-extracted if the sample results do not match historical values, if a sample and a duplicate do not match, or if physical differences are noted in samples. If samples are re-extracted outside of method

specified holding times, both analyses are reported. To request sample/batch re-extraction, do the following:

1. If the extract has been analyzed, process the file and load to LIMS.
2. Enter the code "RP" into the analysis code; this will schedule new sample prep.
3. Complete the Re-extraction Request and Tracking Form (attached) and submit a copy to extraction supervisor.

4. When new extracts are brought to the lab, complete the original Re-extraction Request and Tracking Form and report the data appropriately.
5. If additional sample is not available to re-prep, check with project manager to determine appropriate action to report the available data.
6. If two sets of data will be reported, see login to obtain a re-extracted sample number.
7.

CALCULATIONS

1. $\text{MS \% REC} = \frac{\text{MS Concentration-Sample Concentration}}{\text{spike added}} \times 100$

2. $\text{MSD \% REC} = \frac{\text{MSD Concentration-Sample Concentration}}{\text{spike added}} \times 100$

3. $\text{\% RPD} = \frac{\text{MS-MSD}}{(\text{MS+MSD})/2} \times 100$

   LCS/LCSD results are substituted to calculate %RPD between LCS and LCSD. Results are calculated using the concentration (not percent recovery).

4. Response Factor = A_s/C_s

   As = Peak Area of analyte or surrogate
   Cs = Concentration of the analyte or surrogate

5. $\text{Surrogate/LCS Recovery} = \frac{\text{Concentration Found}}{\text{Concentration Added}} \times 100$

6. Concentration using RF:

   $\text{Concentration } (\mu g/L) = \frac{(A_s)(D)(V_t)}{(RF)(V_s)}$

   $\text{Concentration } (\mu g/kg) = \frac{(A_s)(D)(V_t)}{(RF)(W_s)}$

   A_s = Area of peak for the analyte in sample
   D = Dilution factor
   RF = Mean Response factor from initial calibration
   W_s = Weight of sample extracted in g
   V_t = Total volume of concentrated extract in µL
   V_s = Volume of aqueous sample extracted in mL

7. Concentration using linear curve fit:

   $\text{Concentration } (\mu g/L) = [m(A_S)+b]D$

Concentration (mg/kg) $=[m(A_S)+b]D(5/W_S)$

m = Inverse of slope
A_s = Area of peak for the analyte in sample
b = Intercept of the y-axis
D = Dilution factor
W_s = Weight of sample extracted

8. Concentration using a quadratic curve fit:

$$\text{Concentration (mg/L)} = [b + a(A_S) + a_2(A_S)^2]D(5/V_S)$$

$$\text{Concentration (mg/kg)} = [b + a(A_S) + a_2(A_S)^2]D(5/W_S)$$

9. % Difference $= [(RF_I - RF_C) / RF_I\} \times 100$

RF_I = Average response factor from initial calibration
RF_C = Response factor from current verification check standard

10. % Drift $= \dfrac{\text{(Calculated Conc. – Theoretical Conc.)}}{\text{Theoretical Conc.}} * 100$

11. % RSD $= (SD/X) \times 100$

RSD = Relative Standard Deviation
X = mean of initial RF's for a compound
SD = Standard Deviation of average RF's for a compound

REPORTING LIMITS

The following chart indicates reporting limits for Chlorinated Herbicides Method 8151:

COMPOUNDS	Water µg/L	Solid µg/kg
2,4-D	0.5	17
2,4,5-T	0.5	17
2,4,5-TP (Silvex)	0.5	17
2,4-DB	2.0	17
3,5-Dichlorobenzoic Acid	0.5	17
Acifluorfen	0.5	17
Bentazon	0.5	17
Chloramben	0.5	17
Dalapon	0.5	33
DCPA	0.5	17
Dicamba	0.5	17
Dichloroprop	0.5	17
Dinoseb	0.5	17
MCPA	500	1670
MCPP	500	1670
4-Nitrophenol	0.5	17
Pentachlorophenol	0.5	17
Picloram	0.5	17

NOTE: Reporting limits may vary according to specific project requirements.

QUALITY CONTROL

METHOD BLANK

1. The method blank (extraction blank) is analyzed to demonstrate the extraction procedure did not introduce contamination.

2. No target analytes should be detected in the method blank above the reporting limit. If any target analytes are detected, data may not be reported and samples must be re-extracted and re-analyzed unless the following apply.

   A. If a target analyte is detected above the reporting limit, data may be reported if the concentration is not greater than 5% of the measured concentration in associated samples. Include a narrative with the data.

   B. If a target analyte is detected in the method blank but there are no hits in the samples, the data may be reported with a narrative.

   C. Additional project criteria may apply. See SOP GEN-019.

SURROGATES

1. The surrogate is used to verify that each sample was properly extracted. A surrogate is a non-target compound that is chemically similar to the analytes. The surrogate use is 2,4-Dichlorophenylacetic Acid (DCAA).

2. If a surrogate recovery fails below the lower control limit, re-extract and re-analyze the sample. If the surrogate is outside QC limits in the re-extract sample, then indicate in the case narrative and state that the recovery was outside the control limits due to sample matrix. If re-extraction cannot be performed due to insufficient sample, report the data with a narrative.

3. If the surrogate recovery is above the control limits and the sample results are less than the reporting limit, the data may be reported with a narrative.

Surrogate	Water Recovery Limits	Solid Recovery Limits
DCAA	41-128%	18-136%

4. Project specific limits may apply and may be more stringent; project limits are listed in the LIMS. See SOP GEN-019.

LABORATORY CONTROL STANDARD (LCS/LCSD)

1. A LCS and/or LCSD (if required) is included in each batch to demonstrate the system is in control. Routinely the LCS/LCSD will be spiked with the full list of analytes. The control limits are indicated on the following table:

TABLE I: LCS/LCSD, MS/MSD CONTROL LIMITS

Compound	Water % Recovery	Water RPD	Solid % Recovery	Solid RPD
2,4-D	29-143	40	19-140	40
2,4,5-T	34-147	40	25-145	40
2,4,5-TP (Silvex)	44-130	40	21-141	40
2,4-DB	48-144	40	20-150	40
4-Nitrophenol	30-130	40	20-150	40
Dalapon	30-130	40	20-150	40
Dicamba	34-130	40	20-150	40
Dichloroprop	48-140	40	20-150	40
Dinoseb	21-144	40	10-140	40
MCPA	38-130	40	20-150	40
MCPP	37-139	40	20-150	40
Pentachlorophenol	30-130	40	20-150	40
Picloram	20-130	40	20-150	40

2. If a recovery is below the lower control limit, the batch must be re-extracted and re-analyzed. If a re-extraction is not possible due to insufficient sample volume, report the data with a narrative.

3. If the full list of target analytes is spiked, a small percentage of sporadic failures will be allowed. See Table 3 for the number of allowable failures. The failures are noted in the case narrative.

Table 3: Number of Allowable Failures

Number of Analytes	Failures Allowed
5-15	1
16-30	2

4. Project specific recovery and precision limits may apply and may be more stringent; project limits are listed in the LIMS. See SOP GEN-019. This SOP includes specific LCS limits for Herbicides for DOD projects.

MATRIX SPIKES (MS/MSD)

1. The purpose of the MS/MSD is to assess the performance of the method for a particular sample matrix. The recoveries for each spike compound should be within the control limits specified in Table 2.

2. Whenever the MS and/or MSD recoveries are outside

the control limits, review data to verify that a lab error has not occurred (wrong spike amount, not spiked) before automatically identifying a failure as matrix interference.

3. If recoveries for the MS and/or MSD are outside the control limits and the recoveries are similar, the data is reportable with a narrative stating the LCS recoveries were acceptable. The failure is attributed to sample matrix.

4. If precision is outside of control limits, re-extract the parent, MS, and MSD. If the failure is repeated, check that the samples are homogenous. Narrate the sample results including corrective action and sample appearance if applicable.

5. Native sample concentrations may be high in comparison to the spiking concentration and therefore an accurate recovery cannot be calculated. Document this in the case narrative.

6. Spikes may be diluted out in the analysis process. Document this in the case narrative.

7. Project specific recovery and precision limits may apply and may be more stringent; project limits are listed in Table 2. See SOP GEN-019.

DATA REVIEW

For data review procedures and checklist, please see SOP QA-002.

SOFTWARE TROUBLESHOOTING

The Agilent GC's utilize Agilent software GC Chemstation Version A.10.02 to control the instrument and transfer data acquisition to Target Data Integration software. Target software is utilized to calculate all data. In the event of software malfunction for the GC Chemstation, please contact Agilent technical support for troubleshooting help. In the event of software malfunction when using Target, please contact GCAL's IT Director for troubleshooting help.

METHOD PERFORMANCE

1) In single laboratory studies using organic-free reagent water and clay/still bottom samples, the mean recoveries presented in Tables 4 and 5 of Method 8151A were obtained for diazomethane derivatization. The standard deviations of the percent recoveries of these measurements are also in Tables 4 and 5 of Method 8151A.

2) Table 6 of Method 8151A presents relative recoveries of the target analytes obtained using the PFBBr derivation procedure with spiked water samples.

POLLUTION PREVENTION

See QAPP Section 10.2

WASTE MANAGEMENT

See SOP GEN-009

GLOSSARY

ACCEPTANCE LIMITS – data quality limits specified by the test method or generated by the laboratory. Specified limits placed on an item, process, or service defined in the requirement document.

ACCURACY – a measure of how close a measured value is to a known true value. Accuracy is assessed by means of reference samples and percent recoveries of spiked samples. The degree of agreement between an observed value and an accepted reference value. Accuracy includes combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator.

ALIQUOT – a discrete, measure, or representative portion of a sample taken for analysis.

ANALYTE – the chemical element or compound an analyst seeks to determine; the chemical element of interest.

ANALYTICAL BATCH – the basic unit for analytical quality control, defined as samples that are analyzed together with the same method sequence and the same lots of reagents and with the manipulations common to each sample within the same time period or in continuous sequential time periods. Samples in each batch should be of similar composition (e.g., groundwater, sludge, ash).

ANALYTICAL SAMPLE – any solution or media introduced into an instrument on which an analysis is performed, excluding instrument calibration, initial calibration verification, initial calibration blank, continuing calibration verification, and continuing calibration blank. The following are all analytical samples: undiluted and diluted samples (EPA and non-EPA), predigestion spike samples, duplicate samples, serial dilution samples, analytical spike samples, post digestion spike samples, interference check samples (ICS), CRDL standard for AA(CRA), CRDL standard for ICP(CRI), laboratory control sample(LCS), preparation blank(PB), and linear range analysis sample(LRS).

ANALYST – the designated individual who performs the "hands on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.

AREA UNITS – a term used in gas chromatography that indicates the peak area of a compound exiting a chromatographic column. The size or area of the peak is proportional to the amount of analyte in the sample.

ATOMIC ABSORPTION (AA) – a technique for analyzing metal using an element-specific lamp that emits a characteristic light spectrum. A sample is heated in a flame or graphite furnace and the light beam is passed through it. When the sample absorbs light, an energy loss is detected and is translated into a concentration of metal in the sample. This technique detects one metal at a time.

AUDIT – a systematic check to determine the quality of some function or activity. Two basic types are performance audits and system audits. Perform audits involve a quantitative comparison of the laboratory's results to those of a proficiency sample containing known concentration of analytes. A

system audit is a qualitative evaluation that normally consists of an onsite review of a lab's quality assurance system and physical facilities.

BACKGROUND CORRECTION – a technique usually employed relative to metals analysis, which compensates for variable background contribution to the instrument signal in the determination of trace elements.

BATCH – environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A batch is composed of a maximum of twenty environmental samples. A preparation batch is composed of environmental sample of the same matrix, meeting the above-mentioned criteria and with a maximum time between the start of processing the first and last sample in the batch to be 24 hours. An analytical batch is composed of prepared environmental samples (extracts, digestates or concentrates) and/or those samples not requiring preparation, which are analyzed together as a group using the same calibration curve or factor. An analytical batch can include samples originating from various environmental matrices.

BIAS – the deviation of the mean of replicate analytical measurements from a reference analyte concentration. Relative bias is represented by analytical measurement mean minus the reference analyte concentration and the difference divided by the reference analyte concentration. See accuracy and precision.

4-BROMO-FLUOROBENZENE (BFB) – the compound used to check the tuning of the instrument, and is used as a surrogate compound spiked into every sample for volatile analysis. A compound utilized in EPA gas chromatography/mass spectrometry (GC/MS) volatile methods to establish mass spectral instrument performance.

BIOCHEMICAL OXYGEN DEMAND (BOD) – A measure of the amount of oxygen consumed in the biochemical processes that break down organic matter in water. A larger BOD value indicates a greater degree of organic pollution. A related term, BOD5, is the amount of dissolved oxygen consumed in five days.

BIOSEED – the bacterial culture used to inoculate a sample for testing.

BLANK – an artificial sample designed to monitor the introduction of artifacts into the measurement process. For aqueous samples, reagent water is used as a blank matrix. There are several types of blanks, which monitor a variety of processes:1.) *laboratory blank* is taken through sample preparation and analysis only. It is a test for contamination in sample preparation and analyses. 2.) *storage blank* is stored and analyzed with samples at the laboratory. It is a test for contamination in sample storage as well as sample preparation and analysis. 3.) *trip blank* is shipped to and from the field with the sample containers. It is not opened in the field and, therefore, provides a test for contamination from sample preservation, site conditions, and transport as well as sample storage, preparation, and analysis. It is most commonly used for volatile organics. 4.) *field blank* is opened in the field and tests for contamination from the atmosphere as well as those activities listed under the trip blank.

BNA – base, neutral and acid extractable compounds. The term base, neutral and acid refer to the pH condition of the sample undergoing extraction. Certain compounds extract more efficiently from water under acidic conditions. Such compounds are often referred to as "acid extractables."

CALIBRATE – to determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter or other device, or the correct value for each setting of a control knob. The levels of the applied calibration standard should bracket the range of planned or expect sample measurements.

CALIBRATION – The systematic determination of the relationship of the response of the measurement system to the concentration of the analyte of interest. Instrument calibration performed before any samples are analyzed is called the initial calibration. Subsequent checks on the instrument calibration performed throughout analysis are called continuing calibration verification.

CALIBRATION BLANK (CB) – a volume of reagent water in the same matrix as the calibration standards but without the analyte.

CALIBRATION CURVE – the graphical relationship between the known values, such as concentrations, of a series of calibration standards and their analytical response.

CALIBRATION METHOD – a defined technical procedure for performing a calibration.

CALIBRATION STANDARD – a certified material used to calibrate an instrument.

CERTIFIED REFERENCE MATERIAL (CRM) – reference material, one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body. (ISO Guide 30)

CONTINUING CALIBRATION VERIFICATION (CCV) – used to evaluate the performance of the instrument system with respect to a defined set of method criteria. The CCVs are used to verify instrument performance during analysis. The CCV shall be prepared from the same stock standard solution used to prepare the calibration curve.

CHAIN-OF-CUSTODY–Procedures and associated documents designed to trace the custody of a sample from the point of origin to final disposition, with the intent of legally demonstrating that custody remained intact and the tampering or substitutions were precluded.

CHEMICAL OXYGEN DEMAND (COD) – A measure of the oxygen required to oxidize all compounds in water, both organic and inorganic.

COMBINED STANDARD UNCERTAINTY – The standard uncertainty of the analytical measurement result that is the sum in quadrature (square-root-of-the-sum-of-the-squares) of the component standard uncertainties.

CORRECTIVE ACTION – the action taken to eliminate the causes of an existing non-conformity, defect, or other undesirable situation to prevent reoccurrence.

COVERAGE FACTOR – the numerical factor used as a multiplier of the combined standard uncertainty to expand the uncertainty corresponding to a specific level of confidence. The Student's *t*-distribution is used for determining the coverage factor.

DEMONSTRATION OF CAPABILITY (DOC) – a procedure used to establish the ability of the analyst to generate acceptable accuracy.

DEIONIZED WATER (DI) – water from which the majority of ions have been removed. Water that is contaminant free and used in the laboratory, the resistivity should be ≤ 18 megaohms.

DISSOLVED METALS –- metallic elements determined on a water sample that has been passed through a 0.45-um filter.

DISSOLVED OXYGEN (DO) – the oxygen freely available in water, an indicator of water quality.

DISSOLVED SOLIDS – disintegrated organic and inorganic material contained in water. Excessive amounts make water unfit to drink or use in industrial processes.

DRY WEIGHT – the weight of a sample based on percent solids. The weight of a sample after drying in an oven at a specified temperature.

DUPLICATE MEASUREMENT – a duplicate measurement is a second measurement made on the same or identical sample of material to assist in the evaluation of measurement of variance.

DUPLICATE SAMPLE – two samples taken from the same population and carried through certain stages of sampling and testing. Duplicate sample include field co-located duplicate samples, field-split duplicate samples, and laboratory duplicate subsamples.

EXPANDED UNCERTAINTY – the quantity defining an interval enveloping the analytical measurement that captures a large fraction of the distribution of analyte concentrations that could be attributable to the quantity measured. The combined standard uncertainty is multiplied by the coverage factor to calculate the expanded uncertainty.

EXTERNAL STANDARDS – a method of quantifying chromatographic data in which standards of known concentration are analyzed prior to unknown samples. The chromatographic peak area (or height) of a sample component is compared to a calibration curve of a peak area constructed from the standard data for that component. This comparison allows the concentration of the component in the sample to be determined.

FECAL COLIFORM BACTERIA – bacteria found in mammals' intestinal tracts. Their presence in water or sludge is an indicator of pollution and possible contamination by pathogens.

FLAME IONIZATION DETECTOR (FID) – a gas chromatography detector in which the column effluent gas is mixed with hydrogen and burned in air or oxygen. The ions and electrons produced in the flame generate an electric current proportional to the amount of materials in the detector. The FID responds to nearly all organic compounds, but it does not respond to air and water, which makes it exceptionally suited to environmental analysis.

FLASHPOINT – the lowest temperature at which a flammable liquid gives off sufficient vapor to form an ignitable mixture with air near its surface or within a vessel. Combustion does not continue.

GAS CHROMATOGRAPHY (GC) – a technique for detecting organic compounds by using their physical and chemical properties to separate a mixture. The compounds are identified and quantified with various types of detectors as they exit the chromatograph. Selection of detectors is dependent on the particular compounds of interest.

GAS CHROMATOGRAPHY MASS SPECTROMETRY (GCMS) – a technique in which sample analytes are bombarded with electrons as they exit a gas chromatography column and are fragmented into characteristics ion patterns. The mass spectrometer is the detector. It can determine which fragments are present and therefore the identity of the compounds.

GLUCOSE GLUTAMIC ACID (GGA) – used as a laboratory control standard in BOD procedures.

GRAPHITE FURNACE – a technique used for the analysis of metals. An atomic absorption spectrophotometer heats the sample within a graphite tube using an electrical current. It is also commonly called a flameless furnace and generally provides greater sensitivity for certain metals than flame or inductively coupled argon plasma techniques.

GRAVIMETRIC - analyses based on the direct or indirect weighing of the analyte in question. This technique usually requires the use of an analytical balance with a sensitivity of 0.1 mg or better.

HALL ELECTROLYTIC CONDUCTIVITY DETECTOR – an element-selective gas chromatography detector primarily intended for trace analysis of organic compounds containing chlorine, nitrogen or sulfur. In operation, this detector pyrolyzes the column effluent gas into soluble electrolytes that are dissolved in a stream of deionized liquid. The observed change in electrical conductivity, proportional to the amount of material present, is measured.

HAZARDOUS WASTE – waste regulated under RCRA that can pose a substantial or potential hazard to human health or the environment when improperly managed. Such wastes possess at least one of four characteristics (ignitability, corrosivity, reactivity, or toxicity) or appear on special EPA hazardous waste lists. The term is not interchangeable with hazardous substances or material.

HEADSPACE - Any area in a container not completely filled by the sample in which gases can collect.

HEAVY METALS – metallic elements with high atomic weights, i.e., mercury, chromium, cadmium, arsenic, and lead. They can damage the health of plants and animals at low concentrations and tend to accumulate in the food chain.

HOLDING TIME – the maximum times that samples may be held before analysis and still be considered valid or not compromised. The storage time allowed between sample collection and sample analysis when the designated preservation and storage techniques are employed.

HYDROCARBONS – chemical compounds that consist entirely of carbon and hydrogen.

ICP – Inductively coupled plasma is a type of instrument used for metals analysis. Because the temperature of the plasma is considerable higher ($10{,}000^{o}K$) than the temperature of a flame atomic

absorption spectrophotometer, it is especially useful for refractory metals. Some instruments are also capable of performing simultaneous multielement analysis.

ICP-MS - Inductively coupled plasma mass spectrometry (ICP-MS) is a type of mass spectrometry highly sensitive and capable of the determination of a range of metals and several non-metals at concentrations below one part in 10^{12} (part per trillion). It is based on coupling together an inductively coupled plasma as a method of producing ions with a mass spectrometer as a method of separating and detecting the ions. In trace elemental analysis, the method has advantages of high speed, precision and sensitivity.

IGNITABLE – capable of burning or causing a fire.

INORGANIC CHEMICALS – chemical substances of mineral origin, unlike organic chemicals whose structure relies on carbon atoms.

INITIAL CALIBRATION VERIFICATION (ICV) - also referred to as the Independent Calibration Verification for this laboratory. A standard solution used to verify the calibration curve derived from a source independent of the instrument calibration standard. The ICV is use to quantify second source standard variance and bias.

INSTRUMENT CALIBRATION STANDARD - a reference material used to standardize an analytical instrument.

INSTRUMENT DETECTION LIMIT (IDL) - a term utilized in the EPA Inorganic Contract Laboratory Program. The IDL is three times the standard deviation obtained for the analysis of a standard solution (each analyte in reagent water) at a concentration of three to five times that of the IDL on three nonconsecutive days with seven consecutive measurements per day. The IDL is the concentration equivalent to a signal, due to the analyte of interest, which is the smallest signal that can be distinguished from background noise by a particular instrument. The IDL should always be below the method detection limit, and is not used for compliance data reporting, but may be used for statistical data analysis and comparing the attributes of different instruments.

INSTRUMENT PERFORMANCE CHECK - The analyses of one of the ICSs to verified initial and continuing calibration (CCV). The IPC is used to quantify the instrumental testing repeatability variance and bias.

INSTRUMENT TUNING - a technique used in gas chromatography/mass spectrometry procedures to verify that the instrument is properly calibrated to produce reliable mass spectral information. See 4-Bromofluorobenzene under "B".

INTERNAL STANDARDS - compounds added to every standard, blank, matrix spike, matrix spike duplicate, sample (for volatile organics), and sample extract (for semivolatiles) at a known concentration, prior to analysis. Internal standards are used as the basis for quantification of the target compound.

IONIZATION - Utilized in mass spectrometry to fragment analyte molecules into smaller segments. These smaller mass segments are then separated and plotted to form a "mass spectrum" which is used to identify the parent molecule. Electron impact is one example of ionization used in mass

spectrometry. In more technical terms. Ionization is the process by which neutral atoms or groups of atoms become electrically charged, either positively or negatively, by the loss or gain of electrons.

ISOMERS - chemical compounds with the same molecular weight and atomic composition by differing molecular structure, e.g., n-pentane and 2-methylbutane.

LABORATORY CONTROL SAMPLE (LCS) - a clean-matrix reference sample spiked with a standard with an established analyte concentration. The LCS is carried through the entire chemical preparation and testing procedures. The LCS is used to quantify the variance and bias of the chemical preparation and instrumental testing stages without matrix interference. Also called a Laboratory fortified blank (LFB).

LABORATORY CONTROL SAMPLE DUPLICATE (LCSD) – a duplicate of the laboratory control sample in a clean matrix that is carried through the entire chemical preparation and testing procedures.

LABORATORY DUPLICATE SAMPLE (LAB DUPLICATE) - a portion of the collected sample that is carried through the chemical preparation and testing. The laboratory duplicate subsample is used to quantify the variance of the chemical preparation and instrumental testing stages with matrix interferences.

LEACHATE - a liquid that results from water collecting contaminants as it trickles through wastes, agricultural pesticides or fertilizers. Leaching may occur in farming areas, feedlots, and landfills, and may result in hazardous substances entering surface water, groundwater or soil.

LDEQ – Louisiana Department of Environmental Quality

LIBRARY SEARCH - a technique in which an unknown mass spectrum of a compound is compared to the mass spectra of compounds contained in a computer library in an effort to identify the compound. Compounds identified in this manner are referred to as tentatively identified compounds (TICs).

LIMIT OF DETECTION (LOD) – an estimate of the minimum amount of a substance that an analytical process can reliable detect. An LOD is analyte and matrix specific and may be laboratory dependent.

LIMIT OF QUANTIATION (LOQ) – the minimum levels, concentrations, or quantities of a target variable (e.g. target analyte) that can be reported with a specified degree of confidence..

LIMS – laboratory information management system. Horizons is the LIMS used by GCAL.

LINEAR CALIBRATION RANGE – the concentration range over which the instrument response is linear.

LOG-IN - the receipt and initial management of an environmental sample. It generally includes identifying who sent the sample; maintaining chain-of-custody; checking report and invoice information; recording analysis requested, including methodology and special instructions; and assigning a discreet in-lab identification, usually a number or bar code.

MASS SPECTRUM - a plot of ion mass/charge ratio versus intensity. A fragmentation pattern results from the particles whose mass distribution is characteristic of the parent molecule. Qualitative information is provided by a mass spectrum.

MATERIAL SAFETY DATA SHEET (MSDS) - a compilation of information required under the OSHA Communication Standard on the identity of hazardous chemicals and their associated health and physical hazards, exposure limits and precautions.

MATRIX - The physical characteristics or state of a sample – e.g., water, soil, sludge.

MATRIX INTERFERENCE - the influence of the sample matrix or sample components upon the ability of qualitatively identifies and quantitatively measures compounds in environmental samples.

MATRIX MODIFIERS - chemicals added to samples for metals analysis, which are used to lessen the effects of chemical interference, viscosity and surface tension.

MATRIX SPIKE (MS) – aliquot of a sample fortified (spiked) with known quantities of specific compounds and subjected to the entire analytical procedure in order to indicate the appropriateness of the method for the matrix by measuring recovery of the spike. Matrix spiked samples are used to quantify the variance and bias of the chemical preparation and testing stages with matrix interference.

MATRIX SPIKE DUPLICATE (MSD) - a second aliquot of the same matrix as the matrix spike that is spiked to determine the precision of the method.

METHOD DETECTION LIMIT (MDL) - the minimum concentration of compound that can be measured and reported within 99% confidence that the value is above zero and is determined from analysis of a sample in a given matrix containing the analyte.

MUST – denotes a mandatory requirement.

NARRATIVE - in an analytical report, a descriptive documentation of any problems encountered in processing the samples, along with corrective action taken and problem resolution.

NUTRIENT - any substance assimilated by living things that promote growth. The term is generally applied to nitrogen and phosphorus in wastewater, but is also applied to other essential and trace elements.

ORGANIC - generally, any compound that contains carbon bonded to a hydrogen or halogen atom.

OXIDATION - the process in chemistry whereby electrons are removed from a molecule.

PCBs - Polychlorinated biphenyl, a group of toxic persistent chemicals used in transformers and capacitors for insulating purposes and in gas pipeline systems as a lubricant. Sale of PCBs for new uses was banned by law in 1979.

PERCENT RECOVERY - a measure of accuracy that is calculated as the measured value relative to the true value expressed as a percent.

PERFORMANCE AUDIT - a quantitative evaluation of a measurement system that involves the analysis of standard reference samples or materials which are certified as to their chemical composition or physical characteristics.

PROFICIENCY TEST (PT) SAMPLE - a sample of known composition (unknown to the laboratory), provided by an external source, which is used to evaluate lab performance. For certification purposes the PT sample is purchased from an approved provider.

pH - a numerical designation of relative acidity and alkalinity. A pH of 7.0 indicates precise neutrality. Progressively higher values indicate increasing alkalinity and lower values increasing acidity.

POLLUTANT - generally, any substance introduced into the environment that adversely affects the usefulness of a resource.

PRACTICAL QUANTITATION LIMIT (PQL) - the lowest level that can be reliable achieved within specified limits of precision and accuracy routine laboratory operating conditions. The lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value.

PRECISION - a measure of the ability to reproduce analytical results. It is generally determined through the analysis of duplicate samples. The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range in either absolute or relative terms.

PRESERVATIVE - a chemical or reagent added to a sample to prevent or slow decomposition or degradation of a target analyte or a physical process. Physical and chemical preservation may be used in tandem to prevent sample deterioration.

PURGE AND TRAP - a technique used in the analysis of volatile organic where analytes are purged from a sample by means of an inert gas and trapped on a sorbent column. The sorbent is then flashheated and the analytes are transferred onto a gas chromatographic column for separation and identification.

PURGEABLE ORGANIC - an organic compound that is generally less than 20% soluble in water and has a boiling point at or below 200^{o}C. A volatile organic. An organic compound is generally considered to be purgeable if it can be removed from water using the purging process.

QC BASED NESTED APPROACH - a procedure for estimating the uncertainty of measurement using quality control data. The procedure is described in SOP QA-013.

QUALITY ASSURANCE (QA) - all those planned and systematic actions necessary to provide adequate confidence in laboratory results. An integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets the defined standards of quality with a stated level of confidence.

QUALITY ASSURANCE PROGRAM PLAN - a written assembly of management policies, objectives, principle and general procedures that outlines how the laboratory intends to generate data of known and accepted quality.

QUALITY CONTROL (QC) – the overall system of technical activities whose purpose to measure and control the quality of a product or service so that it meets the needs of the users.

QUALITY CONTROL CHART - a graph of analytical measurement results for a specific QC standard plotted sequentially with upper and lower control limits (±3SD). A central line that is the best estimate of the average variable plotted, and upper and lower marginal exceedence limits (±4SD) are usually included in the Quality Control Chart. The chart may also include upper and lower warning limits (±2SD).

QUALITY SYSTEM – a structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items) and services. The quality system provides the framework for planning, implement and assessing work performed by the organization and for carrying out required QA and QC.

r^2 – Correlation Coefficient Squared – paramet6er used to evaluate the fit of linear or quadratic regression curve fit of initial calibration data.

RAW DATA – any original information from a measurement activity or study recorded in a laboratory note book, worksheets, records, memoranda, notes, or exact copies thereof that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data may include photography, microfilm or microfilm copies, computer printouts, magnetic media, including dictated observations, and recorded data from automated instruments.

REACTIVITY - the tendency of a chemical to explode under normal management conditions, to react violently when mixed with water, or to generate toxic gases.

REAGENT WATER - water in which an interference is not observed at or above the minimum quantitation limit of interest.

REFERENCE MATERIAL - a traceable standard with an established analyte concentration. Material or substance whose property values are sufficiently homogenous, stable and well established to be used for the calibration of an apparatus, the assessment of a measurement method or for assigning values to materials (ISO Guide 30)

REFERENCE METHOD – a method of known and documented accuracy and precision issued by an organization recognized as competent to do so.

RELATIVE RETENTION TIME – a measure of the shift in retention time of an analyte when referenced to an internal standard.

RELATIVE RESPONSE FACTOR (RRF) - a measure of the relative mass spectral response of an analyte compared to its internal standard. RRFs are determined by analysis of standards and are used in the calculation of concentrations of analytes in samples.

REPLICATE ANALYSES - two or more results representing the same sample parameter. Replicate analyses are used to quantify the analytical measurement repeatability precision.

RPD – Relative Percent Difference, a relative difference between two analyses calculated by dividing the absolute difference of thos two results by the average of therir two values, then multiplying by 100.

RESOLUTION - the degree of separation between peaks eluting from a chromatographic column. Sufficient resolution between peaks is required for proper quantitation of unknown analytes.

RETENTION TIME - a term used in gas and liquid chromatography describing the time elapsed from the sample injection until the specific compound elutes or exits the chromatographic column at the detector. Each compound has a characteristics retention time on a specific column; therefore, this information is used to qualitatively identify the compounds in the sample.

SAMPLE – portion of material collect for chemical analysuis, identified by a unique number assigned by the LIMS.

SHALL – denotes a requirement that is mandatory whenever the criterion for conformance with the specification requires that there be no deviation. This does not prohibit the use of alternative approaches or methods for implementing the specification so long as the requirement is fulfilled.

SHOULD – denotes a guideline or recommendation whenever noncompliance with the specification is permissible.

SOLID WASTE – non-liquid, non-soluble materials, ranging from municipal garbage to industrial waste, that contain complex, and sometimes hazardous, substances. Solid wastes include sewage sludge, agricultural refuse, demolition wastes, mining residues, and even liquids and gases in containers.

SOLVENT - a substance, usually liquid, capable of dissolving or dispersing one or more other substances.

SPIKE – a known mass of target analyte added to a blank sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.

STANDARD CURVE - a curve that plots concentrations of known analyte standards versus the instrument response to the analyte. Calibration standards are prepared by diluting the stock analyte solution in graduated amounts that cover the expected range of the samples being analyzed. The calibration standards must be prepared by using the same type of acid or solvent at the same concentration as for the samples following sample preparation. This is applicable to organic and inorganic chemical analyses.

STANDARD OPERATING PROCEDURE - a detailed written description of how a laboratory executes a particular procedure or method intended to standardize its performance.

STANDARDIZED REFERENCE MATERIAL (SRM) – a certified reference material produced by the U.S. National Institute of Standards and Technology or other equivalent organization and characterized for absolute content, independent of analytical metho9d.

STANDARD UNCERTAINTY - the analytical measurement uncertainty expressed as a standard deviation. The relative standard deviation represents the relative standard uncertainty.

SURROGATE - an organic compound similar to the analyte of interest in chemical composition, extraction and chromatography, but not normally found in environmental samples. Primarily used in chromatography techniques, the surrogate is spiked into quality control blanks, calibration and check standards, samples (including duplicated and QC reference samples) and spiked samples before analysis. A percent recovery is calculated for each surrogate.

SUSPENDED SOLIDS - small pollutant particles that float on the surface of, or are suspended in, sewage or other liquids. They resist removal by conventional means.

TARGET COMPOUND - specific compounds that are to be quantified in a sample based on a standard list of potential compounds.

TENTATIVELY IDENTIFIED COMPOUNDS (TICs) - compounds detected in samples that are not target compounds, internal standards, system monitoring compounds or surrogates. TICs usually consist of up to 30 peaks that are greater than 10% of the peak areas, or heights, of the nearest internal standard. They are subjected to mass spectral library searches for tentative identification. A client may specify the number of unknown peaks in its samples it wishes the laboratory to tentatively identify.

TOTAL METALS - metallic elements that have been digested prior to analysis.

TYPE A EVALUATION UNCERTAINTY - the method of evaluation of uncertainty by the statistical analysis of a series of test results.

TYPE B EVALUATION OF UNCERTAINTY - the method of evaluation of uncertainty by means other than statistical analysis.

UNCERTAINTY - the parameter associated with the analytical measurement results that characterizes the dispersion of the values that could be reasonable attributed to the quantity measured.

UNCERTAINTY INTERVAL - the range of analyte concentrations that an analytical measurement could represent at a specified level of confidence. The relative standard deviation is used to represent the relative standard uncertainty in the QC-based Nested Approach.

VALIDATION –the process for evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, or contractual specifications. It essentially evaluates performance against predetermined specifications.

VOA - volatile organic analysis

VOA BOTTLE - a vial used to contain samples for volatile organic analysis.

VOLATILE COMPOUNDS - compounds amendable to analysis by purge and trap. Synonymous with purgeable compounds.

VOLATILE ORGANIC COMPOUND (VOC) - any organic compound that participates in atmospheric photochemical reactions, except for those designated by the EPA Administrator as having negligible photochemical reactivity.

WET CHEMISTRY - procedures that involve distillations, colorimetric determinations and titrimetric measurements. Examples are chloride, nitrates, sulfates and biochemical oxygen demand.

GULF COAST ANALYTICAL LABORATORIES, INC
GCMS - VOLATILES
STANDARD OPERATING PROCEDURE

PROCEDURES: GCMSV-003
PAGE: 1 OF 21
EFFECTIVE DATE: 09/14/11
APPROVED BY:
QA/QC APPROVED:

SUBJECT — SCOPE AND APPLICATION

This is a purge and trap GC/MS method, which quantitatively identifies purgeable organic compounds. A list of target analytes is available in the LIMS.

A 5-mL water sample is purged, with helium at ambient temperature. The purgeable compounds are transferred to the vapor phase and are carried to the trap. Once the purging has been completed, the trap is heated and back flushed with helium to desorb the purgeable compounds onto the column. The compounds are then separated by their molecular weight, the column phasing and increasing temperature, and then detected by a mass spectrometer.

MATRIX — Water and Solids

REFERENCE — SW846 Methods 8260B, 5030B, 5030C, 5035A, 8000B, 8000C
NOTE: For North Carolina and South Carolina projects, Method SW846 8260B and 8000B must be used.

ANALYTE LIST — Refer to Appendix A

PRESERVATIVE — Cool <6^{o}C Aqueous pH <2 with HCl and/or $Na_2S_2O_3$ (unless unpreserved requested)
Acrolein and Acrylonitrile pH 4-5 with $Na_2S_2O_3$, if unpreserved holding time is 3 days.

HOLDING TIME — Water - 14 days from sample collection when preserved in HCl
Solid - 14 days from sample collection
Solid – Encore^{TM} Samplers – 48 hours to preservation/then 14 days to analysis

Water samples that are target for Styrene, Vinyl chloride, and 2-CVE must be collected without HCL preservation and analyzed within 7 days of collection. If samples for these analytes are received with HCl preservative, the data must be qualified with a narrative in the final report.

Specific projects may require non-acid preservation of water samples. If water samples are unpreserved the analysis must be performed in 7 days.

Water samples must be checked for pH preservation after analysis unless a vial

was provided for a pH check at sample receiving. Record the pH on the batch sheet. If the sample has a pH greater than 2 and the sample was analyzed after 7 days, narrate results.

DEFINITIONS See Appendix C

SAFETY Each employee is directly responsible for complete awareness of all health hazards associated with every chemical that he/she uses. The employee must be aware of these hazards, and all associated protective wear and spill clean-up procedures PRIOR TO the use of any chemical. In all cases, the applicable material safety data sheet (MSDS) and the supervisor or safety officer should be consulted. The bottle labels also provide important information that must be noted. Personnel performing this procedure may be working with flammables, poisons, toxins, carcinogens, teratogens, mutagens, and biohazards. In particular, approved gloves, safety glasses, and lab coats must be worn. In addition to other measures, solvents and chemicals must be handled in ventilated hoods.

INTERFERENCES Contamination can be related to impurities in the purge gas and solvent vapors in the lab. The system is shown to be free from contamination by running a reagent blank each 12-hour period.

Samples can be contaminated by diffusion of vapors through the septum seal during shipment and storage. A field blank can be prepared during sample collection and can act as a check for this type of contamination. Holding blanks are analyzed every two weeks to provide an additional check for this type of contamination. These holding blanks are stored in coolers C22, C30, and C4.

Contamination can also be seen when a low level sample is analyzed immediately after a high level sample. Freedom from contamination must be established before sample analysis is considered valid. After analysis of a sample containing high concentrations of volatile organic compounds, a blank should be analyzed to check for contamination. Alternatively, if the sample following the high concentration sample does not contain the volatile organic compounds present in the high level sample above quantitation limits, freedom from contamination has been established. If the blank or preceding sample shows contamination, analyze blanks until an acceptable blank is achieved and/or clean the purge vessel and bake trap. Reanalyze samples with potential carryover contamination.

INSTRUMENTATION & APPARATUS Agilent 6890 and 7890 GC with a 5973 or 5975 Mass Spectrometer coupled with a Teledyne Tekmar purge and trap and autosampler

HP5890 GC with 5972 Mass Spectrometer coupled with a Velocity XPT concentrator using a Solatek 72 or
Each instrument is assigned a maintenance logbook. All maintenance performed on the instrument must be recorded.

Target data acquisition system

Restek (Cat no. 19915) RTX-VMS 30m, 0.25um ID, 1.4 um df

Gas-tight syringes

Electronic Balance – capable of weighing to 0.01g

Volumetric flasks

44 mL VOA vials

2 mL autosampler vials

Glass culture tubes

Pasteur pipets

Magnetic stir bars

Scoopula spatulas

pH paper

REAGENTS

All organic solvent shall be of pesticide grade or equivalent. Label all containers and squeeze bottles with reagent ID, lot, and expiration date.
Water

Methanol – purge and trap reagent grade or equivalent

Blank sand

Sodium bisulfate

STANDARDS

All standards used must be pure material or from prepared certified solutions. The certificate of analysis shall be kept on file. Follow manufacturer's instruction for standard expiration and storage. Label all working standards using completed standard labels.

The following describes the standards used and their preparation:

1. All stock standards are received in glass sealed ampules.
   A. The following stock standards are used, as necessary to prepare solutions for calibration, CCV, LCS, and MS samples:
      A.1 Stock standard solutions – 1000mg/L (8260 mix)- Ultra Part# DWM-588 - commercially prepared certified solutions in methanol, stored at -15ºC ± 5ºC, until the documented manufacturer's expiration date.
      A.2 Stock standard solutions – 2000mg/L (ketone mix)- Ultra Part# CUS 12327 - commercially prepared certified solutions in 4:1 methanol/water, stored at -15ºC ± 5ºC until the documented manufacturer's expiration date.
      A.3 Stock standard – 2000 mg/L custom mix Ultra Part# CUS 12326 – commercially prepared certified solution in methanol, stored at -15ºC ± 5ºC, until the documented manufacturer's expiration date.
      A.4 Stock standard – Acrolein/Acrylonitrile (A–2000 mg/L; Vinyl Acetate – 400 mg/L) (AAV) NSI Part# Q2143 – commercially prepared certified solution in water, stored at 4ºC ± 2ºC, until the documented manufacturer's expiration date.
      A.5 Stock standard – 2-Chloroethyl vinyl ether (CVE)NSI Part# 17-04-15 – 1000 mg/L - commercially prepared certified solutions in methanol, stored at -15ºC ± 5ºC, until the documented manufacturer's expiration date.
      A.6 Stock standard – Appendix IX compounds – 2 mixes – 2500/200 mg/L Ultra Part# CUS 12032 and CUS 11407 – commercially prepared certified solutions in methanol, stored at -15ºC ± 5ºC, until the documented manufacturer's expiration date.
      A.7 Stock standard solutions – oxygenate mix (4 mixes – Ultra Part# CUS 11575, CUS 11651, CUS 11389, CUS 11390 - commercially prepared certified solutions in methanol, stored at -15ºC ± 5ºC, until the documented manufacturer's expiration date.
      A.8 Additional standards may be run that are project specific. All standards shall be certified and stored according to the manufacturer's instructions.

   B. Independent stock standards – standard mixes identical to those listed above from a secondary source or a secondary lot number from the same manufacturer. These standards are used to prepare the ICVs.

   C. Stock IS/SS mix – 5000 mg/L – Ultra Part# STM-541-1 – commercially prepared certified solution in methanol, stored at -15ºC ± 5ºC, until the documented manufacturer's expiration date. This solution is also used to prepare BFB tune check solution.

2. Secondary standards – Secondary standards are prepared by diluting the stock standard as described below. The first three standards listed in Table 1 and labeled 8260 are prepared together then transferred to 2mL ampule vials with minimum headspace and stored at –15°C ±5°C. These standards may be stored for up to 14 days. However, please note that for the individual vials, they should not be used for more than 7 days once opened. All other secondary standards are prepared as listed in Table 1, and then transferred to 2mL ampule vials with minimum headspace and stored at –15°C ±5°C. These standards may be stored for up to 6 months or until the manufactures expiration, whichever is sooner. Procedure for Volatile standard preparation:

   A. Assemble the necessary glassware, syringes and solvent. Purge and trap reagent grade methanol shall be used for all VOA standard preparation.

   B. Ensure that all glassware and syringes are clean and free of moisture by rinsing with at least three aliquots of methanol. Volumetric glassware should never be stored in or placed in heated ovens. The use of dedicated glass will help prevent cross-contamination of standards.

   C. Fill the volumetric glassware to volume with Methanol. Remove the appropriate amount of Methanol that will be replaced by the standard volume. Addition of standards shall proceed by adding the more highly volatile compounds last to prevent compound loss.

   D. Add the proper volume of standards using a syringe. Minimum agitation should occur upon adding the standard solution.

   E. After the addition of standard, the volumetric flask should be diluted until the meniscus reaches the calibration mark.

   F. Insert the glass stopper and mix by inverting three times.

   G. Cool the flask and its contents to approximately 5°C.

   H. Using a Pasteur pipette, transfer the standard to a 2 mL ampule. Seal the ampule immediately.

   I. Standards may be stored in mininert vials with minimal headspace.

   J. Label the vial with the following information:

      Standard Name
      Standard ID #
      Initials of Person Preparing Sample
      Date of Preparation
      Expiration Date

K. Store the vial the same as the stock standard.

L. Dispose of excess materials in accordance with established laboratory procedures.

M. Always quantitate new standards against known standards to ensure accurate concentration levels.

N. Fill out the standards logbook in accordance with proper laboratory.

O. A combined solution containing the internal standards and surrogates is prepared as the secondary standard. IS/SS is added automatically by the Solatek autosampler.

O.1 Internal standards - The recommended internal standards are Fluorobenzene, Chlorobenzene-d5, and 1,4-Dichlorobenzene-d4. Each calibration standard, blank, LCS, and sample undergoing GC/MS analysis must be spiked with 50 ug/L of the internal standard spiking solution prior to analysis. Different internal standards may be used as necessary.

O.2 Surrogate standards – The recommended surrogates are Toluene d-8, Bromofluorobenzene, 1,2 – Dichloroethane-d4, and Dibromofluoromethane. Each, blank, LCS, and sample undergoing GC/MS analysis should be spiked with 50 ug/L of the surrogate spiking solution prior to analysis. Different surrogate standards may be used as necessary.

Table 1
Secondary Standards

	Stock Conc.	Initial Vol.	Final Vol.	Final Conc.	Solvent
8260 mix	2000 mg/L	1.25 mL	10 mL	250 mg/L	Methanol
8260 custom	2000 mg/L	1.25 mL	10 mL	250 mg/L	Methanol
8260 Ketones	2000 mg/L	1.25 mL	10 mL	250 mg/L	Methanol
CVE	1000 mg/L	2.5 mL	10 mL	250 mg/L	Methanol
AAV	2000/400 mg/L	1.25 mL	10 mL	250/50 mg/L	Deionized water
APP IX Mix 1	2500 mg/L	1.0 mL	10 mL	250 mg/L	Methanol

	Stock Conc.	Initial Vol.	Final Vol.	Final Conc.	Solvent
APP IX Mix 2	various	2.5 mL	10 mL	various	Methanol
Oxygenate Mix 1	2000 mg/L	1.25 mL	10mL	250 mg/L	Methanol
Ethanol	250,000 mg/L	2.0 mL	10 mL	50,000 mg/L	Methanol
3,3-Dimethylebutanol	25,000 mg/L	2.0 mL	10 mL	5,000 mg/L	Methanol
IS/SS	5000 mg/L	2.5 mL	250 mL	50 mg/L	Methanol

3. The following working standards are prepared from the secondary standards and diluted in reagent water:
   A. Calibration standards are prepared at a minimum of five concentrations for all target compounds and surrogates (additional concentrations may be analyzed) from the secondary dilution of stock standards. Prepare these standards in deionized water. The calibration standards are prepared immediately before use at concentrations of 5, 20, 50, 100, and 200 ug/L for solids and waters using a 5mL purge. For waters using a 25mL purge prepare the standards at concentrations of 1, 2, 5, 10, and 25 ug/L. Each standard is prepared in a volumetric flask or a 5ml gas tight syringe. Lower concentration standards may be required to meet project requirements. The 8260 mix, ketones, gases, CVE, AAV, and surrogate standards (250 ug/L) are combined. The three APP IX mixes are also combined and are calibrated separately. Analysis of analytes not contained in any of the aforementioned standards may be calibrated for in combination with the 8260 mix, ketones, gases, CVE, and AAV if sufficient resolution is achieved, or may be calibrated for separately. 44mL of each standard is transferred to a 44mL VOA vial for water calibrations performed using the Solatek 72 autosampler. 5mL of each standard is transferred to a 44mL low bleed septa vial for solid calibrations.

   B. Initial calibration verification standard – Prepare a 50 ug/L standard from the secondary dilution of the independent stock standard (250/50 mg/L). The mixes are combined in the same manner as the calibration standards.

   C. LCS and Matrix Spiking Standards – spike at a concentration of 10 ug/L (25 mL purge) and 50 ug/L (5 mL purge and solids) using the working standards. For South Carolina, DOD, and AFCEE project, the LCS must be spiked with all target analytes.

RECOMMENDED CONDITIONS

The following lists conditions that may be used in the lab.
The analyst is allowed to modify settings to optimize operating conditions.

GC Instrument Conditions
Oven Temperature: 35°C
Rate A: 25°C/min to 180°C
Rate B: 45°C/min to 245°C
Hold: 2.26 min
Carrier Gas - Helium

Purge & Trap Conditions
Purge: 11 minutes at 30°C
Desorb Preheat: 205°C
Desorb: 1.5 minutes at 250°C
Bake: 6.5 minutes at 260°C

CHEMSTATION PROCEDURE

Due to shift overlaps which creates the probability that more than one analyst will be accessing a given instrument during a 12-hour tune sample batch, GCAL utilizes a master username and password to access Chemstation software. The password expires every 30 days and access to the passwords is granted by the GCMSV supervisor.

To Log In to Chemstation:

1. Enter "gcmsv" for the user name.
2. Obtain password from the GCMSV supervisor and enter the password when prompted by the Chemstation software.

To Change a Password

1. When a current password has expired, Windows prompts the user to enter current credentials including user name and password.
2. Once this information has been entered, the user is then notified that the password has expired and must be changed.
3. Enter a new password into the software when prompted, confirm the new password, and notify the GCMSV supervisor of the password change.

Chemstation Use

1. Chemstation use is limited to those employees who have been given password access by the GCMSV supervisor and are involved in the process of data production in the GCMSV laboratory. New employees are not granted password access until the GCMSV supervisor is satisfied that the

employee has been properly trained on its use. All employees listed on current organizational chart maintained by the QA/QC department are eligible for password access if granted by the GCMSV supervisor.

2. To create an audit trail, each line in the sequencing file represents a unique sample injection. The analyst that is programming the Chemstation and loading a particular sample must include their initials in the miscellaneous information field as part of the sample sequence. This information is then transferred to Target which is used for all data acquisition. Sequence files must be saved by analytical batch and include the date in the name. On days when multiple batches are performed, letters should be added to the data to denote different analytical batches. The format for individual sample sequencing is as follows:

TYPE	Vial	Data File	Method	Sample Name
"Sample"	Autosampler Position	Unique sequential ascending number	"8260"	GCAL sample number

Miscellaneous Information
GCAL Batch Number*Dilution Factor*Analyst Initials

* Please note, only the vial, datafile, sample name, and miscellaneous information fields are edited when programming sequences. Type and method fields always remain the same for each sequence file.

PROCEDURE

1. Procedures for instrument tuning

   A. The instrument should be tuned using FC-43 (perfluorotributylamine) such that all tuning criteria for BFB can be met (Table 2). Before analysis begins, each instrument must be tuned checked by direct injecting 2 uL of a solution containing 25 mg/L BFB or by purging an amount equivalent to 50ng of BFB standard.

   B. The mass spectrum of 4-Bromoflurorobenzene (BFB) is acquired by using the average of three scans: the peak apex scan and the scans immediately preceding and following the apex. Background subtraction is required using a single scan no more than 20 scans prior to the elution of BFB. The tune method is hard coded to perform the above functions and is checked manually if BFB tune criteria fails.

   C. The BFB tuning criteria in Table 2 must be met before proceeding with analysis. If these criteria cannot be met, the instrument should be manually tuned with FC-43. If tune criteria is still not met instrument maintenance is performed.

D. Once the BFB tune criteria have been met, the instrument is considered to be tuned for a twelve-hour period starting from the injection time of the BFB.

E. The instrument must be retuned before the twelve-hour period has elapsed if any major adjustments are made to the mass spectrometer that may affect the tuning criteria.

Table 2
BFB ACCEPTANCE CRITERIA

M/Z	ION ABUNDANCE CRITERIA
50	15 - 40% OF MASS 95
75	30 - 60% OF MASS 95
95	BASE PEAK, 100% RELATIVE ABUNDANCE
96	5 – 9% OF MASS 95
173	LESS THAN 2% OF MASS 174
174	50 - 120 OF MASS 95
175	5 – 9% OF MASS 174
176	>95 BUT <101% OF MASS 174
177	5 – 9% OF MASS 176

2. Procedures for initial calibration

A. The initial calibration standards are prepared at a minimum of five different concentrations from the secondary dilution. Additional standards are usually included for specific compounds including a 0.2ppb, 0.4ppb, 1ppb, 2ppb, and 10ppb.

The calibration range is defined as the on-column concentration range.

1. At least five contiguous points must be used (six if a quadratic curve fit is employed).
2. Calibration acceptance criteria must be met as described below.
3. The lowest calibration point must support the lowest reporting limit needed in the associated samples.
4. The QC spike amount must be within the calibration range.

B. The standards are analyzed in the following sequence:

B.1. BFB (50 NG)
B.2. 5 PPB initial calibration
B.3. 20 PPB initial calibration
B.4. 50 PPB initial calibration
B.5. 100 PPB initial calibration
B.6. 200 PPB initial calibration

Note: These are the routine concentrations analyzed. In all cases the standards shall be run from lowest concentration to highest, or a blank shall be run following a high concentration standard (standards greater than 50 ppb) to establish a contaminant free instrument.

C. Once the five levels of standards have been analyzed, the validity of the initial calibration must be verified by comparing the SPCCs and CCC's to the following criteria.

C.1. Calibration check compounds (CCC) listed below must be ≤ 30 % RSD.

CCC's	**% RSD**
1,1-Dichloroethene	<30%
Chloroform	<30%
1,2-Dichloropropane	<30%
Toluene	<30%
Ethylbenzene	<30%
Vinyl Chloride	<30%

C.2. System Performance Check Compounds (SPCC) must have a minimum (RF) as indicated. All SPCC's must be evaluated at each level of the calibration curve to insure that compound instability and degradation are checked as required by the method.

SPCC's	**MINIMUM RF**
Chloromethane	0.1
1,1-Dichloroethane	0.1
Bromoform	0.1
1,1,2,2-Tetrachloroethane	0.3
Chlorobenzene	0.3

D. Additionally one of the following options must meet criteria. The analyst will judge criteria in the order given or with prior knowledge of the behavior of target compounds. One of the following must pass before a calibration is considered acceptable:

D.1 All target analytes have an RSD less than 15%.

D.2 A first order least square regression may be used if $r^2 \geq 0.995$. The curve shall not be forced through zero. The analyst should check the y-intercept (b). If the intercept is greater than half the reporting limit, this option cannot be used.

D.3 A quadratic curve fit is used with the coefficient of determination $r^2 \geq 0.990$. A minimum of a six-point calibration is used if this option is chosen and the curve shall not be forced through zero. The analyst should check the y-intercept (b). If the intercept is greater than half the reporting limit, this option cannot be used. The quadratic calibration option is not allowed for South Carolina

projects.

D.4 Alternatively, if the analyte is listed as a poor performer and does not meet the criteria listed above, the data may be reported with a narrative if authorized by the client. NOTE: Compounds cannot be classified as poor performers for South Carolina projects.

D.5. If a CCC compound is a target analyte, then it must exhibit and average %RSD of <15%. If the average %RSD is >15% but <30%, it may be evaluated using a linear or quadratic curve fit.

E. If the initial calibration does not conform to the above listed criteria, corrective action must be taken.

F. The position of the retention time should be set using the mid-point of an initial calibration, and must be checked and reset as necessary after source cleaning or column maintenance.

3. Initial Calibration Verification

A. Immediately following the initial calibration procedure or before sample analysis, the analyst shall perform initial calibration verification (ICV). This will consist of a solution containing all target analytes prepared from a standard that is independent (second source) from the standards used for the initial calibration.

B. The ICV must be analyzed following the initial calibration. The ICV must exhibit a recovery of 70-130%, except for the targets listed in Table 3, which must be recovered between 60-140%. Recovery requirements may differ on a project specific basis. See SOP GEN-019. All analytes must exhibit a recovery of 70-130% for South Carolina samples.

C. If any target analyte recovery is outside the control limits, corrective action must be taken (project specific exceptions may apply). This may include instrument maintenance, re-analysis of the ICV or initial calibration, or re-preparation of the standards involved. If the target fails high and is not present in the associated samples, the data may be reported with a narrative.

4. Procedures for Continuing Calibration

A. The 50 PPB continuing calibration is analyzed in each batch after acceptable BFB tune and before samples. The following criteria shall be achieved before sample analysis:

A.1 CCC's must meet the specified criteria for all target analytes. Calibration Check Compounds (CCC's) are allowed no greater than 20% difference from the initial calibration if calibration option 2.D.1 or 2.D.4 is used or % drift ≤20% if a linear or quadratic calibration option was used. The quadratic calibration option is not allowed for South Carolina projects.

A.2 System performance-check compounds (SPCC's) are required to maintain a relative response factor (RF) as indicated in 2C.2.

A.3 All target analytes should have a %Difference ≤ 20% from the initial calibration if calibration options 2.D.1 or 2.D.4 were used or %Drift ≤20% of expected value if a linear or quadratic calibration option was used. All targets must have difference/drift ≤ 30%. Project specific limits may apply and are listed in the LIMS. The quadratic calibration option is not allowed for South Carolina projects.

NOTE: For Exxon samples any %differences/drift that exceed 20% for target analytes but meet the 30% in house criteria, should be narrated in the final report.

A.4 Some compounds have been classified as poor performers due to poor purging efficiency. These analytes are listed in Table 3 and are acceptable at ≤40% difference/drift. Poor performer exceptions are not allowed for South Carolina samples.

Table 3
Targets that exhibit poor purging efficiency

Acetone	Ethyl acetate
Acetonitrile	2-Hexanone
Acrolein	Isobutyl alcohol
Acrylonitrile	Methacrylonitrile
2-Butanone	4-methyl-2-pentanone
t-Butyl alcohol	Pentachloroethane
1,2-Dibromo-3chloropropane	Propionitrile
1,4-Dichloro-2-butene	Benzal chloride
1,4-Dioxane	1-Nitropropene
2-Chloropropene	1,3 Butadiene
Isopropyl ether	Tetrahydrofuran
2-Nitropropane	2,2,4-Trimethylpentane
2-Chloroethylvinyl ether	Ethyl ether
2-Butanol	Ethyl methacrylate
Cyclohexanone	Dicyclopentadiene
3-Dichloro-1-propene	n-Butanol
Allyl chloride	Methyl methacrylate
Chloroprene	Dichlorodifluoromethane
Bromomethane	TBA
3,3-Dimethylbutanol	t-Amyl Alcohol
Ethanol	Ethyl tertbutyl ether
tert amylmethyl ether	Tertbutyl formate

A.5 If the target analyte (not a CCC) has failed, the RF has increased, and there are no hits during sample analysis, the data is reportable with a narrative. Note: no failures are allowed for South Carolina projects.

A.6 The retention time for any internal standard shall not vary any more than 30 seconds from the mid- point standard of the most recent initial calibration.

A.7 The internal standard area must not deviate by more than a factor of two (-50% to + 100%) from the mid-point standard of the most recent initial calibration.

A.8 Project specific criteria may apply and may be more stringent. See SOP GEN-019.

B. If specified criteria are not met, corrective action must be taken. If no source of the problem can be determined after corrective action has been taken, a new initial calibration must be generated.

5. The purpose of the method blank is to ensure that the analytical system is free of contamination and carryover. The method blank is run at least once per batch (not to exceed 20 samples) before sample analysis. The method blank shall be handled in exactly the same manner as the samples that it represents.

A. The following are a description of the three types of method blanks commonly used in routine analysis and the analysis and evaluation of storage blanks.

A.1 Water - Water blanks require no special preparation. Fill a VOA vial with reagent water. Place the full 44 mL VOA vial on the SOLATek autosampler. 5 uL of the internal standard/surrogate standard will be added automatically.

A.2 Low-level soil – Low-level soil method blanks require special preparation techniques. Place the 5.0 grams of sand in a 44 mL vial and add 5.0 mL of deionized water. Place on the autosampler. The SOLATek will add 5.0 mL of deionized water and the internal/surrogate standards.

A.3 Medium/High level soil – medium/high level soil blanks are prepared by weighing 5.0 grams of sand into a 44 ml VOA vial. Add 5.0 ml Methanol. Shake the vial to extract any volatiles into the solvent. A 1000 uL extract aliquot is diluted to 50ml in a volumetric flask with deionized water. Place on the autosampler. The autosampler will add an amount of internal standard/ surrogate solution equivalent to 50ug/L. Document preparation of blank in logbook.

A.4 Storage Blanks – A set of at least two storage blanks filled with reagent water are kept in each cooler used to store samples. Storage blanks are analyzed every two weeks. If there is detection above ½ the reporting limit, analyze the second vial to confirm the

detection. If the results are confirmed immediately notify QA of the affected blank, cooler tested, and storage time. All data must be filed in the appropriate logbook.

B. To prove a contaminant free system, no target analytes shall be detected in the method blank above one half the reporting limit except for common laboratory contaminants, which shall be less than the reporting limit. If any target analytes are detected above this level, data shall not be reported and samples must be re-extracted and re-analyzed unless the following apply:
   B.1 If a target analyte is detected above the reporting limit, data may be reported if the concentration is not greater than 10% of the measured concentration in associated samples. Include a narrative with the data.
   B.2 If a target analyte is detected in the method blank but there are no hits in the samples, the data may be reported with a narrative.
   B.3 If re-analysis is not possible, flag the associated samples and include a narrative in the report. Document the action taken.
C. The source of blank contamination shall be investigated and measures taken to eliminate future contamination.
D. Project specific criteria may apply and may be more stringent. See SOP GEN-019.

6. Procedure for Laboratory Control Spike (LCS/LCSD). An LCS and LCSD are included in each batch of up to 20 samples to demonstrate the system is in control. An LCSD is not required if an MS/MSD is performed. Routinely the LCS/LCSD will be spiked with the full list of 8260 analytes at 50ug/L. The CCV performed that day may be used as the LCS if allowed by the project. Check with the project manager for project specific spiking criteria; some projects may require all target analytes are spiked. The LCS is assessed using the following criteria:

NOTE: For all sample batches involving Exxon samples, the LCS/LCSD pair analysis must be independent of the CCV analysis.

A. The percent recovery is calculated for all analytes spiked (see Calculation section). Recoveries are compared to the appropriate control limits. In-house control limits are used if project specific limits have not been requested, and are available in the LIMS. Project specific control limits may be requested; check with the project manager for limits needed. For South Carolina samples, all analytes must be recovered at 70-130% of the expected value.

B. If a recovery is above the upper control limit and the sample results are below the reporting limit, the data may be reported with a narrative. All analytes must pass for South Carolina samples.

C. If a recovery is below the lower control limit, the batch must be re-analyzed unless it meets the requirements of a sporadic failure (see below). If a re-extraction is not possible due to insufficient sample volume, report the data with a narrative. All analytes must pass for South Carolina samples.

D. If the full list of target analytes is spiked, a small number of sporadic failures will be allowed. The failure cannot include a primary compound of interest as defined by the client. See Table 4 for the number of allowable failures. The failures are noted in the case narrative. These failures shall be monitored to ensure randomness. This shall be defined as not exceeding failure in 1 of 3 LCS determinations. If the same analyte fails repeatedly and is not included in Table 3, locate the source of the problem and perform corrective action. All analytes must pass for South Carolina samples.

Table 4
Number of Allowable Failures

Number of Analytes	Failures Allowed
<11	0
11-30	1
31-50	2
51-70	3
71-90	4
>90	5

E. If an LCS and an LCSD are analyzed, calculate precision using the RPD in the Calculation section, equation 2. Substitute the LCS and LCSD results for the MS/MSD. Precision is assessed using the criteria in the LIMS.

7. Procedures for Matrix Spikes

A. Analyze one matrix spike/matrix spike duplicate (MS/MSD) pair with each batch of up to 20 samples processed together. The purpose of the spikes is to confirm the matrix being analyzed is not interfering with the recovery of the analytes.

B. The MS/MSD spike includes the full 8260 list of analytes; the spiking level is 50 ug/L. Check with the project manager for project specific spiking criteria; some projects may require all target analytes are spiked.

C. Calculate % recovery for all compounds using Calculations equations 1 and 2. All compounds are evaluated to determine acceptance of the

MS/MSD. Acceptance criteria for MS/MSD are located in Appendix B of this SOP.

D. Whenever the MS and/or MSD recoveries are outside the control limits, check the LCS and LCSD to verify the system was in control, and include this in the case narrative.

E. Precision is calculated as %RPD. Acceptance criteria are listed in the LIMS. Failures are noted in the narrative.

F. Review data to verify that a lab error has not occurred (wrong spike amount, not spiked) before automatically identifying a failure as matrix interference.

G. If recoveries for both the MS/MSD are outside the control limits and the recoveries are similar, the data is reportable with a narrative stating the LCS recoveries were acceptable. The failure is attributed to sample matrix.

H. Native sample concentrations may be high in comparison to the spiking concentration and therefore an accurate recovery cannot be calculated. Document this in the case narrative. Additionally, soil weights may vary significantly for some MS/MSD pairs and will affect the RPD calculation.

8. QC and Sample Preparation:
   A. Aqueous sample - place the full 44 mL VOA vial on the SOLATek autosampler. 5 uL of the internal standard/surrogate standard will be added automatically. All dilutions must be prepared using volumetric flasks or performed by the autosampler. To prepare MB and LCS/LCSD samples use reagent water.

   B. Low-level soil – SOLATek autosampler is used, place the 5.0 grams of sample in a 44 mL vial and add 5.0 mL of reagent water. Place on the autosampler. The SOLATek will add 5.0 mL of reagent water and the internal/surrogate standards. To prepare LCS/LCSD samples use blank sand.

   C. Medium/High level soil and Concentrated Waste – medium/high level soil and concentrated waste samples are prepared by weighing 5.0 grams of sample into a 44 ml VOA vial. Add 5.0 ml Methanol. Shake the vial to extract the volatiles into the solvent. A 1000 uL extract aliquot is diluted into a 50ml volumetric flask containing deionized water. The contents are then transferred to a 44ml VOA vial. The SOLATEK autosampler will add the internal standard/surrogate solution to yield a concentration of 50ug/L. To prepare LCS/LCSD samples use reagent

water.

D. EnCore™ sampler (En Chem, Inc)
   D.1 Preservation – A 200g/L sodium bisulfate solution is prepared by weighing 200g of sodium bisulfate and bringing this to volume with deionized water, in a 1L volumetric flask. 5mL of this solution is added to a VOA vial and a magnetic stirring bar. Record the lot # of the sodium bisulfate solution in the sample prep logbook. Tare the balance. Dispense the contents of the EnCore™ sampler into the vial and record the weight of the sample.
   D.2 Load the vial onto the SOLATek autosampler. The autosampler will add 5 mL of deionized water containing the internal standard and surrogate standard.

9. Sample Analysis:
   A. Samples may be screened by GCAL.
      A.1 Reasons for screening may include but are not limited to the following:
         A.1.1 Inconsistent historical data
         A.1.2 Physical appearance of the sample
         A.1.3 Client notification of suspected high concentration of VOC's
         A.1.4 No historical data

      A.2 Samples that are deemed necessary for screening must have adequate volume for the screening process and the subsequent volume for the reportable analysis.

      A.3 Screening data is not reportable, as the screening analysis is performed on an instrument that has not met acceptable criteria for reportable analysis. The screening data may be provided upon client request, if applicable.

      A.4 The screening process is performed in an attempt to prevent contamination of instrumentation performing reportable analysis, thus reducing the possibility of carryover contamination from samples containing high levels of VOC's and resulting in instrument down time.

      A.5 Screening analyses are typically performed at a dilution factor in the range of 20 to 1000. Dilution factors may be performed outside of this range. Screening dilutions may be determined by, but are not limited to the following:
         A.5.1 Client notification of suspected high concentrations of VOC's
         A.5.2 Physical appearance of the sample

A.5.3 Historical data from similar projects

B. All samples are spiked with the following surrogates: 1,2-Dichloroethane-d4, Toluene-d8, Dibromofluoromethane, and Bromofluorobenzene
   B.1 All surrogates recoveries must be within the ranges as listed in Table 5 below.
   B.2 If any surrogate is below QC limits and target analytes are present, then the sample must be reanalyzed. If the same surrogate still fails in the same manner, then matrix interference is indicated and is included in the case narrative.
   B.3 If the recoveries for surrogates are above the upper control limits and no target analytes are detected, the sample is reported with a case narrative indicating surrogate recovery above control limits.
   B.3 Control limits are updated annually. Project specific control limits and corrective action may apply and may be more stringent. See SOP GEN-019. All project specific limits shall be in the LIMS.

Table 5

Surrogate	Water Recovery Limits	Solid Recovery Limits
1,2-Dichloroethane-d4	71-127	62-125
4-Bromofluorobenzene	78-130	62-127
Dibromofluoromethane	77-127	65-130
Toluene-d8	76-134	71-132

C. Internal Standards (IS) - All samples are spiked with Fluorobenzene, Chlorobenzene-d5, and 1,4-Dichlorobenzene-d4.
   C.1 The Internal Standard area for any internal standard must not deviate by more than (-50% to + 100%) from the daily CCV.
   C.2 The retention time of the IS in the sample must not shift greater than $\pm$ 0.5 min of the retention time of the corresponding IS in the CCV.
   C.3 If the sample fails any of the IS criteria it must be reanalyzed at the same dilution. If it is apparent that the IS is outside criteria due to interference from sample matrix, then contact the client to determine a course of action.
   C.4 Project specific criteria may apply and may be more stringent. DOD and AFCEE projects require the internal standard response drift be evaluated using the most recent ICAL mid-point with control limits of –50 to +100%.

D. All dilutions are prepared in volumetric flasks or by using the dilution feature on the autosampler. Dilute samples so that the on-column amount is approximately in the mid-range of the calibration curve.

E. Load samples onto Solatek 72 autosampler. Sample sequences should be

saved for future review, if needed.

F. Targets are qualitatively identified based on the retention time and on comparison of the analytes mass spectrum with a reference mass spectrum. A reference mass spectrum is generated using the same conditions of the method. In the reference mass spectrum three characteristic ions are identified, one of which is the primary characteristic ion. If there are not three ions, than any ion over 30% relative intensity may be used. The target is said to be present when the following criteria are met:
   F.1 The intensities of the characteristic ion(s) maximize within one scan.
   F.2 The RRT is within ±0.06 RRT units of the RRT of the standard.
   F.3 The relative intensities of the characteristic ion(s) agree within 30% of the relative intensities of these ions in the reference spectrum.
   F.4 Structural isomers may be identified as individual isomers if the height of the valley between them is less than 25% of the sum of the two peak heights.

G. Samples are quantitated once a positive identification has been made. The quantitation will be based on the area of the primary characteristic ion's EICP and the associated internal standard. Calculations are described in the calculation section. The quantitation ion used shall be the ion listed in the reference method(s) unless there are interferences. Qualifier ions shall be used as a replacement, if possible. If the quantitation ion used is not the ion listed in the reference method, this shall be documented and the documentation stored in the lab.

H. TICS may be reported if requested by manually entering data into the LIMS. If no TICS were found, and the client requested a TIC search, this shall be noted in LIMS. A data system library search is used for identification, and the concentration is estimated using an RF of 1 and the area and concentration of the internal standard with the closest retention time.

I. Manual integrations shall be performed as appropriate. The supervisor reviews manual integrations and the raw data is flagged. For additional information see SOP QA-010.

CALCULATIONS 1. MS % REC = $\frac{\text{MS Concentration-Sample Concentration}}{\text{spike added}} \times 100$

2. MSD % REC = $\frac{\text{MSD Concentration-Sample Concentration}}{} \times 100$

spike added

3. % RPD = $\frac{MS-MSD}{\frac{MS+MSD}{2}} \times 100$

4. Response Factor = $\frac{A_s \times C_{is}}{A_{is} \times C_s}$

$\overline{As}$ = Peak Area of analyte or surrogate
Ais = Peak Area of Internal standard
Cs = Concentration of the analyte or surrogate
Cis = Concentration of Internal standard

5. %Recovery = $\frac{\text{Concentration Found}}{\text{Concentration Added}} \times 100$

6. Concentration using RF:

Concentration (µg/L) = $\frac{(A_s)(C_{is})(D)}{(A_{is})(RF)(1000)}$

Concentration (mg/kg) = $\frac{(A_s)(Cis)(D)}{(A_{is})(RF)(W_s)(1000)}$

A_s = Area of peak for the analyte in sample
D = Dilution factor
RF = Mean Response factor from initial calibration (area/ng)
A_{is} = Area of internal standard in sample
C_{is} = Concentration of internal standard
W_s = Weight of sample

7. Concentration using linear curve fit:

Concentration (µg/L) = $[m(A_S/A_{IS})+b]C_{IS}D$

Concentration (mg/kg) =$[m(A_S/A_{IS})+b]C_{IS}D(5/W_S)$

m = Inverse of slope
A_s = Area of peak for the analyte in sample
A_{is} = Area of internal standard in sample
b = Intercept of the y-axis
C_{is} = Concentration of internal standard
D = Dilution factor
W_s = Weight of sample

8. For quadratic curve fit see Target3 Data Analysis Software Reference Guide page 3-17. The quadratic calibration option cannot be used for South Carolina projects.

9. Concentration of TICS:
Concentration (mg/kg) = $\frac{(A_s)(C_{is})(D)}{(A_{is})(1000)}$

A_s = Area of peak for the analyte in sample
D = Dilution factor
A_{is} = Area of internal standard in sample
C_{is} = Concentration of internal standard
W_s = Weight of sample (if aqueous sample W_s = 1 and report in (µg/L)

10. Calculations for various hydrocarbon ranges. See Appendix B

11. % Difference = $[(RF_I - RF_C) / RF_I\} 100$

RF_I = Average response factor from initial calibration
RF_C = Response factor from current verification check standard

12. % Drift = $\frac{|\text{Measured Conc} - \text{Spike Conc}|}{\text{Spike Conc}} * 100$

13. % RSD = (SD / X) 100

RSD = Relative Standard Deviation
X = mean of 5 initial RF's for a compound
SD = Standard Deviation of average RF's for a compound

REPORTING LIMIT Samples analyzed by Method 8260B have a routine reporting limit of 5 ppb for all analytes of interest with the exception of the following compounds:

Acetone – 25 ppb
Acetonitrile – 100 ppb
Acrolein – 25 ppb
Acrylonitrile – 25 ppb
1,4-Dioxane – 200 ppb
Isobutanol – 100 ppb
Methyl Ethyl Ketone – 25 ppb
Methyl Methacrylate – 100 ppb
Propionitrile – 100 ppb
Methylene Chloride – 10 ppb
Benzal Chloride – 20 ppb
n-Butyl Alcohol – 100 ppb
Ethyl Acetate – 100 ppb
Ethyl Ether – 100 ppb

Cyclohexanone – 100 ppb
Cyclohexane – 100 ppb
1,3-Butadiene – 10ppb
1,3-Dichloropropene – 10 ppb
1-nitropropane – 10 ppb
2-methyltetrahydrofuran – 20 ppb
2-methyltetrahydropyran – 10 ppb
2-nitropropane – 20
2-H-tetrahydropyran – 20 ppb
Allyl Chloride – 25 ppb
Chloroprene – 80 ppb
Cumene hydroperoxide – 20 ppb
Ethylene oxide – 100 ppb
Tetrahydrofuran – 100 ppb
Sec-Butanol – 10 ppb
t-Butanol – 10 ppb

Lower limits may be achieved for specific projects. Reporting limits are achieved by running a low level standard at the same level as the reporting limit. The RL should be at least 2X the MDL. Specific project criteria may apply. See SOP GEN-019.

DATA REVEIW

For data review procedures and checklist, please see SOP QA-002.

SOFTWARE TROUBLESHOOTING

The Tekmar Solatek 72 instruments utilize Tekmar software VOC TEKLINK Version 2.4.4647 to control the autosampler and purge and trap function. The Agilent GC/MS's utilize Agilent software MSD Chemstation Version D.02.00.275 to control the instrument and transfer data acquisition to Target Data Integration software. Target software is utilized to calculate all data. In the event of software malfunction for the Tekmar Solatek 72, please contact Tekmar technical support for troubleshooting help. In the event of software malfunction for the GC/MS, please contact Agilent technical support for troubleshooting help. In the event of software malfunction when using Target, please contact GCAL's IT Director for troubleshooting help.

METHOD PERFORMANCE

1. The method detection limit (MDL) is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the value is above zero. The MDL actually achieved in a given analysis will vary depending on instrument sensitivity and matrix effects.

2. This method has been tested using purge-and-trap (Method 5030) in a single laboratory using spiked water. Using a wide-bore capillary column, water was spiked at concentrations between 0.5 and 10 ug/L. Single laboratory accuracy and precision data are presented for the method analytes in Table 6 of the 8260 method. Calculated MDLs are present in Table 1 of the 8260 method.

3. The method was tested using purge-and-trap (Method 5030) with water spiked at 0.1 to 0.5 ug/L and analyzed on a cryofocussed narrow-bore column. The accuracy and precision data for these compounds are presented in Table 7 of the 8260 method. MDL values were also calculated from these data and are presented in Table 2 of the 8260 method.

4. Single laboratory accuracy and precision data were obtained for the Method 5035 analytes in three soil matrices; sand; a soil collected 10 feet below the surface of a hazardous landfill, called C-Horizon; and a surface garden soil. Sample preparation was by Method 5035. Each sample was fortified with the analytes at a concentration of 4 ug/kg. These data are listed in Tables 17, 18, and 19 of the 8260 method. All data were calculated using fluorobenzene as the internal standard added to the soil sample prior to extraction. This causes some of the results to be greater than 100% recovery because the precision of results is sometimes as great as 28%.

5. In general, the recoveries of the analytes from the sand matrix are the highest, the C-Horizon soil results are somewhat less, and the surface garden soil recoveries are the lowest. This is due to the greater adsorptive capacity of the garden soil. This illustrates the necessity of analyzing matrix spike samples to assess the degree of matrix effects.

6. The recoveries of some of the gases, or very volatile compounds such as vinyl chloride, trichlorofluoromethane and 1,1-dichloroethene are somewhat greater than 100%. This is due to the difficulty encountered in fortifying the soil with these compounds, allowing an equilibration period, extracting them with a high degree of precision. Also, the garden soil results in Table 19 of the 8260 method include some extraordinary high recoveries for some aromatic compounds, such as toluene, xylenes, and trimethylbenzenes. This is due to contamination of the soil prior to sample collection, and to the fact that no background was subtracted.

POLLUTION PREVENTION — See QAPP Section 10.2

WASTE

MANAGEMENT See SOP GEN-009

Appendix A -8260 Analyte List

Acetone
Acetonitrile
Acrolein
Acrylonitrile
Benzene
Bromobenzene
Bromochloromethane
Bromodichloromethane
Bromoform
Bromomethane
2-Butanone (MEK)
n-Butylbenzene
sec-Butylbenzene
tert-Butylbenzene
Carbon disulfide
Carbon tetrachloride
Chlorobenzene
Chloroethane
2-Chloroethylvinylether
Chloroform
Chloromethane
2-Chlorotoluene
4-Chlorotoluene
1,2-Dibromo-3-chloropropane
Dibromochloromethane
1,2-Dibromoethane
Dibromomethane
1,2 Dichlorobenzene
1,3 Dichlorobenzene
1,4 Dichlorobenzene
Dichlorodifluoromethane
1,1-Dichloroethane
1,2 Dichloroethane
1,1-Dichloroethene
cis-1,2-Dichloroethene
trans-1,2-Dichloroethene
1,2-Dichloropropane
1,3-Dichloropropane
2,2-Dichloropropane
1,1-Dichloropropene
cis-1,3-Dichloropropylene
trans-1,3-Dichloropropene
Ethylbenzene
2-Hexanone
Hexachlorobutadiene
Isopropylbenzene
p-Isopropyltoluene
Methylene Chloride
4-Methyl-2-pentanone
Methyl tert-butyl ether
Naphthalene
n-Propylbenzene
Styrene
1,1,1,2-Tetrachloroethane
1,1,2,2-Tetrachloroethane
Tetrachloroethene
Toluene
1,2,3-Trichlorobenzene
1,2,4-Trichlorobenzene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethene
Trichlorofluoromethane
1,2,3-Trichloropropane
1,2,4-Trimethylbenzene
1,3,5-Trimethylbenzene
Vinyl acetate
Vinyl chloride
m+p-Xylene
o-Xylene
Xylenes, total
1-Chlorohexane
DIPE
ETBE
TAME
tert-Butyl alcohol
1,2-Diethyl Benzene
1,3-Diethylbenzene
1,4-Diethylbenzene
Total Diethylbenzene

Appendix B

1. Calculations for Total Other VOC's

   The total ion chromatogram of a method 8260B gas chromatographic/mass spectrometric (GC/MS) analysis is integrated and peaks attributed to target analytes, internal standards, surrogates, and those compounds which may elute before Dichlorodifluoromethane and those compounds which may elute after 1,2,3-Trichlorobenzene are subtracted from the total peak area of the chromatogram. The total concentration of non-target volatile organic components is calculated and reported by relating the resultant ion peak area to the total ion peak area of an intern standard (Fluorobenzene) of known concentration (50ppb). An area report is loaded from the Samba server into the Filemaker program. After entering the minimum and maximum retention times (corresponding to the elution times of Dichlorodifluoromethane and 1,2,3-Trichlorobenzene, respectively) and the appropriate dilution factor, the area report is imported and results are generated.

2. Calculations for Other VOC's C6 and Lower

   The total ion chromatogram of a method 8260B gas chromatographic/mass spectrometric (GC/MS) analysis is integrated. A sum of all peak areas beginning with the elution of Dichlorodifluoromethane and ending with the elution of Hexane is generated. The total concentration of C6 components is calculated and reported by relating the resultant C6 area to the peak area of an internal standard (Fluorobenzene) of know concentration (50ppb). An area report is loaded from the Samba server into the Filemaker program. After entering the minimum and maximum retention times (corresponding with the elution times of Dichlorodifluoromethane and 1,2,3-Trichlorobenzene), the retention time for Hexane, and the appropriate dilution factor, the area report is imported and results are generated.

3. Calculations for Other VOC's C7 and Higher

   The total ion chromatogram of a method 8260B gas chromatographic/mass spectrometric (GC/MS) analysis is integrated. A sum of all peak areas beginning with the elution of Hexane and ending with the elution of 1,2,3-Trichlorobenzene is generated. The total concentration of C7 components is calculated and reported by relating the resultant C7 area to the peak area of an internal standard (Fluorobenzene) of know concentration (50ppb). An area report is loaded from the Samba server into the Filemaker program. After entering the minimum and maximum retention times (corresponding with the elution times of Dichlorodifluoromethane and 1,2,3-Trichlorobenzene), the retention time for Hexane, and the appropriate dilution factor, the area report is imported and results are generated.

Appendix C

Glossary

ACCEPTANCE LIMITS – data quality limits specified by the test method or generated by the laboratory. Specified limits placed on an item, process, or service defined in the requirement document.

ACCURACY – a measure of how close a measured value is to a known true value. Accuracy is assessed by means of reference samples and percent recoveries of spiked samples. The degree of agreement between an observed value and an accepted reference value. Accuracy includes combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator.

ALIQUOT – a discrete, measure, or representative portion of a sample taken for analysis.

ANALYTE – the chemical element or compound an analyst seeks to determine; the chemical element of interest.

ANALYTICAL BATCH – the basic unit for analytical quality control, defined as samples that are analyzed together with the same method sequence and the same lots of reagents and with the manipulations common to each sample within the same time period or in continuous sequential time periods. Samples in each batch should be of similar composition (e.g., groundwater, sludge, ash).

ANALYTICAL SAMPLE – any solution or media introduced into an instrument on which an analysis is performed, excluding instrument calibration, initial calibration verification, initial calibration blank, continuing calibration verification, and continuing calibration blank. The following are all analytical samples: undiluted and diluted samples (EPA and non-EPA), predigestion spike samples, duplicate samples, serial dilution samples, analytical spike samples, post digestion spike samples, interference check samples (ICS), CRDL standard for AA(CRA), CRDL standard for ICP(CRI), laboratory control sample(LCS), preparation blank(PB), and linear range analysis sample(LRS).

ANALYST – the designated individual who performs the "hands on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.

AREA UNITS – a term used in gas chromatography that indicates the peak area of a compound exiting a chromatographic column. The size or area of the peak is proportional to the amount of analyte in the sample.

ATOMIC ABSORPTION (AA) – a technique for analyzing metal using an element-specific lamp that emits a characteristic light spectrum. A sample is heated in a flame or graphite furnace and the light beam is passed through it. When the sample absorbs light, an energy loss is detected and is translated into a concentration of metal in the sample. This technique detects one metal at a time.

AUDIT – a systematic check to determine the quality of some function or activity. Two basic types are performance audits and system audits. Perform audits involve a quantitative comparison of the laboratory's results to those of a proficiency sample containing known concentration of analytes. A system audit is a qualitative evaluation that normally consists of an onsite review of a lab's quality assurance system and physical facilities.

BACKGROUND CORRECTION – a technique usually employed relative to metals analysis, which compensates for variable background contribution to the instrument signal in the determination of trace elements.

BATCH – environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A batch is composed of a maximum of twenty environmental samples. A preparation batch is composed of environmental sample of the same matrix, meeting the above-mentioned criteria and with a maximum time between the start of processing the first and last sample in the batch to be 24 hours. An analytical batch is composed of prepared environmental samples (extracts, digestates or concentrates) and/or those samples not requiring preparation, which are analyzed together as a group using the same calibration curve or factor. An analytical batch can include samples originating from various environmental matrices.

BIAS – the deviation of the mean of replicate analytical measurements from a reference analyte concentration. Relative bias is represented by analytical measurement mean minus the reference analyte concentration and the difference divided by the reference analyte concentration. See accuracy and precision.

4-BROMO-FLUOROBENZENE (BFB) – the compound used to check the tuning of the instrument, and is used as a surrogate compound spiked into every sample for volatile analysis. A compound utilized in EPA gas chromatography/mass spectrometry (GC/MS) volatile methods to establish mass spectral instrument performance.

BIOCHEMICAL OXYGEN DEMAND (BOD) – A measure of the amount of oxygen consumed in the biochemical processes that break down organic matter in water. A larger BOD value indicates a greater degree of organic pollution. A related term, BOD5, is the amount of dissolved oxygen consumed in five days.

BIOSEED – the bacterial culture used to inoculate a sample for testing.

BLANK – an artificial sample designed to monitor the introduction of artifacts into the measurement process. For aqueous samples, reagent water is used as a blank matrix. There are several types of blanks, which monitor a variety of processes:1.) *laboratory blank* is taken through sample preparation and analysis only. It is a test for contamination in sample preparation and analyses. 2.) *storage blank* is stored and analyzed with samples at the laboratory. It is a test for contamination in sample storage as well as sample preparation and analysis. 3.) *trip blank* is shipped to and from the field with the sample containers. It is not opened in the field and, therefore, provides a test for contamination from sample preservation, site conditions, and transport as well as sample storage, preparation, and analysis. It is most commonly used for volatile organics. 4.) *field blank* is opened in the field and tests for contamination from the atmosphere as well as those activities listed under the trip blank.

BNA – base, neutral and acid extractable compounds. The term base, neutral and acid refer to the pH condition of the sample undergoing extraction. Certain compounds extract more efficiently from water under acidic conditions. Such compounds are often referred to as "acid extractables."

CALIBRATE – to determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter or other device, or the correct value for each setting of a control knob. The levels of the applied calibration standard should bracket the range of planned or expect sample measurements.

CALIBRATION – The systematic determination of the relationship of the response of the measurement system to the concentration of the analyte of interest. Instrument calibration performed before any samples are analyzed is called the initial calibration. Subsequent checks on the instrument calibration performed throughout analysis are called continuing calibration verification.

CALIBRATION BLANK (CB) – a volume of reagent water in the same matrix as the calibration standards but without the analyte.

CALIBRATION CURVE – the graphical relationship between the known values, such as concentrations, of a series of calibration standards and their analytical response.

CALIBRATION METHOD – a defined technical procedure for performing a calibration.

CALIBRATION STANDARD – a certified material used to calibrate an instrument.

CERTIFIED REFERENCE MATERIAL (CRM) – reference material, one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body. (ISO Guide 30)

CONTINUING CALIBRATION VERIFICATION (CCV) – used to evaluate the performance of the instrument system with respect to a defined set of method criteria. The CCVs are used to verify instrument performance during analysis. The CCV shall be prepared from the same stock standard solution used to prepare the calibration curve.

CHAIN-OF-CUSTODY–Procedures and associated documents designed to trace the custody of a sample from the point of origin to final disposition, with the intent of legally demonstrating that custody remained intact and the tampering or substitutions were precluded.

CHEMICAL OXYGEN DEMAND (COD) – A measure of the oxygen required to oxidize all compounds in water, both organic and inorganic.

COMBINED STANDARD UNCERTAINTY – The standard uncertainty of the analytical measurement result that is the sum in quadrature (square-root-of-the-sum-of-the-squares) of the component standard uncertainties.

CORRECTIVE ACTION – the action taken to eliminate the causes of an existing non-conformity, defect, or other undesirable situation to prevent reoccurrence.

COVERAGE FACTOR – the numerical factor used as a multiplier of the combined standard uncertainty to expand the uncertainty corresponding to a specific level of confidence. The Student's *t*-distribution is used for determining the coverage factor.

DEMONSTRATION OF CAPABILITY (DOC) – a procedure used to establish the ability of the analyst to generate acceptable accuracy.

DEIONIZED WATER (DI) – water from which the majority of ions have been removed. Water that is contaminant free and used in the laboratory, the resistivity should be ≤ 18 megaohms.

DISSOLVED METALS –- metallic elements determined on a water sample that has been passed through a 0.45-um filter.

DISSOLVED OXYGEN (DO) – the oxygen freely available in water, an indicator of water quality.

DISSOLVED SOLIDS – disintegrated organic and inorganic material contained in water. Excessive amounts make water unfit to drink or use in industrial processes.

DRY WEIGHT – the weight of a sample based on percent solids. The weight of a sample after drying in an oven at a specified temperature.

DUPLICATE MEASUREMENT – a duplicate measurement is a second measurement made on the same or identical sample of material to assist in the evaluation of measurement of variance.

DUPLICATE SAMPLE – two samples taken from the same population and carried through certain stages of sampling and testing. Duplicate sample include field co-located duplicate samples, field-split duplicate samples, and laboratory duplicate subsamples.

EXPANDED UNCERTAINTY – the quantity defining an interval enveloping the analytical measurement that captures a large fraction of the distribution of analyte concentrations that could be attributable to the quantity measured. The combined standard uncertainty is multiplied by the coverage factor to calculate the expanded uncertainty.

EXTERNAL STANDARDS – a method of quantifying chromatographic data in which standards of known concentration are analyzed prior to unknown samples. The chromatographic peak area (or height) of a sample component is compared to a calibration curve of a peak area constructed from the standard data for that component. This comparison allows the concentration of the component in the sample to be determined.

FECAL COLIFORM BACTERIA – bacteria found in mammals' intestinal tracts. Their presence in water or sludge is an indicator of pollution and possible contamination by pathogens.

FLAME IONIZATION DETECTOR (FID) – a gas chromatography detector in which the column effluent gas is mixed with hydrogen and burned in air or oxygen. The ions and electrons produced in the flame generate an electric current proportional to the amount of materials in the detector. The FID responds to nearly all organic compounds, but it does not respond to air and water, which makes it exceptionally suited to environmental analysis.

FLASHPOINT – the lowest temperature at which a flammable liquid gives off sufficient vapor to form an ignitable mixture with air near its surface or within a vessel. Combustion does not continue.

GAS CHROMATOGRAPHY (GC) – a technique for detecting organic compounds by using their physical and chemical properties to separate a mixture. The compounds are identified and quantified with various types of detectors as they exit the chromatograph. Selection of detectors is dependent on the particular compounds of interest.

GAS CHROMATOGRAPHY MASS SPECTROMETRY (GCMS) – a technique in which sample analytes are bombarded with electrons as they exit a gas chromatography column and are fragmented into characteristics ion patterns. The mass spectrometer is the detector. It can determine which fragments are present and therefore the identity of the compounds.

GLUCOSE GLUTAMIC ACID (GGA) – used as a laboratory control standard in BOD procedures.

GRAPHITE FURNACE – a technique used for the analysis of metals. An atomic absorption spectrophotometer heats the sample within a graphite tube using an electrical current. It is also commonly called a flameless furnace and generally provides greater sensitivity for certain metals than flame or inductively coupled argon plasma techniques.

GRAVIMETRIC - analyses based on the direct or indirect weighing of the analyte in question. This technique usually requires the use of an analytical balance with a sensitivity of 0.1 mg or better.

HALL ELECTROLYTIC CONDUCTIVITY DETECTOR – an element-selective gas chromatography detector primarily intended for trace analysis of organic compounds containing chlorine, nitrogen or sulfur. In operation, this detector pyrolyzes the column effluent gas into soluble electrolytes that are dissolved in a stream of deionized liquid. The observed change in electrical conductivity, proportional to the amount of material present, is measured.

HAZARDOUS WASTE – waste regulated under RCRA that can pose a substantial or potential hazard to human health or the environment when improperly managed. Such wastes possess at least one of four characteristics (ignitability, corrosivity, reactivity, or toxicity) or appear on special EPA hazardous waste lists. The term is not interchangeable with hazardous substances or material.

HEADSPACE - Any area in a container not completely filled by the sample in which gases can collect.

HEAVY METALS – metallic elements with high atomic weights, i.e., mercury, chromium, cadmium, arsenic, and lead. They can damage the health of plants and animals at low concentrations and tend to accumulate in the food chain.

HOLDING TIME – the maximum times that samples may be held before analysis and still be considered valid or not compromised. The storage time allowed between sample collection and sample analysis when the designated preservation and storage techniques are employed.

HYDROCARBONS – chemical compounds that consist entirely of carbon and hydrogen.

ICP – Inductively coupled plasma is a type of instrument used for metals analysis. Because the temperature of the plasma is considerable higher ($10{,}000^{o}K$) than the temperature of a flame atomic absorption spectrophotometer, it is especially useful for refractory metals. Some instruments are also capable of performing simultaneous multielement analysis.

ICP-MS - Inductively coupled plasma mass spectrometry (ICP-MS) is a type of mass spectrometry highly sensitive and capable of the determination of a range of metals and several non-metals at concentrations below one part in 10^{12} (part per trillion). It is based on coupling together an inductively coupled plasma as a method of producing ions with a mass spectrometer as a method of separating and detecting the ions. In trace elemental analysis, the method has advantages of high speed, precision and sensitivity.

IGNITABLE – capable of burning or causing a fire.

INORGANIC CHEMICALS – chemical substances of mineral origin, unlike organic chemicals whose structure relies on carbon atoms.

INITIAL CALIBRATION VERIFICATION (ICV) - also referred to as the Independent Calibration Verification for this laboratory. A standard solution used to verify the calibration curve derived from a source independent of the instrument calibration standard. The ICV is use to quantify second source standard variance and bias.

INSTRUMENT CALIBRATION STANDARD - a reference material used to standardize an analytical instrument.

INSTRUMENT DETECTION LIMIT (IDL) - a term utilized in the EPA Inorganic Contract Laboratory Program. The IDL is three times the standard deviation obtained for the analysis of a standard solution (each analyte in reagent water) at a concentration of three to five times that of the IDL on three nonconsecutive days with seven consecutive measurements per day. The IDL is the concentration equivalent to a signal, due to the analyte of interest, which is the smallest signal that can be distinguished from background noise by a particular instrument. The IDL should always be below the method detection limit, and is not used for compliance data reporting, but may be used for statistical data analysis and comparing the attributes of different instruments.

INSTRUMENT PERFORMANCE CHECK - The analyses of one of the ICSs to verified initial and continuing calibration (CCV). The IPC is used to quantify the instrumental testing repeatability variance and bias.

INSTRUMENT TUNING - a technique used in gas chromatography/mass spectrometry procedures to verify that the instrument is properly calibrated to produce reliable mass spectral information. See 4-Bromofluorobenzene under "B".

INTERNAL STANDARDS - compounds added to every standard, blank, matrix spike, matrix spike duplicate, sample (for volatile organics), and sample extract (for semivolatiles) at a known concentration, prior to analysis. Internal standards are used as the basis for quantification of the target compound.

IONIZATION - Utilized in mass spectrometry to fragment analyte molecules into smaller segments. These smaller mass segments are then separated and plotted to form a "mass spectrum" which is used to identify the parent molecule. Electron impact is one example of ionization used in mass spectrometry. In more technical terms. Ionization is the process by which neutral atoms or groups of atoms become electrically charged, either positively or negatively, by the loss or gain of electrons.

ISOMERS - chemical compounds with the same molecular weight and atomic composition by differing molecular structure, e.g., n-pentane and 2-methylbutane.

LABORATORY CONTROL SAMPLE (LCS) - a clean-matrix reference sample spiked with a standard with an established analyte concentration. The LCS is carried through the entire chemical preparation and testing procedures. The LCS is used to quantify the variance and bias of the chemical preparation and instrumental testing stages without matrix interference. Also called a Laboratory fortified blank (LFB).

LABORATORY CONTROL SAMPLE DUPLICATE (LCSD) – a duplicate of the laboratory control sample in a clean matrix that is carried through the entire chemical preparation and testing procedures.

LABORATORY DUPLICATE SAMPLE (LAB DUPLICATE) - a portion of the collected sample that is carried through the chemical preparation and testing. The laboratory duplicate subsample is used to quantify the variance of the chemical preparation and instrumental testing stages with matrix interferences.

LEACHATE - a liquid that results from water collecting contaminants as it trickles through wastes, agricultural pesticides or fertilizers. Leaching may occur in farming areas, feedlots, and landfills, and may result in hazardous substances entering surface water, groundwater or soil.

LDEQ – Louisiana Department of Environmental Quality

LIBRARY SEARCH - a technique in which an unknown mass spectrum of a compound is compared to the mass spectra of compounds contained in a computer library in an effort to identify the compound. Compounds identified in this manner are referred to as tentatively identified compounds (TICs).

LIMIT OF DETECTION (LOD) – an estimate of the minimum amount of a substance that an analytical process can reliable detect. An LOD is analyte and matrix specific and may be laboratory dependent.

LIMIT OF QUANTIATION (LOQ) – the minimum levels, concentrations, or quantities of a target variable (e.g. target analyte) that can be reported with a specified degree of confidence..

LIMS – laboratory information management system. Horizons is the LIMS used by GCAL.

LINEAR CALIBRATION RANGE – the concentration range over which the instrument response is linear.

LOG-IN - the receipt and initial management of an environmental sample. It generally includes identifying who sent the sample; maintaining chain-of-custody; checking report and invoice information; recording analysis requested, including methodology and special instructions; and assigning a discreet in-lab identification, usually a number or bar code.

MASS SPECTRUM - a plot of ion mass/charge ratio versus intensity. A fragmentation pattern results from the particles whose mass distribution is characteristic of the parent molecule. Qualitative information is provided by a mass spectrum.

MATERIAL SAFETY DATA SHEET (MSDS) - a compilation of information required under the OSHA Communication Standard on the identity of hazardous chemicals and their associated health and physical hazards, exposure limits and precautions.

MATRIX - The physical characteristics or state of a sample – e.g., water, soil, sludge.

MATRIX INTERFERENCE - the influence of the sample matrix or sample components upon the ability of qualitatively identifies and quantitatively measures compounds in environmental samples.

MATRIX MODIFIERS - chemicals added to samples for metals analysis, which are used to lessen the effects of chemical interference, viscosity and surface tension.

MATRIX SPIKE (MS) – aliquot of a sample fortified (spiked) with known quantities of specific compounds and subjected to the entire analytical procedure in order to indicate the appropriateness of the method for the matrix by measuring recovery of the spike. Matrix spiked samples are used to quantify the variance and bias of the chemical preparation and testing stages with matrix interference.

MATRIX SPIKE DUPLICATE (MSD) - a second aliquot of the same matrix as the matrix spike that is spiked to determine the precision of the method.

METHOD DETECTION LIMIT (MDL) - the minimum concentration of compound that can be measured and reported within 99% confidence that the value is above zero and is determined from analysis of a sample in a given matrix containing the analyte.

MUST – denotes a mandatory requirement.

NARRATIVE - in an analytical report, a descriptive documentation of any problems encountered in processing the samples, along with corrective action taken and problem resolution.

NUTRIENT - any substance assimilated by living things that promote growth. The term is generally applied to nitrogen and phosphorus in wastewater, but is also applied to other essential and trace elements.

ORGANIC - generally, any compound that contains carbon bonded to a hydrogen or halogen atom.

OXIDATION - the process in chemistry whereby electrons are removed from a molecule.

PCBs - Polychlorinated biphenyl, a group of toxic persistent chemicals used in transformers and capacitors for insulating purposes and in gas pipeline systems as a lubricant. Sale of PCBs for new uses was banned by law in 1979.

PERCENT RECOVERY - a measure of accuracy that is calculated as the measured value relative to the true value expressed as a percent.

PERFORMANCE AUDIT - a quantitative evaluation of a measurement system that involves the analysis of standard reference samples or materials which are certified as to their chemical composition or physical characteristics.

PROFICIENCY TEST (PT) SAMPLE - a sample of known composition (unknown to the laboratory), provided by an external source, which is used to evaluate lab performance. For certification purposes the PT sample is purchased from an approved provider.

pH - a numerical designation of relative acidity and alkalinity. A pH of 7.0 indicates precise neutrality. Progressively higher values indicate increasing alkalinity and lower values increasing acidity.

POLLUTANT - generally, any substance introduced into the environment that adversely affects the usefulness of a resource.

PRACTICAL QUANTITATION LIMIT (PQL) - the lowest level that can be reliable achieved within specified limits of precision and accuracy routine laboratory operating conditions. The lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value.

PRECISION - a measure of the ability to reproduce analytical results. It is generally determined through the analysis of duplicate samples. The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range in either absolute or relative terms.

PRESERVATIVE - a chemical or reagent added to a sample to prevent or slow decomposition or degradation of a target analyte or a physical process. Physical and chemical preservation may be used in tandem to prevent sample deterioration.

PURGE AND TRAP - a technique used in the analysis of volatile organic where analytes are purged from a sample by means of an inert gas and trapped on a sorbent column. The sorbent is then flashheated and the analytes are transferred onto a gas chromatographic column for separation and identification.

PURGEABLE ORGANIC - an organic compound that is generally less than 20% soluble in water and has a boiling point at or below 200^{o}C. A volatile organic. An organic compound is generally considered to be purgeable if it can be removed from water using the purging process.

QC BASED NESTED APPROACH - a procedure for estimating the uncertainty of measurement using quality control data. The procedure is described in SOP QA-013.

QUALITY ASSURANCE (QA) - all those planned and systematic actions necessary to provide adequate confidence in laboratory results. An integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets the defined standards of quality with a stated level of confidence.

QUALITY ASSURANCE PROGRAM PLAN - a written assembly of management policies, objectives, principle and general procedures that outlines how the laboratory intends to generate data of known and accepted quality.

QUALITY CONTROL (QC) – the overall system of technical activities whose purpose to measure and control the quality of a product or service so that it meets the needs of the users.

QUALITY CONTROL CHART - a graph of analytical measurement results for a specific QC standard plotted sequentially with upper and lower control limits (±3SD). A central line that is the best estimate of the average variable plotted, and upper and lower marginal exceedence limits (±4SD) are usually included in the Quality Control Chart. The chart may also include upper and lower warning limits (±2SD).

QUALITY SYSTEM – a structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items) and services. The quality system provides the framework for planning, implement and assessing work performed by the organization and for carrying out required QA and QC.

r^2 – Correlation Coefficient Squared – paramet6er used to evaluate the fit of linear or quadratic regression curve fit of initial calibration data.

RAW DATA – any original information from a measurement activity or study recorded in a laboratory note book, worksheets, records, memoranda, notes, or exact copies thereof that are necessary for the

reconstruction and evaluation of the report of the activity or study. Raw data may include photography, microfilm or microfilm copies, computer printouts, magnetic media, including dictated observations, and recorded data from automated instruments.

REACTIVITY - the tendency of a chemical to explode under normal management conditions, to react violently when mixed with water, or to generate toxic gases.

REAGENT WATER - water in which an interference is not observed at or above the minimum quantitation limit of interest.

REFERENCE MATERIAL - a traceable standard with an established analyte concentration. Material or substance whose property values are sufficiently homogenous, stable and well established to be used for the calibration of an apparatus, the assessment of a measurement method or for assigning values to materials (ISO Guide 30)

REFERENCE METHOD – a method of known and documented accuracy and precision issued by an organization recognized as competent to do so.

RELATIVE RETENTION TIME – a measure of the shift in retention time of an analyte when referenced to an internal standard.

RELATIVE RESPONSE FACTOR (RRF) - a measure of the relative mass spectral response of an analyte compared to its internal standard. RRFs are determined by analysis of standards and are used in the calculation of concentrations of analytes in samples.

REPLICATE ANALYSES - two or more results representing the same sample parameter. Replicate analyses are used to quantify the analytical measurement repeatability precision.

RPD – Relative Percent Difference, a relative difference between two analyses calculated by dividing the absolute difference of thos two results by the average of therir two values, then multiplying by 100.

RESOLUTION - the degree of separation between peaks eluting from a chromatographic column. Sufficient resolution between peaks is required for proper quantitation of unknown analytes.

RETENTION TIME - a term used in gas and liquid chromatography describing the time elapsed from the sample injection until the specific compound elutes or exits the chromatographic column at the detector. Each compound has a characteristics retention time on a specific column; therefore, this information is used to qualitatively identify the compounds in the sample.

SAMPLE – portion of material collect for chemical analysuis, identified by a unique number assigned by the LIMS.

SHALL – denotes a requirement that is mandatory whenever the criterion for conformance with the specification requires that there be no deviation. This does not prohibit the use of alternative approaches or methods for implementing the specification so long as the requirement is fulfilled.

SHOULD – denotes a guideline or recommendation whenever noncompliance with the specification is permissible.

SOLID WASTE – non-liquid, non-soluble materials, ranging from municipal garbage to industrial waste, that contain complex, and sometimes hazardous, substances. Solid wastes include sewage sludge, agricultural refuse, demolition wastes, mining residues, and even liquids and gases in containers.

SOLVENT - a substance, usually liquid, capable of dissolving or dispersing one or more other substances.

SPIKE – a known mass of target analyte added to a blank sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.

STANDARD CURVE - a curve that plots concentrations of known analyte standards versus the instrument response to the analyte. Calibration standards are prepared by diluting the stock analyte solution in graduated amounts that cover the expected range of the samples being analyzed. The calibration standards must be prepared by using the same type of acid or solvent at the same concentration as for the samples following sample preparation. This is applicable to organic and inorganic chemical analyses.

STANDARD OPERATING PROCEDURE - a detailed written description of how a laboratory executes a particular procedure or method intended to standardize its performance.

STANDARDIZED REFERENCE MATERIAL (SRM) – a certified reference material produced by the U.S. National Institute of Standards and Technology or other equivalent organization and characterized for absolute content, independent of analytical metho9d.

STANDARD UNCERTAINTY - the analytical measurement uncertainty expressed as a standard deviation. The relative standard deviation represents the relative standard uncertainty.

SURROGATE - an organic compound similar to the analyte of interest in chemical composition, extraction and chromatography, but not normally found in environmental samples. Primarily used in chromatography techniques, the surrogate is spiked into quality control blanks, calibration and check standards, samples (including duplicated and QC reference samples) and spiked samples before analysis. A percent recovery is calculated for each surrogate.

SUSPENDED SOLIDS - small pollutant particles that float on the surface of, or are suspended in, sewage or other liquids. They resist removal by conventional means.

TARGET COMPOUND - specific compounds that are to be quantified in a sample based on a standard list of potential compounds.

TENTATIVELY IDENTIFIED COMPOUNDS (TICs) - compounds detected in samples that are not target compounds, internal standards, system monitoring compounds or surrogates. TICs usually consist of up to 30 peaks that are greater than 10% of the peak areas, or heights, of the nearest internal standard. They are subjected to mass spectral library searches for tentative identification. A client may specify the number of unknown peaks in its samples it wishes the laboratory to tentatively identify.

TOTAL METALS - metallic elements that have been digested prior to analysis.

TYPE A EVALUATION UNCERTAINTY - the method of evaluation of uncertainty by the statistical analysis of a series of test results.

TYPE B EVALUATION OF UNCERTAINTY - the method of evaluation of uncertainty by means other than statistical analysis.

UNCERTAINTY - the parameter associated with the analytical measurement results that characterizes the dispersion of the values that could be reasonable attributed to the quantity measured.

UNCERTAINTY INTERVAL - the range of analyte concentrations that an analytical measurement could represent at a specified level of confidence. The relative standard deviation is used to represent the relative standard uncertainty in the QC-based Nested Approach.

VALIDATION –the process for evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, or contractual specifications. It essentially evaluates performance against predetermined specifications.

VOA - volatile organic analysis

VOA BOTTLE - a vial used to contain samples for volatile organic analysis.

VOLATILE COMPOUNDS - compounds amendable to analysis by purge and trap. Synonymous with purgeable compounds.

VOLATILE ORGANIC COMPOUND (VOC) - any organic compound that participates in atmospheric photochemical reactions, except for those designated by the EPA Administrator as having negligible photochemical reactivity.

WET CHEMISTRY - procedures that involve distillations, colorimetric determinations and titrimetric measurements. Examples are chloride, nitrates, sulfates and biochemical oxygen demand.

GULF COAST ANALYTICAL LABORATORIES, INC
GCMS SEMI-VOLATILES
STANDARD OPERATING PROCEDURE

PROCEDURE: GCMSSV-001
PAGE: 1 OF 18
EFFECTIVE DATE: 04/11/11
APPROVED BY:
QA/QC APPROVED:

SUBJECT SCOPE AND APPLICATION

EPA Method 8270C (SW-846) is used to quantitatively analyze most neutral, acidic and basic (BNA) organic compounds that are soluble in methylene chloride and capable of being eluted without derivatization as sharp peaks from a gas chromatographic fused-silica capillary column coated with a slightly polar silicone. Such compounds include polynuclear aromatic hydrocarbons, chlorinated hydrocarbons and pesticides, phthalate esters, organophosphate esters, nitrosamines, haloethers, ethers, aldehydes, ketones, anilines, pyridines, quinolines, aromatic nitro compounds and phenols, including nitrophenols. BNAs are generally extracted using SOPs EXT-001 for solids and EXT-003 for aqueous samples. High-level wastes are prepared by waste dilution. A list of target analytes is available in the LIMS.

Theory & Principle - Gas chromatographic analysis utilizing Mass Selective Detectors eliminates, to a great extent, the secondary column and detector for confirmation. Mass selective detectors ionize each compound to produce its own unique mass fragmentation profile. Direct injection by autosampler is the introduction method for samples to be analyzed via EPA Method 8270 (SW-846). The polarity of the column phase, molecular weight and temperature determine the elution order. The end of the column is positioned so that the eluting compounds are ionized immediately. The ensuing charged ions are directed along an electronically charged quadruple to the electron multiplier, where the signal is amplified. The MSD can be used in selective ion monitoring and scan mode. In the scan mode, the detector scans for all ions in a selected range. The resulting ion fragmentation profiles are compound fingerprints. The selective ion-monitoring (SIM) mode allows for the detection of two to three selected ions per compound in each retention window resulting in lower detection limits. Isomeric compounds must also depend upon retention times as a determining factor. Semi-volatile analysis primarily involves medium to high molecular weight compounds that are readily soluble in methylene chloride. The BNA sample preparation process utilizes the very polar methylene chloride, to extract the target compounds. Helium is used as the carrier gas.

MATRIX Water and Solid Extracts

REFERENCE SW846 8270C and 8000B

HOLDING TIME & PRESERVATIVE

Waters - store at 4±2°C for up to but not exceeding seven days before extraction. Hold up to 40 days after extraction at −15 ± 5°C in sealed vials. Protect from light.

Solids - store at 4±2°C for up to but not exceeding fourteen days before extraction. Hold up to 40 days after extraction at −15 ± 5°C in sealed vials. Protect from light.

DEFINITIONS

See SOP GEN-016

SAFETY

Each employee is directly responsible for complete awareness of all health hazards associated with every chemical that he/she uses. The employee must be aware of these hazards, and all associated protective wear and spill clean-up procedures PRIOR TO the use of any chemical. In all cases consult the applicable material safety data sheet (MSDS) and the supervisor or safety officer. The bottle labels also provide important information that must be noted. Personnel performing this procedure may be working with flammables, poisons, toxins, carcinogens, teratogens, mutagens, and biohazards. In particular, approved gloves, safety glasses, and lab coats must be worn. In addition to other measures, solvents and chemicals must be handled in ventilated hoods.

INTERFERENCES

Interferences due to contamination are monitored by analysis of a method blank performed with each batch.
Interferences with the parent (quantitation) ion may occur with co-elution and must be monitored by the analyst.

INSTRUMENTATION & APPARATUS

Agilent 5975-6890N GC/MS with autosampler
Target data acquisition system
RTX 5sil MS columns 30m, 0.25mm ID, 0.25um df
Volumetric flasks
Syringes – gas-tight
Pasteur pipets
Disposable glass micropipettes
2 mL autosampler vials with crimp tops
Bottles – amber glass with PTFE-lined screw tops or crimp tops

REAGENTS

All organic solvent shall be of pesticide grade or equivalent. Label all containers and squeeze bottles with reagent ID, lot, and expiration date.
Methylene chloride (DCM)
Helium gas

STANDARDS

All standards used must pure material or from prepared certified solutions. The certificate of analysis shall be kept on file. Follow manufacturer's instruction for standard expiration and storage. Label all working standards using completed standard labels.

1. All stock standards are received in glass sealed ampoules.
   A. The following stock standards are used to prepare solutions for calibration and CCV samples:
      A.1 Stock calibration standard - A custom-made stock standard (TCL-200 ug/ml level) is purchased from NSI. It is stored in an amber vial in the freezer at -15° ± 5°C, until the documented manufacturer's expiration date. This standard includes the surrogates.
      A.2 Stock calibration standards – 2000 ug/mL – for Appendix IX compounds – commercially prepared stored at -15°C ± 5°C until the documented manufacturer's expiration date.
      A.3 Additional standards may be run that are project specific. All standards shall be certified and stored according to the manufacturer's instructions.

   B. Independent stock standards – standard mixes identical to those listed above from a secondary source or a different lot number from the same manufacturer. These standards are used to prepare the ICV.

   C. Stock Internal Standard Mixture: 4000 ug/mL – commercially prepared in methylene chloride, stored at -15°C ± 5°C until the documented manufacturer's expiration date.

   D. Tuning Standard: 500 ug/mL – commercially prepared in methylene chloride, stored at -15°C ± 5°C until the documented manufacturer's expiration date.

2. Working standards – working standards are prepared by diluting the stock standard as described below.

   A. Assemble the necessary glassware, syringes and solvent. Spectroscopic grade methylene chloride is used in making all standards.

   B. Ensure that all glassware and syringes are clean and free of moisture by rinsing with at least three aliquots of methylene chloride. Volumetric glassware must never be stored in or placed in heated ovens. The use of dedicated glass will help prevent cross-contamination of standards.

   C. Fill the volumetric glassware to approximately 75 percent volume.

   D. Add the proper volume of standards using a syringe.

E. After the addition of standard, dilute to the calibration mark in the volumetric flask

F. Insert the glass stopper and mix.

G. Using a Pasteur pipette, transfer the standard to a 2 mL ampoule. Seal the ampoule immediately.

H. Label the vial with the following information:
Expiration Date
Standard ID #

I. Store the vial the same as the stock standard.

J. Dispose of excess materials in accordance with established laboratory procedures.

K. Always quantitate new standards against known standards to ensure accurate concentration levels.

L. Fill out the standards logbook in accordance with proper laboratory procedure and enter required information in LIMS.

3. The working standards are prepared in the following manner:

A. Working Appendix IX standards – prepare a 200ug/mL standard mix from the 2000ug/mL stock standards.

B. Working standards from 0.2 ug/mL to 160 ug/mL are prepared as needed before a calibration is performed. They are stored in amber vials in the freezer at -15° ± 5°C. To make 1.0 mL of each "working standard" of a calibration, do the following:

- Dilute 1 µL of TCL-200 to a final volume of 1.0 mL with DCM to make a 0.2 µg/mL standard.
- Dilute 5 µL of TCL-200 to a final volume of 1.0 mL with DCM to make a 1.0 µg/mL standard.
- Dilute 10 µL of TCL-200 to a final volume of 1.0 mL with DCM to make a 2.0 µg/mL standard.
- Dilute 50 µL of TCL-200 to a final volume of 1.0 mL with DCM to make a 10.0 µg/mL standard.
- Dilute 250 µL of TCL-200 to a final volume of 1.0 mL with DCM to make a 50.0 µg/mL standard.
- Dilute 400 µL of TCL-200 to a final volume of 1.0 mL with DCM to make a 80.0 µg/mL standard.
- Dilute 600 µL of TCL-200 to a final volume of 1.0 mL with DCM to make a 120.0 µg/mL standard.

- Dilute 800 µL of TCL-200 to a final volume of 1.0 mL with DCM to make a 160.0 µg/mL standard.
- The high concentration standard is the stock standard – 200 ug/mL
- Add 10 µL of 4000 ng/µL Internal Standard Mix to each 1.0mL of the "working standard" before shooting

To make the calibration standards for SIM analysis, the TCL standard is used to make the following working and calibration standards.

- Dilute 500 µL of TCL-200 to 5.0 mL using DCM to make a 20 µg/mL standard.
- Dilute 5 µL of 20 µg/mL standard to 5.0 mL using DCM to make a 0.1 µg/mL standard.
- Dilute 25 µL of 20 µg/mL standard to 5.0 mL using DCM to make a 0.5 µg/mL standard.
- Dilute 50 µL of 20 µg/mL standard to 5.0 mL using DCM to make a 1.0 µg/mL standard.
- Dilute 250 µL of 20 µg/mL standard to 5.0 mL using DCM to make a 5.0 µg/mL standard.
- Dilute 500 µL of 20 µg/mL standard to 5.0 mL using DCM to make a 10.0 µg/mL standard.
- The high concentration standard is the 200 µg/mL standard.

C. The Appendix IX calibration standards are prepared in the same manner from the 200ug/mL working standard. The 200 ug/mL standard will serve as the high concentration standard.

D. Additional stock standards shall be purchased for compounds not included in the mixes.

GC RECOMMENDED CONDITIONS

The following lists conditions that may be used in the lab. Conditions vary for each instrument. Adjustments are made when new columns are installed. The analyst is allowed to modify settings to optimize operating conditions.

Initial Temperature: 40°C
Rate A: ~40°C/min to ~245°C
Hold: ~4 to 5 minutes
Injector Temperature: ~ 250°C
Injection volume: 1 uL

PROCEDURE

Analysis Procedure

1. Injection port maintenance is performed every day of use at a minimum. This includes replacement of septa and liner.
2. Tuning - Before analysis begins each GC/MS must meet tuning

criteria specified in the method. A solution containing 50 ug/ml each of Decafluorotriphenylphosphine (DFTPP), 4,4'-DDT, Pentachlorophenol and Benzidine is analyzed. The DFTPP tuning criteria listed below must be met before proceeding with analysis. DDT breakdown shall not exceed 20% and is calculated as:

$$\%\text{Breakdown} = \frac{\text{area DDE + area DDD}}{\text{area DDE + area DDD + area DDT}} \times 100$$

Evaluate the tailing factor for Benzidine and Pentachlorophenol. Check that response is normal and that there is not excessive tailing. If tailing is observed, calculate tailing factors using the equations in EPA 625 Figure 13. The calculated tailing factor for Benzidine and for pentachlorophenol shall be less than 2.0. Excess tailing indicates the need for instrument maintenance. If there is no visible tailing document this.

Analyze The DFTPP result using three scans, the apex and the scan prior and following the apex and subtracting the background no more than 20 scans prior to elution of the DFTPP peak. If the DFTPP fails the criteria listed below, then the analyst shall re-tune the instrument, then run another DFTPP. If the DFTPP still fails the criteria, the analyst shall perform instrument maintenance. These criteria must be met once for every 12 hours of analysis time.

DFTPP KEY ION ABUNDANCE CRITERIA

MASS	ION ABUNDANCE CRITERIA
51	30 TO 60% of mass 198
68	less than 2% of mass 69
69	mass 69 relative abundance
70	less than 2% of mass 69
127	40 to 60% of mass 198
197	less than 1% of mass 198
198	base peak, 100% relative abundance
199	5 to 9% of mass 198
275	10 to 30% of mass 198
365	greater than 1% of mass 198
441	present but less than mass 443
442	greater than 40% of mass 198
443	17 to 23% of mass 442

3. Calibration - The initial calibration consists of a series of standards analyzed at the concentration noted in the Standards Section 3.B-D. An initial calibration curve for each target analyte must be analyzed and evaluated before any peak for

that analyte can be quantitated.

The calibration range is defined as the on-column concentration range adjusted for sample prep. Because nine calibration standards are used, the analyst has the option of eliminating several of the points using the criteria below. Within the following requirements the analyst may select the points that improve linearity, obtain the calibration range needed for a specific project, or maintain the default calibration range (10-200ug/mL):

a) At least five contiguous points must be used (six if a quadratic curve fit is employed).
b) Calibration acceptance criteria must be met as described below.
c) The lowest calibration point must support the lowest reporting limit needed in the associated samples.
d) The QC spike amount must be within the calibration range.

Replacing points in the middle of a curve is not allowed unless the analyst can document a technical issue at the time of analysis or spiking of the standard. The new point must be analyzed in the same analytical batch. If the problem appears to be associated with a single standard, that one standard may be reanalyzed. Replacing the standard may be necessary in some cases.
Prepare the calibration standards and Add 10 µL of 4000 ug/ml Internal Standard Mix to each.

When performing analysis in the SIM mode, use the same retention windows used in scan analysis and at least two of the ions listed in Table 1 of SW-846 8270C. The primary ion is used for quantitation and the secondary ion(s) as confirmation.

In addition, when performing SIM analysis the following minimum response factors should be met for the PAH compounds. The method allows for a maximum of 2 of these compounds to not meet this requirement.

Acenaphthene	0.9	Dibenz(a,h)anthracene	0.4
Acenaphthylene	0.9	Fluoranthene	0.6
Anthracene	0.7	Fluorene	0.9
Benzo(a)anthracene	0.8	Indeno(1,2,3-cd)pyrene	0.5
Benzo(a)pyrene	0.7	2-Methylnapthene	0.4
Benzo(b)fluoranthene	0.7	Naphthalene	0.7
Benzo(g,h,i)perylene	0.5	Phenathrene	0.7
Benzo(k)fluoranthene	0.7	Pyrene	0.6
Chrysene	0.7		

The calibration curve is now ready for analysis.

The acceptance criteria for initial calibration must be satisfied before analysis of samples begin. Select projects may have additional or more stringent criteria that must be achieved for the applicable samples. See SOP GEN-019.

A. Initial Calibration Acceptance Criteria:
   A.1 Calibration Check Compounds must be less than 30% RSD.
   A.2 System Performance Check Compounds must have an (RF) of 0.05 or greater

CCC's	SPCC's
Acenaphthene	N-Nitroso-di-n-propylamine
Hexachlorobutadiene	Hexachlorocyclopentadiene
Di-n-octylphthalate	2,4-Dinitrophenol
Benzo(a)pyrene	4-Nitrophenol
2,4-Dichlorophenol	
2,4,6-Trichlorophenol	
Phenol	
Fluoranthene	
1,4-Dichlorobenzene	
N-Nitroso-di-n-phenylamine	
4-Chloro-3-methylphenol	
2-Nitrophenol	
Pentachlorophenol	

B. Additionally one of the following options must be met. Always attempt to meet calibration criteria using the average response factor. If the average response factor does not pass, options B.2 and B.3 are evaluated, but do not need to be evaluated in the order listed (if historical results indicate that quadratic fits are appropriate for a particular analyte, that option may be selected without evaluating linear). Option B.4 may be used for some projects if the other options are not successful. The calibration options and requirements are as follows:
   B.1 Average Response Factor Calibration. For each of the standards, calculate the response factor of each compound. Calculate the average of a minimum of five response factors and the standard deviation across the selected five response factors. Use the average RF and the standard deviation to calculate the percent relative standard deviation (%RSD). All equations can be found in the Calculation section. When the five (or more) response factors of the standards demonstrate less than 15% RSD for a target analytes, linearity through the origin can be assumed. If the RSD for any analyte is greater than 15%, the analyst may wish to review the results for those analytes to ensure that the problem is not associated with just one of the initial calibration standards.
   B.2 For those compounds that the RSD exceeds 15%, a linear regression equation that is not forced through the origin may be used. The coefficient of determination

must be at least 0.995 for the curve to be acceptable. As part of the evaluation, check the y-intercept (b) and any negative factors (b or M). Negative factors may result in false negatives and positives. Large shifts in the y-intercept from zero will impact the data. If the intercept is greater than half the reporting limit, this option shall not be used. Check the required reporting limit and any impacts on the data. False positives shall be indicated in the case narrative.

B.3 A quadratic curve fit may be used if the coefficient of determination $r^2 \geq 0.990$. A minimum of a six-point calibration is used if this option is chosen and the curve shall not be forced through zero. As part of the evaluation, check the y-intercept (b) and any negative factors (b or M). Negative factors may result in false negatives and positives. Large shifts in the y-intercept from zero will impact the data. If the intercept is greater than half the reporting limit, this option shall not be used. Check the required reporting limit and any impacts on the data. False positives shall be indicated in the case narrative.

B.4 If the %RSD is greater than 15% for any analyte of interest, the initial calibration may still be acceptable if the following conditions are met:

a. The mean of the RSD values for <u>all</u> analytes in the calibration is ≤15%.

b. Mean RSD = $\frac{\text{Sum of RSD value for each analyte}}{\text{Total \# analytes}}$

c. Mean RSD criterion applies to all analytes in the standards, regardless of whether or not they are of interest for a specific project.

d. The maximum RSD allowed for any compound is 50%, except for poor performers as defined in Appendix A. For poor performers which exceed 50%, narrate exceedences in the final report.

<u>Note:</u> the use of this calibration option is not acceptable for some projects. If this option is used, include the analytes that did not pass the first three options in the report narrative.

C. If the calibration criteria are not met, possible corrective action includes cleaning the injection port, cutting off the first 4 inches of column or source cleaning, and adjusting the calibration range.

D. Check the position of the retention time by using the mid-point of an initial calibration. Check and reset as necessary after source cleaning or column maintenance.

3. INITIAL CALIBRATION VERIFICATION

Immediately following the initial calibration procedure or before sample analysis, the analyst shall perform initial calibration verification (ICV). This will consist of a solution containing all target analytes prepared from a standard that is independent from the initial calibration.

The ICV must be analyzed following the initial calibration. The ICV recovery must be 70-130% except for the compounds listed in Appendix A, which must meet a percent recovery of 50-150%. Specific project criteria may apply that must be achieved for the associated samples. See SOP GEN-019.

If any target analyte recovery is outside the control limits, corrective action must be taken. This may include instrument maintenance, re-analysis of the ICV or initial calibration, or re-preparation of the standards involved. If holding time or agreed project due dates will not be met because of ICV failure, the client must be contacted and approve of proceeding with the analysis. Note all failures in the case narrative.

4. CONTINUING CALIBRATION VERIFICATION –

If the instrument has been previously calibrated, then a continuing calibration is required. A mid-level standard, 50 ug/mL for scan and 0.5 ug/mL for SIM is analyzed and checked against the initial calibration for verification every 12 hours. CCC's and SPCC's must meet the specified criteria. Calibration Check Compounds must have a %D of ≤20. SPCC's are required to maintain a relative response factor (RF) of 0.05. If there are any deviations, the calibration check standard must be re-analyzed or if necessary, column maintenance should be performed. If the calibration check standard still fails the criteria, then another initial calibration must be run.

All other targets must have a %difference/drift ≤ 30% except for method defined poor performers, listed in Appendix A. Project specific limits may apply that must be achieved for the associated samples. See SOP GEN-019.

The retention time for any internal standard shall not vary any more than 30 seconds from the last calibration check (12 hours). The extracted Ion Current Profile area for any internal standard must not deviate by more than a factor of two.

5. SAMPLE ANALYSIS

Samples can be analyzed after an acceptable CCV. Add 10 uL of the internal standard mixture to each extract before analysis.

Compound identification – positive hits are achieved by the following criteria:

A. The quantitation ion used shall be the ion listed in the reference method unless there are interferences. Qualifier ions shall be used as a replacement, if possible. If the quantitation ion used is not the ion listed in the reference method, this shall be documented.
B. The characteristic m/z's must maximize within one scan of each other.
C. The retention time of the compound in the sample must be within ± 0.50 minutes of the retention time of that compound in the standard and have an RRT of ± 0.06.
D. The relative abundance of the three characteristic m/z's in the sample must fall within ± 30% of the relative abundances of that parameter in the standard.
E. Structural isomers can be differentiated only if the height between the baseline and the valley between the pairs is less than 25% of the sum of the two peak heights. Otherwise they must be reported as isomeric pairs.
F. If samples have compounds that are above the calibration range, the sample must be diluted. A portion of the sample, measured with a syringe, is diluted to one mL with DCM. Additional internal standard is added to maintain a concentration of 40µg/L. Surrogate recovery is affected and is considered diluted out of the sample with a dilution of 10X or greater. The dilution factor is recorded in Target and used to calculate analyte concentrations and to adjust reporting limits and MDLs. Multiple dilutions are required for some projects. Report multiple dilutions as required. If historical values indicate that the sample needs to be performed at multiple dilutions and all analytes must be reported at the lowest reporting limit possible, the sample extract may be prepared and performed at multiple dilutions without screening.
G. Manual integrations shall be performed as appropriate. Manual integrations undergo several layers of review and the raw data is flagged. For additional information see SOP QA-010.
H. Monitor drift by using the internal standard report in target to check the % Difference of internal area response and retention time. Internal area response must be between -50 to 100% of the internal standard response in the mid-point of the ICAL. Retention time must be within ± 0.5 minutes. If the criteria are not met reanalyze at a dilution for the affected analytes or report with a narrative. Project specific limits may apply. See SOP GEN-019.

QUALITY CONTROL METHOD BLANK

1. The method blank (extraction blank) is analyzed with each preparatory batch to demonstrate the extraction procedure did

not introduce contamination. Run batch QC in the same analytical batch whenever possible. The batch QC must be analyzed with at least one client sample from the prep batch. This blank also establishes the instrument to be free of contamination.

2. No target analytes should be detected in the method blank above one half the reporting limit. If any target analytes are detected, data shall not be reported and samples must be re-extracted and re-analyzed unless the following apply.
   A. If a target analyte is detected above the reporting limit, data may be reported if the concentration is not greater than 5% of the measured concentration in associated samples. Include a narrative with the data.
   B. If a target analyte is detected in the method blank but there are no hits in the samples, the data may be reported with a narrative.

SURROGATES

1. The surrogates are used to verify that each sample was properly extracted and is not adversely affected by the sample matrix. A surrogate is a non-target compound that is chemically similar to the analytes. The surrogates used are listed in the table below. Surrogates are spiked in each sample at the levels listed in Table 1. Some samples use the same extract for scan and SIM analysis. In these cases the surrogates will be spiked at the scan level.

2. Control limits are evaluated after sample analysis. Determine for each sample the project-required limits. If no specific limits are needed, evaluate the recoveries using step 3. If specific limits are needed evaluate using step 4. Evaluate limits as soon as possible to allow necessary repreps to be performed within holding time.

3. Laboratory derived control limits are listed in the LIMS. One surrogate in each fraction (base-neutral or acid) may have a recovery outside the control limits. When this occurs, report the data with a narrative. If more than one surrogate recovery for each fraction is below the lower control limit, re-extract and re-analyze the sample. If the recoveries are outside control limits in the re-extract sample, then indicate in the case narrative and state that the recovery was outside the control limits due to sample matrix. If re-extraction cannot be performed due to insufficient sample, report the data with a narrative. If the surrogate recovery is above the control limits and the sample results are less than the reporting limit, the data may be reported with a narrative.

4. Project specific recovery limits may apply that must be achieved for the associated samples. See SOP GEN-019. Some

projects require reprep and/or reanalysis if any surrogate fails recovery criteria either high or low. Check project criteria before proceeding.

Table 1
Surrogates

Surrogates	Scan Conc. mg/L (On column)	SIM Conc mg/L (On column)
Acid Surrogates:		
2-Fluorophenol	100	2
Phenol-d5	100	2
2,4,6-Tribromophenol	100	2
Base - Neutral Surrogates:		
Nitrobenzene-d5	50	1
2-Fluorobiphenyl	50	1
Terphenyl-d14	50	1

LABORATORY CONTROL STANDARD (LCS/LCSD)

1. A LCS and LCSD are included in each preparatory batch to demonstrate the system is in control. Routinely the LCS/LCSD will be spiked with the full list of analytes. The control limits for waters and solids are available in the LIMS. Control limits may be project specific and must be achieved for the associated samples. See SOP GEN-019. Evaluate the data and perform corrective action based on the project limits. Run batch QC in the same analytical batch whenever possible. The batch QC must be analyzed with at least one client sample from the prep batch.

2. If a recovery is above the upper control limit and the sample results are below the reporting limit, the data may be reported with a narrative. Check project criteria. Required corrective action may differ in different projects and must be followed for associated samples.

3. If a recovery is below the lower control limit or precision fails, the entire batch must be re-extracted and re-analyzed. If a re-extraction is not possible due to insufficient sample volume, report the data with a narrative.

4. If the full list of target analytes is spiked, a small number of sporadic failures will be allowed. The failure cannot include a primary compound of interest. See Table 2 for the number of allowable failures. The failures are noted in the case narrative. These failures shall be monitored by the QA Department to ensure randomness. This shall be defined as not exceeding failure in 1 of 3 LCS determinations.

Table 2

Number of Allowable Failures

Number of Analytes	Failures Allowed
<11	0
11-30	1
31-50	2
51-70	3
71-90	4
>90	5

MATRIX SPIKES (MS/MSD)

1. The purpose of the MS/MSD is to assess the performance of the method for a particular sample matrix. The recovery criteria for waters and solids are available in the LIMS and are typically the same as the LCS recovery criteria. Project specific recovery and RPD limits may apply, and the data evaluated and corrective action performed based on project requirements.

2. The MS/MSD spike includes the full list of analytes.

3. Whenever the MS and/or MSD recoveries are outside the control limits, check that the LCS and LCSD passed criteria to verify the system was in control. If the LCS and LCSD recoveries and precision are acceptable then continue processing the data. If the LCS and/or LCSD failed then follow the procedure in the LCS section.

4. Review data to verify that a lab error has not occurred (wrong spike amount, not spiked) before automatically identifying a failure as matrix interference.

5. If recoveries for both the MS/MSD are outside the control limits and the recoveries are similar, the data is reportable with a narrative stating the LCS recoveries were acceptable. The failure is attributed to sample matrix.

6. Precision is calculated as %RPD. Acceptance criteria are listed in the LIMS. Failures are noted in the narrative.

7. Native sample concentrations may be high in comparison to the spiking concentration and therefore an accurate recovery cannot be calculated. Document this in the case narrative.

8. Spikes may be diluted out in the analysis process. Document this in the case narrative. The spike is diluted out if the dilution is a 10X or greater. MS/MSD are analyzed at the same dilution as the parent sample.

SAMPLE RE-EXTRACTION

Samples are to be re-extracted due to failed QC or due to the sample results. When a MB, LCS, or LCSD fails to meet criteria, the entire batch is sent to extractions for re-extraction. If the MS, MSD, or surrogates fail criteria, only the affected samples are sent to extractions. Particular samples may be re-extracted if the sample results do not match historical values, if a sample and a duplicate do not match, or if physical differences are noted in samples. If samples are re-extracted outside of method specified holding times, both analyses are reported. To request sample/batch re-extraction, do the following:

1. If the extract has been analyzed, process the file and load to LIMS.
2. Enter the code "RP" into the analysis code; this will schedule new sample prep.
3. Complete the Re-extraction Request and Tracking Form (attached) and submit a copy to extraction supervisor.
4. When new extracts are brought to the lab, complete the original Re-extraction Request and Tracking Form and report the data appropriately.
5. If additional sample is not available to re-prep, check with project manager to determine appropriate action to report the available data.
6. If two sets of data will be reported, see login to obtain a re-extracted sample number.

CALCULATIONS

1. $$\text{MS \% REC} = \frac{\text{MS Concentration} - \text{Sample Concentration}}{\text{spike added}} \times 100$$

2. $$\text{MSD \% REC} = \frac{\text{MSD Concentration} - \text{Sample Concentration}}{\text{spike added}} \times 100$$

3. $$\text{\% RPD} = \frac{\text{MS} - \text{MSD}}{(\text{MS}+\text{MSD})/2} \times 100$$

LCS/LCSD results are substituted to calculate %RPD between LCS and LCSD. Results are calculated using the concentration (not percent recovery).

4. $$\text{Response Factor} = \frac{A_s \times C_{is}}{A_{is} \times C_s}$$

As = Peak Area of analyte or surrogate
Ais = Peak Area of Internal standard
Cs = Concentration of the analyte or surrogate
Cis = Concentration of Internal standard

5. Surrogate/LCS Recovery = $\frac{\text{Concentration Found}}{\text{Concentration Added}} \times 100$

6. Concentration using RF:

Concentration (µg/L) = $\frac{(A_s)(C_{is})(D)(V_t)}{(A_{is})(RF)(V_s)}$

Concentration (µg/kg) = $\frac{(A_s)(C_{is})(D)(V_t)}{(A_{is})(RF)(W_s)}$

A_s = Area of peak for the analyte in sample
D = Dilution factor
RF = Mean Response factor from initial calibration
A_{is} = Area of internal standard in sample
C_{is} = Concentration of internal standard in µg/mL
W_s = Weight of sample extracted in g
V_t = Total volume of concentrated extract in µL
V_s = Volume of aqueous sample extracted in mL

7. Concentration using linear curve fit:

Concentration (µg/L) = $[m(A_S/A_{IS})+b]C_{IS}D$

Concentration (mg/kg) = $[m(A_S/A_{IS})+b]C_{IS}D(5/W_S)$

m = Inverse of slope
A_s = Area of peak for the analyte in sample
A_{is} = Area of internal standard in sample
b = Intercept of the y-axis
C_{is} = Concentration of internal standard in µg/mL
D = Dilution factor
W_s = Weight of sample extracted

8. Concentration using a quadratic curve fit:

Concentration (mg/kg) = $[b + a(A_S/A_{IS}) + a_2(A_S/A_{IS})^2]C_{IS}D(5/W_S)$

9. Concentration of TICS:

Concentration (mg/kg) = $\frac{(A_s)(C_{is})(D)}{(A_{is})(1000)}$

A_s = Area of peak for the analyte in sample
D = Dilution factor
A_{is} = Area of internal standard in sample
C_{is} = Concentration of internal standard
W_s = Weight of sample (if aqueous sample W_s = 1 and report in (µg/L)

10. % Difference = $[(RF_I - RF_C) / RF_I\}$ X 100 where:
RF_I = Average response factor from initial calibration
RF_C = Response factor from current verification check standard

11. % Drift = $\frac{\text{Calculated Conc. – Theoretical Conc).}}{\text{Theoretical Conc.}} * 100$

12. % RSD = (SD / X) X 100 Where:
RSD = Relative Standard Deviation
X = mean of 5 initial RF's for a compound
SD = Standard Deviation of average RF's for a compound

REPORTING LIMITS

Quantitation limits (PQLs) are defined by the low-level calibration standard. Default reporting limits are employed for reporting and cannot be lower than the PQL. The PQL cannot be lower than the estimated MDL and project specific requirements may define the relationship between the PQL and the MDL that must be achieved for the associated samples. See SOP GEN-019.

DATA REVIEW

For data review procedures and checklist, please see SOP QA-002

SOFTWARE TROUBLESHOOTIN

The Agilent GC/MS's utilizes Agilent software MSD Chemstation Version D.02.00.275 to control the instrument and transfer data acquisition to Target Data Integration software. Target software is utilized to calculate all data. In the event of software malfunction for the MSD Chemstation, please contact Agilent technical support for troubleshooting help. In the event of software malfunction when using Target, please contact GCAL's IT Director for troubleshooting help.

METHOD PERFORMANCE

Method 8250 (the packed column version of Method 8270) was tested by 15 laboratories using organic-free reagent water, drinking water, surface water, and industrial wastewater spiked at six concentrations ranging from 5 to 1,300 ug/L. Single operator accuracy and precision, and method accuracy were found to be directly related to the concentration of the analyte and essentially independent of the sample matrix. Linear equations to describe these relationships are presented in Table 7 of Method 8270C. These values are presented as guidance only and are not intended as absolute acceptance criteria.

Internal control limits are generated for laboratory QC samples including LCS/LCSD, MS/MSD, and surrogates.

POLLUTION PREVENTION

See QAPP Section 10.2

WASTE MANAGEMENT

See SOP GEN-009

APPENDIX A POOR PERFORMING COMPOUNDS

Benzidine	1,4-Naphthoquinone	4-Nitroquinoline-1-oxide
Benzoic Acid	m-Dinitrobenzene	Parathion
2-Picoline	Pentachlorobenzene	Metapyriline
n-Nitrosomethylethylamine	2-Naphthylamine	Isodrin
Methyl methanesulfonate	2,3,4,6-Tetrachlorophenol	Aramite
n-Nitrosodiethylamine	1-Naphthylamine	p-(Dimethylamino) azobenznen
Ethyl methanesulfonate	Thionazin	Chlorobenzilate
Pentachloroethane	5-Nitro-o-toluidine	Famphur
o-Toluidine	Tetraethyl dithiopyrophosphate	3,3'-Dimethylbenzidine
n-Nitrosomorpholine	Diallate	2-Acetylaminofluorene
n-Nitrosopiperidine	Phorate	7,12-Dimethylbenz(a)anthracene
o,o,o-Triethylphosphoroate	sym-Trinitrobenzene	Hexachlorophene
α,α-Dimethylphenethylamine	Phenacetin	3-Methylcholanthrene
Hexachloropropene	Dimethoate	Acrylamide
2,6-Dichlorophenol	Pentachloronitrobenzene	n-Nitrosopyrrolidine
n-Nitrosodi-n-butylamine	4-Aminobiphenyl	Phthalic Acid/Anhydride
p-Phenylenediamine	Pronamide	1,4-Dinitrobenzene
Isosafrole	Dinoseb	Kepone
1,2,4,5-Tetrachlorobenzene	Disulfoton	4,4-Methylenebis(2-chloroaniline)
Safrole	Methyl Parathion	tris-2,3-Dibromopropylphosphate
Maleic Anhydride	Benzaldehyde	

GCAL
STANDARD OPERATING PROCEDURE
REVIEW FORM

GCAL

Standard Operating Procedure for Preparation of PosiRS soil/sediment samples

Procedure: ESH-062

Revision: 16

Effective Date: 12/23/09

Reviewed By/Date: [signature] 2/25/11

Approved By/Date: JDT 2/25/11

No changes needed.

GULF COAST ANALYTICAL LABORATORIES
EXTRACTIONS
STANDARD OPERATING PROCEDURES

PROCEDURE: EXT-002
PAGE: 1 of 4
EFFECTIVE DATE: 12/23/09
APPROVED BY: MAP
QA/QC APPROVED: JDT

SUBJECT — SCOPE AND APPLICATION

A 30 gram portion or organic fraction is mixed with anhydrous sodium sulfate and extracted with methylene chloride/acetone using an ultrasonic probe. If peaks are present at greater than 10,000 µg/kg, discard the extract and prepare the sample by the medium level method.

MATRIX — Solid

REFERENCE — SW846 Method 3550C

PRESERVATIVE — Cool 4°C

SAMPLE COLLECTION — Samples should be collected and stored in glass containers.

HOLDING TIME — Pesticides - 14 days to extract, 40 days to analyze following extraction.

PCB's - 1 year to extract, 1 year to analyze following extraction.

DEFINITIONS — See SOP GEN-016

SAFETY — Each employee is directly responsible for complete awareness of all health hazards associated with every chemical that he/she uses. The employee must be aware of these hazards, and all associated protective wear and spill clean-up procedures PRIOR TO the use of any chemical. In all cases, the applicable material safety data sheet (MSDS) and your supervisor or safety officer should be consulted. The bottle labels also provide important information that must be noted. Personnel performing this procedure may be working with flammables, poisons, toxins, carcinogens, teratogens, mutagens, and biohazards. In particular, approved gloves, safety glasses, and lab coats must be worn. In addition to other measures prescribed by the division, solvents must be handled in ventilated hoods.

APPARATUS

250 mL beaker
Kuderna Danish (K-D) apparatus
a) Concentrator tube, 10 mL graduated
b) Evaporation flask, 500 mL (attach to tube with blue clamp)
c) Synder column
Sonicator, Fisher Scientific Ultrasonic Dismembrator equipped with ¾ inch disruptor horn. Misonex sonicators are also available as a backup.
Filter paper - FisherBrand Q8, 125mm
Analytical balance
0.5 mL syringe
1.0 mL syringe or Eppendorf
1.0 mL Class "A"volumetric flask
5.0 mL Class "A" volumetric flask
10.0 mL Class "A" volumetric flask

REAGENT — All organic solvent shall be of pesticide grade or equivalent. Label all containers and squeeze bottles with

reagent ID, lot, and expiration date.

1:1 Methylene chloride/Acetone
Methylene chloride
Acetone
Hexane
Sodium sulfate - granular, anhydrous – heat at 400°C for a minimum of 4 hours. Store prepared sodium sulfate in glass screw cap jars. Keep covered at all times when not in use. Record preparation in logbook.

STANDARDS

Follow manufacturer's instruction for standard expiration and storage. Label all working standards using completed standard labels.

1. Surrogate Standard Spiking Solution

   Surrogate standards are added to all samples (including QC). The surrogates for this procedure are Tetrachloro-m-xylene and Decachlorobiphenyl. For method 8082, only Decachlorobiphenyl is required although both surrogates are included in the standard.

   Stock surrogate standard - 200 µg/mL Tetrachloro-m-xylene and Decachlorobiphenyl.

   Working surrogate standard – 0.5 µg/mL -Prepare by adding 0.5 mL of the stock surrogate standard to a 200 mL volumetric flask and diluting to volume with Methanol. Store the standard at 4°C in Teflon-sealed containers. The standards must be replaced after six months, when stock standard expires, or sooner if comparisons with quality control check samples indicate a problem.

2. Pesticide Spiking Solutions

   Stock 608 spike - 1000 µg/mL of:

Aldrin	Endosulfan sulfate
alpha-BHC	Endrin
beta-BHC	Endrin aldehyde
delta-BHC	Endrin ketone
gamma-BHC	Heptachlor
4,4'-DDD	Heptachlor epoxide
4,4'-DDE	Methoxychlor
Endosufan I	Dieldrin
alpha-chlordane	Endosulfan II
gamma-chlordane	

   Working 608 spike - 0.5 µg/mL – Prepare by adding 50 µL of the stock standard to a 100 mL volumetric flask and diluting to volume with Methanol. Store the standard at 4°C in teflon-sealed containers. The standards must be replaced after six months, when stock standard expires, or sooner if comparisons with quality control check samples indicate a problem.

3. PCB Spiking Solutions (8082)

   Stock standard - 5000 µg/mL individual standards of Aroclor-1260 and Aroclor-1016

   Working PCB spike – 4 µg/mL - Prepare by adding 400 µL of the stock standards to a 500 mL volumetric flask and diluting to volume with methanol. Store the standard at

4°C in teflon-sealed containers. The standards must be replaced after six months, or sooner if comparison with quality control check samples indicate a problem.

Projects may require spiking with an Aroclor other than 1016/1260. Stock standards will be ordered as needed in this case. Working spikes will be prepared at 4 µg/mL.

PROCEDURE

Sample Extraction

1. Label each beaker with the sample ID of the sample or QC sample to be extracted. Complete the extraction sheet with the sample ID's.

2. For the method blank, LCS and LCSD, weigh 30 grams sodium sulfate into a 250 mL beaker. Spike the blank, LCS and LCSD with 1.0 mL of the working surrogate standard. For method 8081 add 1.0 mL of the working 608 spike to the LCS and LCSD. For method 8082, add 1 mL of the PCB working spike to the LCS and LCSD.

3. Homogenize sample by pouring the contents of the sample onto a piece of butcher paper, chop and mix with a tongue depressor or spatula. Remove any foreign objects such as sticks, leaves, or rocks. Weigh approximately 30g of homogenized sample to the nearest 0.1g into a 250 mL beaker and add 30 g of anhydrous Sodium sulfate. Mix well. The sample should have a sandy texture at this point. Add 1.0 mL of the surrogate working standard to each sample and the spiked samples. For method 8081A, add 1.0 mL of the working 608 spike to the MS and MSD. For method 8082, add 1 mL of the PCB working spike to the MS and MSD.

4. Immediately, add at least 100 mL of 1:1 Methylene chloride/Acetone to each beaker. The solvent level should be about 2 inches above the sample in the beaker.

5. Sonicate for three minutes with the W-385 (or three minutes with the W-375), using a N. 2083/4 inch standard disrupter horn with output control knob set at 6 (or No. 3053/4 inch tapped high gain "Q" disrupter horn set at 5) and mode switch on "1 second pulse" and percent duty cycle knob set at 50 percent. Do NOT use MICROTIP probe.

6. Decant and filter extracts through FisherBrand Q8 glass filters into a K-D concentrator consisting of 10 mL concentrator tube and a 500 mL flask. The flask contains 1 boiling chip.

7. Repeat extraction two more times with two additional 100 mL portions of 1:1 Methylene chloride/Acetone. Decant off the extraction solvent after each sonication. On the final sonication, filter the entire sample and rinse filter with Methylene chloride.

8. Attach a three-ball Snyder column. Pre-wet the Snyder column by adding about 1.0 mL of Methylene chloride to the top. Place the K-D apparatus on a steam generator (100°C). At the proper rate of distillation, the balls of the column will actively chatter but the chambers

will not flood with condensed solvent. When the apparent volume of the extract reaches 10 mL, add 50 mL of pesticide-grade hexane through the Snyder column. Concentrate the solvent extract as before. The elapsed time of concentration should be about 5-10 minutes. When the apparent volume of liquid reaches 1.0 mL, remove the K-D apparatus and cool and drain for 10 minutes as above.

9. Remove the Snyder column, wipe the joint between the flask and concentrator tube with a Kim-wipe, in order to remove excess water, and rinse the flask and its lower joint with 1.0 to 2.0 mL of Hexane from a Teflon wash bottle. Adjust the final extract volume to 10.0 mL using a 10.0 mL Class "A" volumetric flask. NOTE: For adjusted RDL's use appropriate 1.0 mL or 5.0 mL Class "A" volumetric flasks.

10. If the analyst determines that clean up is required, remove a 1.0 mL aliquot of the final extract to perform any required clean-up procedures. Refer to Standard Operating Procedure EXT-058 and EXT-059 for information on Acid/Permanganate clean-up and Florosil clean-up.

11. Record the standard ID's and solvent lot numbers on the extraction sheet. Enter the sample prep information in the LIMS. Deliver the extracts and a copy of the extraction sheet to the GC-SV Laboratory. If no one is available to receive the extracts, place the extracts in the appropriate refrigerator.

12. Samples are analyzed by SOP GC-013 and GC-023

METHOD PERFORMANCE

1) The recovery of surrogates is used to monitor unusual matrix effects, sample processing problems, etc. The recovery of matrix spiking compounds, when compared to laboratory control sample (LCS) recoveries, indicates the presence or absence of unusual matrix effects.

2) The performance of each 3500 method will be dictated by the overall performance of the sample preparation in combination with the cleanup method and/or the analytical determinative method.

POLLUTION PREVENTION — See QAPP Section 13.2

WASTE MANAGEMENT — See SOP GEN-009

METHOD MODIFICATION — Procedure step 4 - The extraction solvent is added to the sample to be approximately 2 inches above the solid sample in the beaker. Exactly 100 mL is not measured as stated in the method.

GULF COAST ANALYTICAL LABORATORIES
EXTRACTIONS
STANDARD OPERATING PROCEDURE

PROCEDURE: EXT-010
PAGE: 1 OF 5
EFFECTIVE DATE: 1/7/10
APPROVED BY:
QA/QC APPROVED:

SUBJECT — SCOPE AND APPLICATION

This Standard Operating Procedure describes the steps for separating Pesticide/PCB compounds in aqueous samples. A measured volume of sample, 1.0 L at a pH between 5 and 9 is serially extracted with Methylene chloride using a separatory funnel. The extract is dried, concentrated and as necessary exchanged into a solvent compatible with the cleanup or determinative step to be used.

MATRIX — Water

REFERENCE — EPA Method 608
SW846 Method 3510C

PRESERVATIVE — None, cool to 4°C

SAMPLE COLLECTION — Samples should be collected and stored in 1 liter glass containers.

HOLDING TIME — Pesticides - 7 days to extract, 40 days to analyze following extraction

PCB's - 1 year to extract, 1 year to analyze following extraction

DEFINITIONS — See SOP GEN-016

SAFETY — Each employee is directly responsible for complete awareness of all health hazards associated with every chemical that he/she uses. The employee must be aware of these hazards, and all associated protective wear and spill clean-up procedures PRIOR TO the use of any chemical. In all cases, the applicable material safety data sheet (MSDS) and your supervisor or safety officer should be consulted. The bottle labels also provide important information that must be noted. Personnel performing this procedure may be working with flammables, poisons, toxins, carcinogens, teratogens, mutagens, and biohazards. In particular, approved gloves, safety glasses, and lab coats must be worn. In addition to other measures prescribed by the division, solvents must be handled in ventilated hoods.

INTERFERENCES

1. Solvents, reagents, glassware and other sample extraction apparatus may yield interferences to sample analysis. All these must be demonstrated to be free from interferences under the conditions of analysis by analyzing method blanks.
2. Interferences co-extracted from the samples will vary considerably from source to source. If analysis of an extracted sample is prevented due to interferences, further cleanup of the sample extract may be necessary.
3. Glassware contamination resulting in analyte

degradation. Certain analytes (Aldrin, Heptachlor and most organophosphorus pesticides) may degrade due to soap residue on glassware. Glassware that is particularly difficult to rinse such as a K-D flask should be hand rinsed very carefully to avoid this problem.

APPARATUS

2000 ml Teflon separatory funnel with Teflon stopcock
Kuderna-Danish (K-D) apparatus
A) Concentrator tube, 10 mL, 25 mL, graduated
B) Evaporation flask, 500 mL, attach tube with blue clamp.
C) Snyder column, three-ball macro
Boiling chips, Teflon
Water bath
Graduated cylinder - 1 liter
Volumetric flasks - 200 mL, 250 mL
pH indicator paper with range between pH 2-14
250 and 500 uL syringes
1.0 mL syringe
1.0 mL Class "A" volumetric flask
5.0 mL Class "A" volumetric flask
10.0 mL Class "A" volumetric flask

REAGENTS

All inorganic reagents must be reagent grade or equivalent. All organic solvents must be pesticide grade or equivalent. Label all reagents as required by SOP GEN-006.

Deionized water
Sodium sulfate - granular, anhydrous
Methylene chloride
Hexane
Methanol
5N Sodium hydroxide
1:1 Sulfuric acid

STANDARDS

1. Surrogate Standard Spiking Solution

Surrogate standards are added to all samples (including QC). The surrogates for this procedure are Tetrachloro-m-xylene and Decachlorobiphenyl. For method 8082, only Decachlorobiphenyl is required although both surrogates are included in the standard.

Stock surrogate standard - 200 ug/mL Tetrachloro-m-xylene and Decachlorobiphenyl.

Working surrogate standard - 0.5 ug/mL - prepare by adding 0.5 mL of the stock surrogate standard to a 200 mL volumetric flask and diluting to volume with Methanol. Store the standard at 4°C in Teflon-sealed containers. The standards must be replaced after six months, or sooner if comparisons with quality control check samples indicate a problem.

2. Pesticide Spiking Solutions

Stock 608 spike - 1000 ug/mL of:

Aldrin	Endosulfan sulfate
alpha-BHC	Endrin
beta-BHC	Endrin aldehyde
delta-BHC	Endrin ketone
gamma-BHC	Heptachlor
4,4'-DDD	Heptachlor epoxide
4,4'-DDE	Methoxychlor
Endosufan I	alpha-chlordane
Dieldrin	gamma-chlordane
Endosulfan II	

Working 608 spike - 0.5 ug/mL - Prepare by adding 100 uL of the stock standard to a 100 mL volumetric flask and diluting to volume with Acetone. Store the standard at 4°C in Teflon-sealed containers. The standards must be replaced after six months, or sooner if comparisons with quality control check samples indicate a problem.

3. PCB Spiking Solutions (8082)

Stock standard - 5000 ug/mL individual standards of Aroclor-1260 and Aroclor-1016

Working PCB spike - 4 ug/mL - Prepare by adding 400 uL of the stock standards to a 500 mL volumetric flask and diluting to volume with Methanol. Store the standard at 4°C in Teflon-sealed containers. The standards must be replaced after six months, or sooner if comparisons with quality control check samples indicate a problem.

Projects may require spiking with an Aroclor other than 1016/1260. Stock standards will be ordered as needed in this case. Working spikes will be prepared at 4 ug/mL.

PROCEDURE

1. Rinse all separatory funnels with Methylene chloride two times. Discard solvent rinse into waste container.

2. Label each separatory funnel with the sample ID to be extracted. Complete the laboratory extraction sheet with the sample IDs.

3. With each extraction batch, a method blank, LCS/LCSD and MS/MSD are performed. A LCSD/MSD are not required for method 608.

4. Use a Sharpie to mark the water meniscus on each sample container. This mark will later determine the initial sample volume. For TCLP Pesticide samples, use a graduated cylinder to measure 100 mL of sample.

5. Shake and mix the sample well. Pour the entire contents of the sample container into a labeled separatory funnel.

6. Check pH of the sample with pH paper by removing a

drop of sample with a disposable Pasteur pipet and adjust to between pH 5 and 9 with a 5N Sodium hydroxide solution and/or 1:1 Sulfuric acid solution.

7. Add 1.0 mL of surrogate standard spiking solution into each sample using a 1 mL syringe for SW846 8081/8082 samples and 0.5 mL of surrogate for each sample for EPA 608.

8. For method 608, add 0.5 mL of the working 608 spike to the LCS and MS. For method 8082, add 1 mL of the PCB working spike to the LCS, LCSD, MS, and MSD.

9. Use 60 mL of Methylene chloride to rinse the sample bottle (if entire contents are used) and graduated cylinder (after rinsing the bottle, transfer to the graduated cylinder). (**Note**: If significant amounts of sediment are in the bottom of the sample container, it may not be possible to rinse with the solvent). Transfer this rinse solvent to the separatory funnel and extract the sample by shaking the funnel for a minimum of two minutes, with periodic venting to remove excess pressure. Allow the organic (lower) layer to separate from the water phase for at least 10 minutes. If the emulsion interface between layers is more than one-third the volume of the solvent layer, the technician must employ mechanical techniques to effect a phase separation. Optimum techniques depend upon the sample and may include stirring, filtration of the emulsion through glass wool, centrifugation, or other physical methods. Filter the Methylene chloride extract directly through a prepared glass funnel and collect in a K-D concentrator flask, fitted with a 10 mL graduated receiver. Using the Methylene chloride rinse bottle, rinse the funnel with a stream of Methylene chloride and collect in the K-D concentrator.

10. The initial sample volume is determined by filling the sample container with water to mark indicating the water meniscus. Pour the entire contents into a 1000 mL graduated cylinder. Record the initial volume on the bench sheet.

11. Add a second 60 mL volume of Methylene chloride to the sample in the separatory funnel and repeat the extraction procedure, combining the extracts in the K-D flask. Perform a third extraction in the same manner. (**Note**: It is imperative that the K-D flask as well as the separatory funnel be labeled with the sample identification number.) Rinse the Sodium sulfate drying tube with 20 to 30 mL of Methylene chloride to complete quantitative transfer to K-D flask.

12. Add one or two clean silicon carbide boiling chips to the K-D flask and attach a three-ball Snyder column. Pre-wet the Snyder column by adding about 1.0 mL of Methylene chloride to the top. Place the K-D apparatus in a water bath. At the proper rate of distillation, the balls of the column will actively chatter but the

chambers will not flood with condensed solvent. When the apparent volume of the extract reaches 10 mL, add 50 mL of Pesticide-grade Hexane through the Snyder column. Concentrate the solvent extract as before. The elapsed time of concentration should be about 5-10 minutes. When the apparent volume of liquid reaches 1.0 mL, remove the K-D apparatus and cool and drain for 10 minutes as above.

13. Remove the Snyder column, wipe the joint between the flask and concentrator tube with a Kim-wipe in order to remove excess water, and rinse the flask and its lower joint with 1.0 to 2.0 mL of Hexane from a Teflon wash bottle. Adjust the final extract volume to 10.0 mL in a 10 mL volumetric flask with Hexane for SW846 8081/8082 and 5.0 mL using a 5mL volumetric flask with Hexane for EPA 608 samples. Transfer approximately 1mL of each extract to a 2mL vial.

14. Enter the prep batch information in the LIMS. Deliver a copy of the extraction log and the extracts to the GC-Semivolatiles lab. If no one is available to receive the extracts, place the extracts in the appropriate refrigerator.

15. Samples are analyzed by SOP GC-013 and GC-023.

METHOD PERFORMANCE

1) The recovery of surrogates is used to monitor unusual matrix effects, sample processing problems, etc. The recovery of matrix spiking compounds, when compared to laboratory control sample (LCS) recoveries, indicates the presence or absence of unusual matrix effects.

2) The performance of each 3500 method will be dictated by the overall performance of the sample preparation in combination with the cleanup method and/or the analytical determinative method.

POLLUTION PREVENTION

See QAPP Section 10.2

WASTE MANAGEMENT

See SOP GEN-009

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GULF COAST ANALYTICAL LABORATORIES
EXTRACTIONS
STANDARD OPERATING PROCEDURE

PROCEDURE: WL-054
PAGE: 1 OF 4
EFFECTIVE DATE: 05/18/10
APPROVED BY:
QA/QC APPROVED: JDT

SUBJECT	SCOPE AND APPLICATION This method is applicable to all wastes, with the condition that wastes that are combined with acids do not form explosive mixtures. This method provides a way to determine the specific rate of release of hydrocyanic acid and hydrogen sulfide upon contact with an aqueous acid. This test measures only the hydrocyanic acid and hydrogen sulfide evolved at the test conditions.
MATRIX	Water and Solid
REFERENCE	SW846 7.3.3.2 and 7.3.4.2
PRESERVATIVE	None - Samples should be stored at ≤6°C
SAMPLE COLLECTION	Samples should be collected with a minimum of aeration. The sample bottle should be completely filled, minimizing headspace.
SAMPLE CHAIN OF CUSTODY	Wet lab personnel scan the barcode of the sample out for analysis in the LIMS to transfer internal custody of the sample. When the analysis is complete, Login personnel will scan the samples back to the cooler to complete the internal chain-of-custody. See QAPP Chapter 8 for more details.
HOLDING TIME	28 days
DEFINITIONS	See SOP GEN-016
SAFETY	Each employee is directly responsible for complete awareness of all health hazards associated with every chemical that he/she uses. The employee must be aware of these hazards, and all associated protective wear and spill clean-up procedures PRIOR TO the use of any chemical. In all cases, the applicable material safety data sheet (MSDS) and your supervisor or safety officer should be consulted. The bottle labels also provide important information that must be noted. Personnel performing this procedure may be working with flammables, poisons, toxins, carcinogens, teratogens, mutagens, and biohazards. In particular, approved gloves, safety glasses, and lab coats must be worn. In addition to other measures prescribed by the division, solvents must be handled in ventilated hoods.
APPARATUS	Round-bottom flask, 500 mL, two-neck Gas Scrubber - 100 mL Stirring plate Stirring bars Addition funnel Flexible tubing Flowmeter for monitoring nitrogen flow rate Analytical Balance Pipets

Mechanical pipet
Graduated cylinders
Wood tongue depressors
Scoopula spatulas
Large carboy
Volumetric flasks
Nitrogen cylinder and regulator
pH paper

REAGENTS & STANDARDS

Deionized water (DI)
Sulfuric acid - concentrated
Sulfuric acid - 0.01N H_2SO_4 - Add 10.5 mL concentrated H_2SO_4 to the carboy and dilute to 10 gallons with deionized water
Cyanide standard - 1000 mg/L, commercially prepared
Sulfide reference solution - 1000 mg/L hydrogen sulfide - Dissolve 7.50 g of $Na_2S \cdot 9H_2O$ in 1.0 L of deionized water (The true value will be determined by the titrimetric method)
50% Sodium hydroxide (w/w)
Sodium Hydroxide solution - (1.0 N)- weigh 160g of the 50% sodium hydroxide in a 2000 mL volumetric flask and dilute to volume with deionized water.

PROCEDURE

1. Prepare a bench sheet.

2. Add 25 mL of the 1.0 N Sodium Hydroxide solution to each labeled scrubber and dilute to 100 mL with deionized water.

3. Weigh 10g or measure 10 mL of the waste into a labeled flask. Also set up a flask for a blank (deionized water), Reactive Cyanide LCS (add 2.5 mL of the 1000 mg/L cyanide standard and 7.5 mL DI water) and Reactive Sulfide LCS (add 10 mL of the sulfide standard).

4. Fill the addition funnel with 0.01N sulfuric acid (250 mL). Close the system and adjust the nitrogen flow to 60 mL/min. The flow may need to be adjusted to greater than 60 mL/min if a back pressure is present. Verify no fluid is rising in the dispersion tube.

5. With the nitrogen flowing, begin adding the sulfuric acid in the funnel to the flask. Start the 30-minute test period. Begin stirring while the acid is entering the flask. The stirring speed must remain constant. The stirring should not be fast enough to create a vortex.

6. After 30 minutes, close off the nitrogen and disconnect the scrubber.

7. Split the sample into aliquots, (~30 mL for cyanide and (~70 mL for sulfide). Deliver to the wet chemistry department with a copy of the bench sheet.

8. Analyze the cyanide by Method 9012A (LACHAT) and the Sulfide by Method 9034 (Titration). Substitute the

following for Procedure Step 3 in SOP WL-051 (Sulfide Titration). The scrubber solution must be brought to a pH of 2 before proceeding. Test with pH paper. Stir or mix with minimal aeration when adjusting the pH.

CALCULATIONS

Total releasable HCN (mg/L or mg/kg)= (instrument reading X 5 X DF)x 10

5 is a factor to correct for the water concentration factor included in the calibration.

Total releasable H_2S (mg/L or mg/kg)= Concentration of H_2S in scrubber x 10

Concentration of H_2S in scrubber is calculated using the total sulfide formula in SOP-051. The mL of sample is equal to the mL of scrubber solution titrated.

The 10 factor for both cyanide and sulfide is =

$$\frac{\text{(volume of solution in scrubber (0.1 L)}}{\text{(weight of sample (0.01 kg)}} \times \frac{1800 \text{ seconds}}{1800 \text{ seconds}}$$

REPORTING LIMITS

Reactive Cyanide is 250 mg/kg or mg/L
Reactive Sulfide is 80 mg/kg or mg/L.

QUALITY CONTROL

1. Prep and analyze a blank with each batch of 20 or fewer samples. The concentration must be less than 1/2 the reporting limits or less than 5% of the concentration of any associated samples. If the blank does not meet this criterion, all samples in the batch must be reprepped.

2. Prep and analyze an LCS with each batch of 20 or fewer samples. Perform an LCSD if insufficient sample is available to perform a batch duplicate. The LCS recovery limits are:

   Reactive Sulfide: 47-106%
   Reactive Cyanide: 1-20%

   Sulfide - Concentration = True value of standard used for spiking the LCS (determined by titration of the standard

   Cyanide - Concentration = 250 mg/kg

   If the LCS fails low for the above criteria, the entire batch of samples must be reprepped and reanalyzed. If the LCS fails high for the above criteria, samples maybe reported if no results are above the regulatory limits of 250mg/kg. In this case, the data should be flagged as estimated and a narrative should be included in the final report.

3. Duplicate one sample in each batch of twenty or

fewer samples. The duplicate RPD must be ≤25. If the duplicate does not meet this criterion, all samples in the batch must be reprepped and reanalyzed unless it can be determined that the duplicate failure is the result of a sample that cannot be homogenized.

Sulfide - Concentration = True value of standard used for spiking the LCS (determined by titration of the standard

Cyanide - Concentration = 250 mg/kg

METHOD PERFORMANCE — The operation of the system can be checked and verified by using the LCS. The LCS is processed as a sample and the % recovery is calculated. In this laboratory, 30 standards were analyzed for reactive cyanide with an average recovery of 7.58% and 30 standards were analyzed for reactive sulfide with an average recovery of 76.3%.

POLLUTION PREVENTION — See QAPP Section 10.2

WASTE MANAGEMENT — See SOP GEN-009

GCAL
STANDARD OPERATING PROCEDURE
REVIEW FORM

GCAL

Standard Operating Procedure for SPLP method 1312

Procedure: Ext-070

Revision: 3

Effective Date: 2/1/10

Reviewed By/Date: [signature] 3/4/11

Approved By/Date: JDT 3/4/11

NO Changes

STANDARD OPERATING PROCEDURE FOR SULFIDE TITRATION	REVISION NO. 8

GULF COAST ANALYTICAL LABORATORIES, INC.
WET LAB
STANDARD OPERATING PROCEDURE

PROCEDURES: WL-051
PAGE: 1 OF 3
EFFECTIVE DATE: 03/10/11
APPROVED BY:
QA/QC APPROVED:

SUBJECT	SCOPE AND APPLICATION This method is applicable to the measurement of total and dissolved Sulfide in water and waste samples. Acid insoluble Sulfides are not measured by this method. Excess Iodine is added to a sample. The Iodine oxidizes the Sulfide to Sulfur under acidic conditions. The excess Iodine is back titrated with Sodium thiosulfate.
MATRIX	Water
REFERENCES	SM 18th Edition 4500S E SW846 9034
PRESERVATION	Cool 4°C, add Zinc acetate plus Sodium hydroxide to pH >9
SAMPLE COLLECTION	Samples may be collected and stored in plastic or glass containers.
HOLDING TIME	7 days - if not preserved, run immediately
INTERFERENCES	The iodometric method suffers interferences from reducing substances that react with Iodine, including Thiosulfate and Sulfite.
DEFINITIONS	See SOP GEN-016
SAFETY	Each employee is directly responsible for complete awareness of all health hazards associated with every chemical that he/she uses. The employee must be aware of these hazards, and all associated protective wear and spill clean-up procedures PRIOR TO the use of any chemical. In all cases, the applicable material safety data sheet (MSDS) and the supervisor or safety officer should be consulted. The bottle labels also provide important information that must be noted. Personnel performing this procedure may be working with flammables, poisons, toxins, carcinogens, teratogens, mutagens, and biohazards. In particular, approved gloves, safety glasses, and lab coats must be worn. In addition to other measures, solvents and chemicals must be handled in ventilated hoods.
REAGENTS	Sulfide Working Standard (100mg/L) – Dissolve 7.5 g of $Na_2S \bullet 9H_2O$ in 1 liter of DI water NOTE: This standard will be titrated to determine the true concentration. Expires after 1 month 0.025N Iodine Solution – commercially prepared

0.025N Sodium Thiosulfate-Titrant – commercially prepared
6N HCl
Starch Indicator Solution-commercially prepared
Deionized water

APPARATUS

Burette
5 & 10 mL plastic pipets
Flasks or beakers 250mL or larger
pH paper
Stir bars
Stirring plate
50mL Class “A” pipette
200mL Class “A” pipette

PROCEDURE

1. Place a mark on outside of the sample jar indicating volume of sample.

2. Decant liquid from sample jar being careful not pour out preservative.

3. Refill sample container with DI water to previous marked line.

4. Place a known amount of Iodine solution into beaker. The routine volume used is 20mL. The amount should be estimated to be in excess of the amount of Sulfide expected.

5. Add 2.5mL of 6N HCl to the Iodine solution.

6. Use a 200mL Class “A” pipette to carefully dispense 200mL of sample below the layer of the Iodine. Samples must be taken with a minimum exposure to the air. A brown hue should remain persistent once the sample is added. If it does not, add more Iodine in 20mL aliquots until the brown hue remains. Alternatively, a reduced volume of sample may be prepared. Record the total volume of Iodine used and volume of sample used in the logbook.

NOTE: Use 50mL for Reactive Sulfide and 120mL for distilled solid samples.

7. Add 1mL of Starch indicator.

8. Using pH paper, verify that the pH is below 2. Use additional 6N HCl if necessary.

9. Titrate with the 0.025N Sodium Thiosulfate titrant until the sample returns to its original color. Record the mLs of titrant used.

NOTE: Some samples may have a yellow tinge.

QUALITY CONTROL

1. Method Blank – Use 200mL of DI water and analyze with every 20 samples. The method blank can be prepped with Reactive Sulfide and Total Sulfide solid sample batches. Use 50mL for Reactive Sulfide and 120mL for Total Sulfide solid samples.

2. Duplicate – Analyze with every 20 samples.

3. LCS – Analyze with every 20 samples.

4. Determine 'true value' concentration for the Sulfide working standard by diluting 5mL of stock standard to 200mL with DI water. Repeat twice. Average the three readings for the true concentration.

CALCULATION

$$\frac{16{,}030\ (VI \times NI) - (VST)(NST)}{\text{Volume of Sample (mL) or weight of sample (g)}}$$

VI = volume of iodine
NI = normality of iodine
VST = volume of sodium thiosulfate
NST = normality of sodium thiosulfate

REPORTING LIMIT

1.0 mg/L

METHOD PERFORMANCE

Precision and accuracy for this method have not been determined.

POLLUTION PREVENTION

See QAPP Section 10.2

WASTE MANAGEMENT

See SOP GEN-009

GULF COAST ANALYTICAL LABORATORIES, INC.
EXTRACTIONS
STANDARD OPERATING PROCEDURE

PROCEDURE: EXT-070
PAGE: 1 OF 6
EFFECTIVE DATE: 2/1/10
APPROVED BY:
QA/QC APPROVED: JDT

SUBJECT — SCOPE AND APPLICATION

This Standard Operating Procedure describes method 1312 that is designed to determine the mobility of both organic and inorganic analytes present in samples of liquid, solids and multiphasic wastes. This procedure is not applicable to volatile analytes.

For liquid samples (i.e., those containing <0.5% dry solid material), the sample, after filtration through a 0.6 to 0.8 um glass fiber filter is defined as the extract. For samples containing >0.5% dry solids, the liquid is separated from the solid phase and stored for later analysis. The solid phase is then extracted with a specific amount of the appropriate extraction fluid. The extraction fluid employed is a function of the region of the country where the sample site is located if the sample is a soil. If the sample is a waste or wastewater, the extraction fluid employed is a pH 4.2 solution. After the appropriate extraction time, the liquid is filtered off and recombined, if compatible, with the initial liquid portion of the sample collected. If there was no initial liquid phase, the filtrate obtained is defined as the extract. In the event these two are not compatible, then they must be analyzed separately and the proper layer percentages assigned to each fraction.

MATRIX — Water and Solid

REFERENCE — SW846 1312

SAMPLE COLLECTION — Samples should be collected in appropriate containers. Sufficient sample should be available for the preliminary evaluation of the percent solids if required and for the extraction procedure. When volatiles are being analyzed care should be taken to minimize their loss.

PRESERVATIVE — Cool to 4°C unless refrigeration results in irreversible physical change to the waste.

HOLDING TIME — From field collection to SPLP extraction:
- Semi-volatiles - 14 days
- Mercury - 28 days
- Metals - 180 days

From SPLP extraction to Preparative extraction:
- Semi-volatiles - 7 days
- Not applicable for other analytes

From Preparative extraction to Determinative analysis:
- Semi-volatiles - 40 days

Mercury - 28 days
Metals - 180 days

DEFINITIONS

See SOP GEN-016

SAFETY

Each employee is directly responsible for complete awareness of all health hazards associated with every chemical that he/she uses. The employee must be aware of these hazards, and all associated protective wear and spill clean-up procedures PRIOR TO the use of any chemical. In all cases, the applicable material safety data sheet (MSDS) and your supervisor or safety officer should be consulted. The bottle labels also provide important information that must be noted. Personnel performing this procedure may be working with flammables, poisons, toxins, carcinogens, teratogens, mutagens, and biohazards. In particular, approved gloves, safety glasses, and lab coats must be worn. In addition to other measures prescribed by the division, solvents must be handled in ventilated hoods.

APPARATUS

Agitation apparatus capable of end-over-end rotation @ 30 ±2 rpm.
Plastic extraction bottles (metals only) - TCLP jug
Teflon or glass extraction bottles - TCLP jug
Filter Holder (stainless steel) - capable of supporting a glass fiber filter and able to exerting pressures of up to 50 psi
Filter holder for use with vacuum pump
Borosilicate glass fiber filters, 150mm, 0.6 to 0.8 um nominal pore size - acid wash if metals are analytes
pH meter (accurate to ± 0.05 pH units)
pH electrode with automatic temperature compensation
Analytical balance - accurate to 0.01 grams
Spatula
9.5 mm sieves
Wide mouth quart jars - glass (plastic may be used for metals only)
1 L Plastic bottles (metals extract)
1 L Amber glass bottles (organics extract)

REAGENTS

All reagents shall be reagent grade or equivalent. Label all containers and squeeze bottles with reagent ID, lot, and expiration date.

Deionized water
Sulfuric acid - concentrated
Nitric acid - concentrated
Sulfuric acid/nitric acid (60/40 weight percent mixture) - H_2SO_4/HNO_3 - Cautiously mix 60g of concentrated Sulfuric and 40 g of concentrated Nitric acid. If preferred, a more dilute H_2SO_4/HNO_3 acid mixture may be prepared and used
pH Buffers (calibration)

EXTRACTION FLUID #1 - This fluid is made by adding the 60/40 weight percent mixture of Sulfuric and Nitric acids (or a suitable dilution) to Deionized water until the pH is 4.20 ± 0.05. The fluid is used to

determine the leachability of soil from a site that is east of the Mississippi River, and the leachability of wastes. Note: Solutions are unbuffered and exact pH may not be attained.

EXTRACTION FLUID #2 - This fluid is made by adding the 60/40 weight percent mixture of Sulfuric and Nitric acids (or a suitable dilution) to Deionized water until the pH is 5.00 ± 0.05. The fluid is used to determine the leachability of soil from a site that is west of the Mississippi River.

PROCEDURE

PRELIMINARY EVALUATIONS

Perform preliminary evaluations on a minimum 100 gram aliquot of sample. This aliquot may not actually undergo extraction. The preliminary evaluations include: (1) determination of percent solids; (2) determination of whether the waste contains insignificant solids and is, therefore its own extract after filtration; and determination if the solid portion of the waste requires particle size reduction.

1. Determination of percent solids: percent solids are defined as that fraction of a waste sample (as a percentage of the total sample) from which no liquid may be forced out by an applied pressure;

   A. 100% solids - samples that will yield no liquid when subjected to pressure filtration. Homogenize the sample by pouring the contents of the sample container onto a piece of butcher paper, chop and mix with a tongue depressor or spatula. Remove any foreign objects such as sticks, leaves, or rocks. If the particle size is > 9.5 mm, perform particle size reduction by crushing, grinding, or cutting the sample. The sample may be sieved to verify proper particle size. Filamentous (paper, cloth, similar) waste materials should have a surface area per gram of material of 3.1 cm^2 or greater. Actual measurement of surface area is not required, nor is it recommended.

   B. Liquid or Multiphasic - a determination of the % solids must be performed as outlined below:

      1. Weigh a 0.8 um filter and place on the screen of the filter apparatus. Assemble the filter apparatus.

      2. Weigh a wide mouth quart jar.

      3. Weigh a minimum of 100 grams of sample in the jar and record this weight in the logbook. Allow to settle or centrifuge.

      4. Place the jar under the filter apparatus.

      5. Pour the liquid sample into the filtering apparatus followed by the solid portion of the sample. Spread the sample evenly over the surface of the filter. If filtration of the waste at 4°C reduces the amount of expressed liquid over what would be

expressed at room temperature, then allow the sample to warm up to room temperature in the device before filtering. If there is obvious residue left in the jar, reweigh the jar and subtract the weight of the residue from the weight of the sample to be filtered.

6. Gradually apply pressure of 1-10 psi, until the air or pressurizing gas moves through the filter. If this point is not reached under 10 psi, and if no additional liquid has passed through the filter in any 2-minute interval, slowly increase the pressure in 10 psi increments to a maximum of 50 psi. After each incremental increase of 10 psi, if no additional liquid has passed through the filter in any 2-minute interval, proceed to the next 10 psi increment. When the pressurizing gas begins to move through the filter, or when liquid flow has ceased at 50 psi (filtration does not result in any additional filtrate within any 2-minute period), stop the filtration. Note: instantaneous application of high pressure can degrade the glass fiber filter and may cause premature plugging. Note: some samples, such as oily wastes and some paint wastes, will obviously contain some material that appears to be a liquid, but even after applying pressure filtration, this material may not filter. If this is the case, the material within the filtration device is defined as a solid. Do not replace the original filter with a fresh filter under any circumstances. Use only one filter.

7. Weigh the jar and filtrate. Subtract the weight of the jar from the jar and filtrate weight. This is the liquid phase.

8. Subtract the liquid phase from the weight of the total sample. This is the solid phase.

$$\% \text{ Solids} = \frac{\text{weight of solid phase}}{\text{total weight of sample}} \times 100$$

If the % solids are equal to or greater than 0.5%, determine if the solid needs particle size reduction. Follow the procedure in 1 (A) to perform particle size reduction. If it is noticed that filtrate may be entrained in the filter then remove the solid phase and filter and dry at 100 ± 20°C cycles until two successive weighings are within ±1% of each other. Calculate the % dry solids.

$$\%\text{dry solids} = \frac{(\text{Weight Of dry sample + filter}) - \text{Weight of filter}}{\text{Initial weight of sample}} \times 100$$

If the % dry solids is <0.5%, then the filtered liquid is the SPLP extract. Additional sample may be filtered to generate sufficient liquid to support all required analyses. If the percent dry solids is greater than 0.5%, repeat the filtration process using a fresh aliquot of sample. Use

sufficient sample to generate at least 100 g of solid material for the extraction process. Perform particle size reduction for the solid portion if necessary.

2. Determination of extraction fluid

   A. For soils, if the sample is from a site that is east of the Mississippi River, extraction fluid #1 should be used. If the sample is from a site west of the Mississippi river, extraction fluid #2 should be used.

   B. For wastes, extraction fluid #1 should be used.

   C. For Cyanide-containing wastes and/or soils, Deionized water must be used because leaching of Cyanide containing samples under acidic conditions may result in the formation of Hydrogen Cyanide gas.

EXTRACTION

Solids from samples which are 100% solid or >0.5% solids (solid portion) are prepared and extracted as follows.

1. Weigh 100g of 100% solids into the labeled TCLP jug (plastic for metals only; Teflon or glass if organics will be analyzed). Weigh the appropriate amount of % solid samples to yield 100 g of solid, filter, and place the filter and solids into the labeled TCLP jug. Store the liquid phase at 4°C.

2. Slowly add the appropriate extraction fluid in the amount of 20 times the sample weight (accounting for % solids).

3. Secure the bottle in the agitation device and rotate at 30 rpm for 18 ± 2 hours. The temperature of the room in which extraction takes place shall be maintained at 23 ± 2°C during the extraction period.

4. After rotation, allow the sample to stand and settle for at least 30 minutes before filtration.

5. Assemble a filtration vessel and filter the sample through a new acid rinsed filter paper. During the final filtration of the extract, the glass fiber filter may be changed to facilitate filtration. Vacuum filtration can only be used for wastes with <10% solids content. If using the pressure filtration method, gradually apply pressure to a maximum of 50 psi.

6. After the sample has been filtered, for 100% solids, the filtrate is the SPLP extract. For % solid samples, combine the filtrate with the initial liquid phase if compatible. If incompatible, each phase is prepped and analyzed separately. The volumes of the individual phases must be determined and the results combined mathematically by using a simple volume-weighted average:

$$\text{Final analyte concentration} = \frac{(V1)(C1) + (V2)(C2)}{V1 + V2}$$

Where:
V1 = the volume of first phase (L)
C1 = the concentration in the first phase (mg/L)
V2 = the volume of second phase (L)
C2 = the concentration in the second phase (mg/L)

7. Record the pH. Preserve the metals aliquot of the extract to a pH of <2 with 1:1 Nitric acid. Preservation will be performed by the metals prep analyst.

8. Store extracts at 4°C until ready to proceed with the preparation and/or analysis procedures required for the analytes of interest. Transfer the extract to the appropriate laboratory for preparation for analysis.

QUALITY CONTROL

1. A minimum of one blank (using the same extraction fluid as used for the samples) should be performed for every 20 extractions that are conducted.

2. A matrix spike should be performed for each waste type. Follow the matrix spike guidance in the preparatory and analytical procedures. Matrix spikes are added after filtration of the extract. Matrix spies should not be added prior to the extraction of the sample.

3. Follow all QC requirements for the preparatory and analytical methods.

METHOD PERFORMANCE

1. Precision results for semi-volatiles and metals: An eastern soil with high organic content and a western soil wit low organic content were used for the semi-volatiles and metal leaching experiments. Both types of soils were analyzed prior to contaminant spiking. The results are shown in Table 6 of the method. The concentration of contaminants leached form the soils were reproducible, as shown by the moderate relative standard deviations (RSDs) of the recoveries (averaging 29% for the compounds and elements analyzed.

2. Performance for the analytical methods is included in each SOP.

POLLUTION PREVENTION — See QAPP Section 10.2

WASTE MANAGEMENT — See SOP GEN-009

GULF COAST ANALYTICAL LABORATORIES, INC. PROCEDURE: EXT-026
EXTRACTIONS PAGE: 1 OF 5
STANDARD OPERATING PROCEDURE EFFECTIVE DATE: 3/1/11
APPROVED BY:
QA/QC APPROVED:

SUBJECT — SCOPE AND APPLICATION

This Standard Operating Procedure describes method 1311 that is designed to determine the mobility of both organic and inorganic analytes present in samples of liquid, solids and multiphasic wastes. This procedure is not applicable to volatile analytes.

PURPOSE — For liquid samples (i.e., those containing <0.5% dry solid material), the sample, after filtration through a 0.6 to 0.8 um glass fiber filter is defined as the extract. For samples containing >0.5% dry solids, the liquid is separated from the solid phase and stored for later analysis. The solid phase is then extracted with a specific amount of the appropriate extraction fluid. After the appropriate extraction time, the liquid is filtered off and recombined, if compatible, with the initial liquid portion of the sample collected. If there was no initial liquid phase, the filtrate obtained is defined as the extract. In the event these two are not compatible, then they must be analyzed separately and the proper layer percentages assigned to each fraction.

MATRIX — Water and Solid

REFERENCE — SW846 1311

PRESERVATIVE — Cool to 4^{o}C, if Volatiles are to be extracted

SAMPLE COLLECTION — Samples may be collected in plastic or glass containers. When volatiles are being analyzed care should be taken to minimize their loss.

HOLDING TIME — From field collection to TCLP extraction:
- Volatiles - 14 days
- Semivolatiles - 14 days
- Mercury - 28 days
- Metals - 180 days

From TCLP extraction to Preparative extraction:
- Semivolatiles - 7 days
- Not applicable for other analytes

From Preparative extraction to Determinative analysis:
- Volatiles - 14 days
- Semivolatiles - 40 days
- Mercury - 28 days
- Metals - 180 days

DEFINITIONS

See SOP GEN-016

SAFETY

Each employee is directly responsible for complete awareness of all health hazards associated with every chemical that he/she uses. The employee must be aware of these hazards, and all associated protective wear and spill clean-up procedures PRIOR TO the use of any chemical. In all cases, the applicable material safety data sheet (MSDS) and your supervisor or safety officer should be consulted. The bottle labels also provide important information that must be noted. Personnel performing this procedure may be working with flammables, poisons, toxins, carcinogens, teratogens, mutagens, and biohazards. In particular, approved gloves, safety glasses, and lab coats must be worn. In addition to other measures prescribed by the division, solvents must be handled in ventilated hoods.

APPARATUS

Agitation apparatus capable of end-over-end rotation @ 30 ±2 rpm
Plastic extraction bottles (metals only) - TCLP jug
Teflon extraction bottles - TCLP jug
Filter holder - 150mm polypropylene
Glass fiber filters, 150mm, 0.6 to 0.8 um nominal pore size
pH meter (accurate to "0.01 pH unit)
pH electrode with automatic temperature compensation
Analytical balance - accurate to 0.01 grams
Spatula
4oz wide-mouth jar
Hot plate/ magnetic stirrer
Magnetic stir bars
Graduated cylinders - 1000 mL glass
Vacuum manifold and pump
1 mm and 9.5 mm sieves
1 L Plastic bottles (metals extract)
1 L Amber glass bottles (organics extract)

REAGENTS

All reagents shall be reagent grade or equivalent. Label all containers and squeeze bottles with reagent ID, lot, and expiration date.

Deionized water
Glacial acetic acid
Sodium hydroxide 50%
Hydrochloric acid (1N) - 8.3 mL HCl to 100 mL DI water
1:1 Nitric acid
pH Buffers (calibration)

EXTRACTION FLUID #1
20 liters DI water
114 mL Acetic acid
70 mL 50% NaOH
pH = 4.93 ± 0.05 pH units(4.88-4.98)

EXTRACTION FLUID #2
20 liters DI water
114 mL Acetic acid
pH = 2.88 ± 0.05 pH units(2.83-2.93)
Record in the preparation logbook and assign a laboratory ID.

PROCEDURE

A. Determination of percent solids:

1. Liquid wastes - wastes with <0.5% solids after filtration through a 0.6 to 0.8 um glass fiber filter is defined as the TCLP extract.

2. 100% solids - samples that will yield no liquid when subjected to pressure filtration. Homogenize the sample by pouring the contents of the sample container onto a piece of butcher paper, chop and mix with a tongue depressor or spatula. Remove any foreign objects such as sticks, leaves, or rocks. If the particle size is > 9.5 mm, perform particle size reduction by crushing, grinding, or cutting the sample. The sample may be sieved to verify proper particle size.

3. Multiphasic - a determination of the % solids must be performed as outlined below:

   a. Weigh a 0.8 um filter and place on the screen of the filter apparatus. Assemble the filter apparatus.
   b. Weigh a wide mouth quart jar.
   c. Weigh a minimum of 100 grams of sample and record the weight in the logbook. Allow to settle or centrifuge.
   d. Place the jar under the filter apparatus.
   e. Pour the liquid sample into the filtering apparatus followed by the solid portion of the sample. If there is obvious residue left in the cup, reweigh the cup and subtract the weight of the residue from the weight of the sample to be filtered.
   f. Apply pressure to the Millipore filter apparatus to 10 psi. Filter until no liquid passes through the filter for 2 minutes. Increase the pressure in 10 psi increments up to 50 psi. After each incremental increase of 10 psi, if no liquid has passed through the filter for 2 minutes, proceed to the next 10 psi increment.
   g. Relieve the pressure from the filter apparatus when the gas flows through the filter or when there is more than 2 minutes between drops of filtrate at 50 psi.
   h. Weigh the jar and filtrate. Subtract the weight of the jar from the jar and filtrate weight. This is the liquid phase.
   i. Subtract the liquid phase from the weight of the total sample. This is the solid phase.

$$\% \text{ Solids} = \frac{\text{weight of solid phase}}{\text{total weight of sample}} \times 100$$

If the % solids is >0.5%, determine if the solid needs particle size reduction. Follow the procedure in step 2 to perform particle size reduction. If it is noticed that the filtrate may be entrained in the filter then remove the solid phase and filter and dry at 100 ± 20°C cycles until two successive weightings are within ± 1% of each other. Calculate the % dry solids. If the % dry solids are <0.5%, then the filtrate is the TCLP extract. The worksheet in Appendix 1 can be used to calculate % solids.

B. Determination of extraction fluid

Solids from samples which are 100% solid or >0.5% solids (solid portion) are prepared and extracted as follows.

1. Label with the sample number, a 4oz wide-mouth jar and TCLP jug. A plastic TCLP jug may be used if the extract is to be analyzed for metals only. If organics will be analyzed, a Teflon TCLP jug must be used.

2. Weigh a small sub-sample of the solid phase of the waste and reduce to a particle size of approximately 1 mm. Sieve if necessary. Transfer 5.0 grams of sample into the 4oz wide-mouth jar.

3. Add 96.5 mL (± 1 mL) of DI water to the 4 oz wide-mouth jar. Add a stir bar, and place the sample on a magnetic stirrer and stir vigorously for 5 minutes. Measure and record the pH in the TCLP log book. If the pH is <5, extraction fluid #1 shall be used. If the pH measured is >5, add 3.5 mL of 1.0 N HCL to the jar and slurry the mixture. Heat to 50°C. Hold at this temperature for 10 minutes. Remove from the hot plate and measure the pH. If the measured pH is <5, then extraction fluid #1 will be used. If it is >5, then extraction fluid #2 must be used. Record the fluid used in the logbook.

C. Extraction:

1. Weigh 100g of 100% solids into the labeled TCLP jug. Weigh 100g of % solid sample, filter, and place the filter and solids into the labeled TCLP jug. Store the liquid phase at 4°C. If there are not 100g of the solid or % solid sample, contact client services immediately and wait for further instructions. Do not perform TCLP extraction on a smaller sample aliquot without authorization from the client.

2. Slowly add the appropriate extraction fluid in the amount of 20 times the sample weight (accounting for % solids).

3. Secure the bottle in the agitation device and rotate at 30 rpm for 18 ± 2 hours. The temperature must be maintained at 23 ± 2°C during the TCLP extraction. Document the max and min temperature in the TCLP logbook.

4. After rotation, allow the sample to stand and settle for at least 30 minutes before filtration.

5. Assemble a filtration vessel and filter the sample through a new acid rinsed filter paper. Vacuum filtration can only be used for wastes with <10% solids content.

6. After the sample has been filtered, for 100% solids, the filtrate is the TCLP extract. For % solid samples, combine the filtrate with the initial liquid phase if compatible. If incompatible, each phase is prepped and analyzed separately.

7. Record the pH. Preserve the metals aliquot of the extract to a pH of <2 with 1:1 Nitric acid. This step will be performed by the metals prep analyst. Store extracts at 4^{o}C until ready to proceed with the preparation and/or analysis procedures required for the analytes of interest.

8. Notify metals prep analyst of TCLP extracted samples needing metals analysis. Extract samples for semivolatile analysis using the applicable SOP.

METHOD PERFORMANCE

Many TCLP precision (reproducibility) studies have been performed, and have shown that, in general, the precision of the TCLP is comparable to or exceeds that of the EP Toxicity test and that method precision is adequate. One of the more significant contributions to poor precision appears to be related to sample homogeneity and inter-laboratory variation (due to the nature of waste materials).

1) *Metals* – The results of a multi-laboratory study are shown in Table 6 of Method 1311, and indicate that a single analysis of a waste may not be adequate for waste characterization and identification requirements.

2) *Semivolatile Organic Compounds* – The results of two studies are shown in Tables 7 and 8 of Method 1311. Single laboratory precision was excellent with greater than 90 percent of the results exhibiting an RSD less than 25 percent. Over 85 percent of all individual compounds in the multi-laboratory study fell in the RSD range of 20-120 percent. Both studies concluded that the TCLP provides adequate precision. It was also determined that the high acetate content of the extraction fluid did not present problems (i.e., column degradation of the gas chromatograph) for the analytical conditions used.

POLLUTION PREVENTION

See QAPP Section 10.2

WASTE MANAGEMENT

See SOP GEN-009

Appendix 1

TCLP CALCULATION SHEET

Sample ID		Description:			
A) cup					
B) filter					
C) prefiltrate bottle					
D) original sample (>100g)		- E result =			
E) cup+ leftover sample		- A =			
F) Bottle + prefiltrate		- C =		= weight of liquid phase	
G) Sample (D result) - liquid (F result) =		weight of solid =		/sample x 100 =	%solid
H) dried filter + solids		- B =		/sample x 100 =	%dry solid
Procedure:					

Sample ID		Description:			
A) cup					
B) filter					
C) prefiltrate bottle					
D) original sample (>100g)		- E result =			
E) cup+ leftover sample		- A =			
F) Bottle + prefiltrate		- C =		= weight of liquid phase	
G) Sample (D result) - liquid (F result) =		weight of solid =		/sample x 100 =	%solid
H) dried filter + solids		- B =		/sample x 100 =	%dry solid
Procedure:					

Sample ID		Description:			
A) cup					
B) filter					
C) prefiltrate bottle					
D) original sample (>100g)		- E result =			
E) cup+ leftover sample		- A =			
F) Bottle + prefiltrate		- C =		= weight of liquid phase	
G) Sample (D result) - liquid (F result) =		weight of solid =		/sample x 100 =	%solid
H) dried filter + solids		- B =		/sample x 100 =	%dry solid
Procedure:					

Sample ID		Description:			
A) cup					
B) filter					
C) prefiltrate bottle					
D) original sample (>100g)		- E result =			
E) cup+ leftover sample		- A =			
F) Bottle + prefiltrate		- C =		= weight of liquid phase	
G) Sample (D result) - liquid (F result) =		weight of solid =		/sample x 100 =	%solid
H) dried filter + solids		- B =		/sample x 100 =	%dry solid
Procedure:					

GCAL
STANDARD OPERATING PROCEDURE
REVIEW FORM

GCAL

Standard Operating Procedure for TCLP Volatiles Extraction

Procedure: EXT-036

Revision: 7

Effective Date: 1/6/2010

Reviewed By/Date: [signature] 2/25/11

Approved By/Date: 2/25/11 JDT

No changes needed

GULF COAST ANALYTICAL LABORATORIES, INC
EXTRACTIONS
STANDARD OPERATING PROCEDURE

PROCEDURE: EXT-036
PAGE: 1 OF 4
EFFECTIVE DATE: 1/6/2010
APPROVED BY:
QA/QC APPROVED:

SUBJECT	SCOPE AND APPLICATION The ZHE procedure is used to test for the mobility of volatile analytes. The ZHE allows for liquid/solid separation within the device and eliminates headspace.
MATRIX	Water and Solid
REFERENCE	SW846 1311
PRESERVATIVE	Cool to 4°C
SAMPLE COLLECTION	Samples may be collected in plastic or glass conatiners. When volatiles are being analyzed care should be taken to minimize their loss.
HOLDING TIME	From field collection to TCLP extraction: 14 days From TCLP extraction to determinative analysis: 14 days
DEFINITIONS	See SOP GEN-016
SAFETY	Each employee is directly responsible for complete awareness of all health hazards associated with every chemical that he/she uses. The employee must be aware of these hazards, and all associated protective wear and spill clean-up procedures PRIOR TO the use of any chemical. In all cases, the applicable material safety data sheet (MSDS) and your supervisor or safety officer should be consulted. The bottle labels also provide important information that must be noted. Personnel performing this procedure may be working with flammables, poisons, toxins, carcinogens, teratogens, mutagens, and biohazards. In particular, approved gloves, safety glasses, and lab coats must be worn. In addition to other measures prescribed by the division, solvents must be handled in ventilated hoods.
APPARATUS	Zero-Headspace Extraction Vessel (ZHE) - This device is for use only when the waste is being tested for the mobility of volatile analytes. The ZHE allows for liquid/solid separation within the device, and effectively precludes headspace. This type of vessel allows for initial filtration without opening the vessel. Clean as described in SOP EXT-019. Agitation apparatus capable of end-over-end rotation @ 30 ± 2 rpm (check and record the rotation rate monthly.) pH meter (accurate to ± 0.05 pH units) pH electrode with automatic temperature compensation Analytical balance Air compressor Pump for transferring extraction fluid Borosilicate Microfiber Filters, 90mm, 0.7 um Gastight syringe Tedlar bags

20 and 40 mL VOA vial

REAGENTS

All reagents shall be reagent grade or equivalent. Label all containers and squeeze bottles with reagent ID, lot number, and expiration date.

Extraction Fluid #1
5 gallons Deionized water
114 mL Acetic acid
70 mL 50% NaOH
pH = 4.93 ± 0.05 pH units (4.88-4.98)
pH buffers

PROCEDURE

Do not allow the sample, initial liquid phase or extract, to be exposed to the atmosphere any longer than is necessary. Do not homogenize the sample. To help in making this possible, have the ZHE completely put together (particularly the top) so that when the sample is weighed in the piston chamber, the top can be replaced as quickly as possible. Make sure the ZHE is clean. No Acetone or Methylene chloride is to be used in the TCLP volatile area (no components) except for Methanol (only as a drying agent).

A ZHE vessel blank is prepped with each batch to check for vessel contamination. Add 500mL of extraction fluid to the ZHE vessel and tumble as a sample.

100 % Solid Samples -

1. Check the pH of extraction fluid #1 (range 4.88 - 4.98). Make new extraction fluid if it does not test within range. Record the extraction fluid ID # and pH in the logbook.

2. Place 25 ± 0.1 grams (record to one decimal place) of sample into the piston vessel. Place a top onto the piston vessel. Multiply the amount of sample (25 grams) by 20 = the amount of extraction fluid that is to be used.

3. With the ZHE in a vertical position, attach a Luer Lock line from the pump attached to the extraction fluid reservoir to the liquid inlet/outlet valve (Luer Lock on top of extractor). Release the gas pressure on the ZHE piston (from the gas inlet/outlet valve), open the liquid inlet/outlet valve, and begin transferring extraction fluid by pumping into the ZHE. Continue pumping until the appropriate amount of fluid has been introduced into the ZHE.

4. After the extraction fluid has been added, immediately close the liquid inlet/ outlet valve and disconnect the extraction fluid line. Check the ZHE to be sure that all valves are closed. Attach the compressed air line and pressurize the ZHE to 5-10 psi and slowly open the liquid inlet/outlet valve to bleed out any headspace. The bleeding shall be done quickly and shall be stopped at the first sign of liquid. Allow the ZHE to set on the counter approximately one hour,

to ensure no pressure leakage.

5. Place a rubber strap around the ZHE extractor and rotate for 18 ± 2 hours. Temperature shall be maintained at 23 ± 2°C.

6. Record all weights, sample ID's, rotation times, and temperatures in the ZHE logbook.

% Solids -

1. Weigh out a subsample of the waste of the appropriate size and record the weight to one decimal place. The appropriate size is determined by dividing 25 by the percent solids determined by filtration of the sample for extraction for non-volatiles. This value is then multipled by 100. The actual amount of solids remaining after filtration of the liquid phase cannot exceed 25g. To find the % soil in the sample charged to the ZHE, perform the following calculations:

   Record all weights to one decimal place.
   Weight of sample charged to ZHE
   Weight of Tedlar bag (empty)

2. Attach a Tedlar bag to the ZHE inlet/outlet valve. Attach the compressed air line to the gas inlet/outlet valve. Apply gentle pressure of 1-10 psi to force the liquid phase of the sample into the Tedlar bag. If no additional liquid has passed thorough the filter in any a 2-minute interval, slowly increase the pressure in 10 psi increments to a maximum of 50 psi. After each incremental increase of 10 psi, if no additional liquid has passed through the filter in any 2-minute interval, proceed to the next 10 psi increment. When the liquid flow has ceased such that continued pressure filtration at 50 psi does not result in any additional filtrate within a 2-minute period, stop the filtration. Close the liquid inlet/outlet valve, discontinue pressure to the piston, and disconnect and weigh the Tedlar bag.

   Weight of Tedlar bag with liquid - weight of Tedlar bag empty = amount of liquid

   Weight of original sample (grams) - amount of liquid= grams of solid

   % Solid = grams solid / grams of sample

   Then multiply by 100 = % solid

   To find the amount of extraction fluid #1 to be used:

   Weight of solid X 20

   Follow the instructions as given in the 100% solids section.

Sample Removal from the ZHE extractor

1. Remove vessel from rotator. Check to see if pressure was maintained during the rotation time. This is a visual check that includes checking for visual bubbling or the presence of liquid around any seals or at the liquid inlet/outlet valve. If this inspection indicates the presence of liquid on any of the seals then the pressure was not maintained and the samples should be reset up. Let the ZHE settle for 5 to 10 minutes before filtering.

2. Hook up the air compressor and place a gastight syringe on top of Luer Lock flange valve. Bleed off the extraction fluid into two 40 mL vials (properly labeled) with zero-headspace. (Remember: Do not expose this extract fluid to the atmosphere any longer than is necessary.) If % solid, bleed the extraction fluid into a Tedlar bag (which was labeled during the previous step to match this sample.)

3. Fill out the ZHE sample prep sheet and make a copy. Provide a copy to GC/MS along with TCLP volatile extracts. The samples shall be analyzed by SOP GCMSV-003.

METHOD PERFORMANCE

Many TCLP precision (reproducibility) studies have been performed, and have shown that, in general, the precision of the TCLP is comparable to or exceeds that of the EP Toxicity test and that method precision is adequate. One of the more significant contributions to poor precision appears to be related to sample homogeneity and inter-laboratory variation (due to the nature of waste materials).

1) *Volatile Organic Compounds* – Eleven laboratories participated in a collaborative study of the use of the ZHE with two waste types that were fortified with a mixture of VOCs. The results of the collaborative study are shown in Table 9 of Method 1311. Precision results for VOCs tend to occur over a considerable range. However, the range and mean RSD compared very closely to the same collaborative study metals results in Table 6 of Method 1311. Blackburn and Show concluded that at the 95% level of significance: 1) recoveries among laboratories were statistically similar, 2) recoveries did not vary significantly between the two sample types, and 3) each laboratory showed the same pattern of recovery for each of the two samples.

POLLUTION PREVENTION

See QAPP Section 10.2

WASTE MANAGEMENT

See SOP GEN-009

ZERO HEADSPACE TCLP EXTRACTIONS

DATE: _____ BATCH # _____ ANALYST: _____

Sample Number:								
Sample Description								
Client								
Sample Extractor								
1.VISUAL SAMPLE EVALUATION								
100% solid (Proceed to 3)	(√)							
Sample is <0.5% Solid	(√)							
Sample is >0.5% and <100% solid	(√)							
2. FILTRATION-ZHE*								
Subsample Weight (g)								
Tedlar Bag Weight (g)								
Weight of Filtrate = (Tedlar Bag + Filtrate) - Tedlar Bag Weight (g)								
Weight of Solid = Subsample Weight - Weight of Filtrate (g)								
% Solid = (Weight of Solid / Subsample Weight) x 100								
3.ZHE EXTRACTION**								
Particle Size Reduced (9.5mm max.)	(√)							
Sample Weight (solid) (g)								
Amount of Fluid Needed = 20 x Sample Weight (g)								
4. TCLP ROTATION (Rotate for 18 ± 2 hours at 23 ± 2°C and 30 ± 2 rpm)								
Start Time								
Stop Time								
5. FINAL TCLP EXTRACT								
Volume Extract Obtained in Step 3	V1							
Volume Compatible Filtrate from Step 2	V2							
Volume Non-Compatible Filtrate from Step 2	V3							
Compatible Phase Ratio= (V1+V2) + (V1+V2+V3)								
Non-Compatible Phase Ratio= (V3) + (V1+V2+V3)								

*** If sample is <0.5 %FS; or <0.5 %DS; Filter fresh sample using ZHE, collect filtrate and skip to 5. If sample is multiphase, filter 25g of sample.**

****If sample is 100% solid, charge ZHE with 25 g sample and 500 mL fluid**

Temperature controls: 23 +/-2 oC

Temperature: Minimum °C _____ **Maximum °C** _____

EXTRACTION FLUID #1 pH and ID: _____

Rotation Start Time: _____ **Rotation Stop Time:** _____

Revision 1: 01/18/2007

Secondary Review: _____

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STANDARD OPERATING PROCEDURES
SOLID EXTRACTION OF
NITROAROMATICS AND NITRAMINES
METHOD 8330

Issue/Implementation Date: 15 March 2010

Last Review Date: 15 March 2012

Microbac Laboratories, Inc.
Ohio Valley Division
158 Starlite Drive
Marietta, Ohio 45750

Approved by:

Chad E. Barnes, Extraction Supervisor — Date 03/12/12

Leslie S. Bucina, Quality Assurance Officer — Date 3-16-12

David E. Vandenberg, Managing Director — Date 3/19/12

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1.0 SCOPE AND APPLICATION

1.1 Soil and sediment samples are extracted using acetonitrile in an ultrasonic bath, filtered and analyzed using SW 846 Methods 8330A or 8330B.

1.2 This SOP also contains special sample preparation procedures to comply with the unique requirements presented in DoD's "Guide for Implementing SW-846 Method 8330B", July 7, 2008. The laboratory uses the LIMS to indicate when the special DoD/EDQW procedures must be followed.

1.3 Definitions and Acronyms

The following is a list of terms, definitions, and acronyms referenced in this SOP that are unique to the method.

DI water	Deionized water
GC/MS	Gas Chromatography/Mass Spectrometer
L	liter
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
mL	milliliter
MS	Matrix Spike
MSD	Matrix Spike Duplicate
MDL	Method Detection Limit
N	Normality
QC	Quality Control
RL	Reporting Limit
SOP	Standard Operating Procedure
ug	microgram

For a more comprehensive list of common terms and definitions, consult Appendix A in Microbac SOP LQAP.

2.0 SAFETY PRECAUTIONS

2.1 Standard precautionary measures used for handling other organic compounds should be sufficient for the safe handling of the analytes targeted by Method 8330. The only extra caution that should be taken is when handling the analytical standard neat material for the explosives themselves and in rare cases where soil or waste samples are highly contaminated with the explosives. Follow the note for drying the neat materials at ambient temperatures.

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2.2 It is advisable to screen soil or waste samples using Method 8510 to determine whether high concentrations of explosives are present. Soil samples as high as 2% 2,4,6-TNT have been safely ground. Samples containing higher concentrations should not be ground in the mortar and pestle. Method 8510 is for 2,4,6-TNT, however, the other nitroaromatics will also cause a color to develop and provide a rough estimation of their concentrations. 2,4,6-TNT is the analyte most often detected in high concentrations in soil samples. Visual observation of a soil sample is also important when taken from a site expected to contain explosives. Lumps of material that have a chemical appearance should be suspect and not ground. Explosives are generally a very finely ground grayish-white material.

2.3 Proper lab coats, gloves and safety glasses must be worn while performing this extraction.

3.0 SAMPLE PRESERVATION AND STORAGE

3.1 Samples should be collected in wide-mouth glass containers with teflon lined caps.

3.2 Sample preservation should be at ≤ 6° C and the sample maximum holding time from date of collection is 14 days. Samples and sample extract must be kept in the dark at ≤ 6° C.

3.3 Sample dried and crushed weight needed for extraction is 2.0 g if using 8330A and 10.0 g if using 8330B. Contact the Customer Service Representative if insufficient sample is provided for extraction.

3.4 For DoD projects that specify multi increment sampling, a minimum of 1 kg of soil is required.

4.0 INTERFERENCES AND CORRECTIVE ACTION

4.1 Solvents, reagents, glassware and other sample processing hardware may yield discrete artifacts and/or elevated baseline, causing misinterpretation of the chromatograms. All of these materials must be demonstrated to be free from interferences.

4.2 2,4-DNT and 2,6-DNT elute at similar retention times (retention time difference of 0.2 minutes). A large concentration of one isomer may mask the response of the

other isomer. If it is not apparent that both isomers are present (or are not detected), an isomeric mixture is reported.

4.3 Tetryl decomposes rapidly in methanol/water solutions, as well as with heat. All aqueous samples expected to contain tetryl should be diluted with acetonitrile prior to filtration. All samples expected to contain tetryl should not be exposed to temperatures above room temperature.

4.4 Degradation products of tetryl appear as a shoulder on the 2,4,6-TNT peak. Peak heights rather than peak area should be used when tetryl is present in concentrations that are significant relative to the concentration of 2,4,6-TNT.

5.0 EQUIPMENT AND SUPPLIES

5.1 Major Instrumentation

5.1.1 Temperature controlled ultrasonic bath

5.2 Apparatus or equipment

5.2.1 Balance ± 0.01 g

5.2.2 Mortar and pestle

5.2.3 Coffee grinder Kitchen Aid (14 cup, 4 oz. 120 mL) or equivalent

5.2.4 Puck Mill – Lab Tech Essa Lm2-P or equivalent

5.3 Glassware

5.3.1 Pipets - Class A, glass

5.3.2 Pasteur pipets

5.3.3 Scintillation Vials - 40 mL amber, glass

5.3.4 Vials - amber, glass, Teflon-lined cap

5.3.5 Graduated cylinder – 10 mL TD

5.4 Other supplies

5.4.1 Syringes – 1 mL

5.4.2 Sieve – 10 mesh [2.00 mm], 200 mesh [75 um], and 30 mesh [600 um]

5.4.3 Drying trays

5.5 Glassware cleaning should be performed by following Microbac SOP 37.

6.0 STANDARDS AND REAGENTS

6.1 All purchased stock standards and reagents are logged into the LIMS system and assigned certificate of analysis (COA) numbers. All intermediate and working solutions are similarly logged into the LIMS and assigned STD or RGT numbers. Detailed information regarding solution concentrations, aliquot volumes and final volumes and concentrations are included under the STD or RGT number.

6.2 Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available. Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lowering the accuracy of the determination.

6.3 Acetonitrile, CH_3CN - HPLC grade.

6.4 Organic-free reagent water - All references to water in this method refer to organic-free reagent water, as defined in Chapter One of SW846.

6.5 Surrogate: 1,2-Dinitrobenzene 5.0 ug/mL (Accustandard M-8330-SS).

6.6 Spike: (ACCUSTANDARD M-8330-R) or equivalent.

2-Amino-4,6-dinitrotoluene	5.0 ug/mL
4-Amino-2,6-dinitrotoluene	5.0 ug/mL
1,3-Dinitrobenzene	5.0 ug/mL
2,4-Dinitrotoluene	5.0 ug/mL
2,6-Dinitrotoluene	5.0 ug/mL
HMX	5.0 ug/mL
RDX	5.0 ug/mL
Nitrobenzene	5.0 ug/mL
2-Nitrotoluene	5.0 ug/mL

3-Nitrotoluene	5.0 ug/mL
4-Nitrotoluene	5.0 ug/mL
Tetryl	5.0 ug/mL
TNT	5.0 ug/mL
1,3,5-Trinitrobenzene	5.0 ug/mL
Nitroglycerin	5.0 ug/mL

Other compounds of concern may be:

PETN	5.0 ug/mL

6.7 LCS for 8330B DoD – ERA Custom SRM – Cat. No. 093

6.8 Soil Blank Media

6.9 Calcium chloride ($CaCl_2$) – Reagent grade prepared aqueous solution at 5 g/L.

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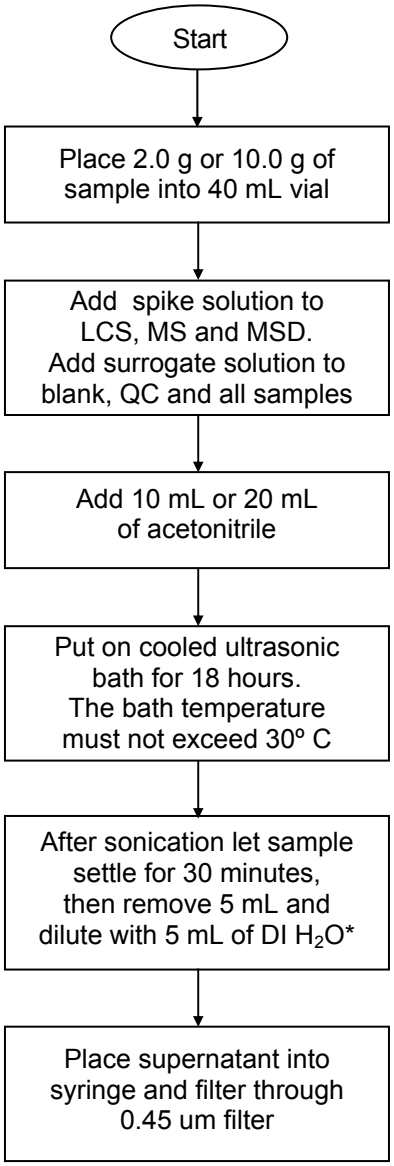
7.0 DIAGRAM OR TABLE TO OUTLINE PROCEDURES



* 8330A uses $CaCl_2$

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8.0 SAMPLE PREPARATION

8.1 Microbac will follow these procedures for drying, sieving, grinding, and multi-Increment subsampling of soil samples in preparation for SW-846 method 8330B. The laboratory obtained additional guidance for these procedures from "DoD Guide for Implementing EPA SW-846 Method 8330B", July 7, 2008.

NOTE: When following 8330A samples are dried to a constant weight at room temperature. The samples are then ground and homogenized to pass through a 30 mesh sieve. The rest of Section 8.0 does not apply to 8330A.

8.2 Sample Drying

Record the date, time, and ambient temperature of the drying room for each day of the drying period.

Before proceeding to the sieving step, the laboratory must verify that the samples have percent solids level of 99%, or higher, or that they reached a constant weight, with consecutive weights agreeing within 1%.

Once dry weigh the entire sample to the nearest 0.1 g and record on the benchsheet. Remove the entire contents of the 8330 sample container and spread the soil evenly in a shallow pan lined with aluminum foil.

8.3 Sieving Procedure

Gently crush the air-dry soil using a large spoon or glass rod and transfer to a clean 2 mm sieve. Stir, shake, and mix the sample and allow it to pass through the sieve, and collect in a foil-lined pan. Do not use excessive force in this step, as this may damage the screens. Do not intentionally include vegetation in the portion that passes the sieve. Remove all large pebbles, sticks, and other solids too large to pass through a 2 mm screen. Collect and weigh any portion that does not pass the sieve. The sample is now the portion that passes the 2 mm screen.

8.4 Grinding Procedure

Transfer the sieved sample to a puck mill, coffee grinder, or mortar and pestle. The choice of the grinding equipment will be project defined. Grind entire sample reducing the particle size to 75 micron, or less.

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NOTE: The laboratory must initially demonstrate that the grinding procedure is capable of reducing the particle size to < 75 um by passing representative portions of ground sample through a 200 mesh sieve.

8.5 Sub-sampling

Transfer the entire ground sample to a clean shallow pan, spreading the soil to thickness of 1–2 cm. Using a small spatula, randomly remove at least thirty increments of approximately 0.33 g each, giving a representative subsample of 10.0 g. Record the weight of the subsample to the nearest 0.01 g. This is the sample aliquot to be taken for extraction via ultrasonic bath.

8.6 Triplicate Analysis and MS/MSD (EDQW or other projects as specified)

For each sample delivery batch of 1–20 samples, process the client-specified sample(s) in triplicate by processing three discrete 10.0 g sub-samples as per 8.4. Individual projects may vary the rate of samples processed in triplicate. Repeat the subsampling procedure two more times for each sample specified for MS/MSD. Do not perform triplicate analysis on any type of blank material.

8.7 Grinding Blanks (EDQW or other projects as specified)

A grinding blank with each batch of samples is used to verify the effectiveness of the cleaning procedures. Some projects may require grinding blanks after each sample. The project QAPP specifies the frequency of these blanks, and are logged into the LIMS accordingly. The grinding blank(s) must meet the same criteria as the 8330B method blank (no target analytes ≥ one-half the RL).

8.8 Grinder Cleaning Procedures

Use the following procedures to clean the mortar and pestle, coffee grinder(s), or puck and bowl between samples:

1. Remove bowl/blade from base of grinder or bowl and puck from mill.
2. Immerse bowl/blade or puck in soapy water and remove all visible soil residue
3. Rinse with tap water
4. Rinse with DI Water
5. Wipe with paper towel and air dry and with puck and bowl can use acetone.

8.9 MDL Verification Procedures

The laboratory will verify MDLs with blank spikes at approximately two (2) times the current MDLs . These samples are spiked pre-grinding (step 8.4). Perform these verification procedures after the initial MDL study, and quarterly thereafter.

9.0 ANALYTICAL PROCEDURES

9.1 Place 10.0 g sub-sample (sample homogenized, dried, and ground as in Section 8.0) of each soil in a 40 mL amber vial. Add 1 mL of surrogate to all samples, blanks, LCS and spikes. Add 1 mL of spike to all designated QC. Add 20 mL of acetonitrile, cap with a Teflon-lined cap, and swirl for 1 minute. Place in a cooled ultrasonic bath for 18 hours. The temperature of the bath must not exceed 30° C. [For screening purposes, the ultrasonic bath time may be cut to 4 hours] **NOTE:** If performing 8330A, only 2.0 g of sub-sample is needed and 10 mL of acetonitrile is used.

9.2 Remove 5 mL of extract and dilute with 5 mL of DI H_2O. After extraction, allow the sample to settle for thirty (30) minutes. If performing 8330A, dilute with 5 mL of $CaCl_2$ instead of DI H_2O.

9.3 Using a 10 mL disposable syringe, remove 8 mL of the extract and filter through a 0.45 um PTFE filter, discarding the first mL. You may remove any remaining solids using centrifugation.

10.0 QUALITY CONTROL REQUIREMENTS

10.1 Standard Requirements

10.1.1 A reagent blank, LCS, MS and MSD are extracted with each batch. The only exception is if the client does not send enough sample to perform a MS and MSD, then a reagent blank, LCS and a LCSD is performed at the client's request.

10.1.2 All batch QC samples are subjected to exactly the same extraction and clean-up procedures as those used on actual samples in the extraction batch.

10.2 DoD DoD/EDQW Requirements (This does not apply if using 8330A.)

10.2.1 Each preparation batch must consist of a minimum of a method blank and an LCS using the DoD SRM. The batch may also include MS/MSD samples, triplicate

samples, and additional grinding blanks as specified in the LIMS project details. The laboratory will subject the batch QC samples to the sample preparation procedures (Section 8.0) as the field samples.

10.2.2 For the method blank, weigh a nominal 10.0 g subsample of ground soil blank media (6.8), record the weight to 0.01 g, and perform normal extraction.

10.2.3 For the LCS and LCSD, weigh a nominal 10.0 g subsample of the dry, ground DoD SRM (6.7), record the weight to 0.01 g, and perform the normal extraction.

10.2.4 For MS/MSD samples, weigh a nominal 10.0 g subsample of the ground parent, record the weight to 0.01 g, spike with 1000 uL of spike solution (6.6), and perform the normal extraction.

10.3 Control of Nonconforming Data

The laboratory implements general procedures to be followed when departures from documented policies, procedures and quality control have occurred. The policies and procedures are found in Section 13.0 of Microbac SOP LQAP (Laboratory Quality Assurance Program), Microbac SOP GP-CAPA (Corrective Action/Preventive Action: Initiating, Tracking and Monitoring) and Microbac SOP GP-RCA (Root Cause Analysis).

11.0 WASTE MANAGEMENT AND POLLUTION CONTROL

11.1 Microbac is dedicated to eliminating or minimizing any and all laboratory waste, which requires disposal or contributes to pollution of any type. To that extent Microbac has implemented new technology and converted to micro techniques when available to facilitate these goals.

Each laboratory generates specific waste streams which are segregated and collected in labeled satellite containers. The analysts in each department are responsible for proper disposal of the spent samples and chemical waste in the specified satellite waste collection vessel. The waste management technician checks the satellite containers either daily, or as needed. They are then combined into waste drums in our explosion-proof waste building located outside of the Microbac laboratory facility. These drums are labeled with start date and a manifest is created for each. They are picked up on a regular basis for disposal at a licensed disposal facility.

11.2 Laboratory policies and procedures for management of hazardous waste are found in Microbac SOP 33 – Laboratory Waste Management and the waste management section of the analytical SOPs contain procedures specific to

each method. All laboratory waste is accumulated, stored and disposed in accordance with all federal and state laws and regulations. Each employee receives training in the proper handling and disposal of hazardous waste that is specific to their job description. As a hazardous generator, we are subject to inspection from the Ohio EPA.

11.3 The following are waste streams in the sample preparation area, for the solid extraction Methods 8330A and 8330B.

11.3.1 Non-Halogenated solvents: Hexane, Ether, Methanol, Acetone

11.3.2 Acetonitrile: Acetonitrile

11.3.3 Solid Waste: Filters, tongue depressors, gloves, any solid material that is a waste after being processed in the lab. These wastes are all kept in satellite containers in each lab and are combined into the proper 55 gallon waste drums in our explosion proof waste building located outside of the Microbac laboratory facility by a waste disposal technician. These drums are labeled and a manifest is created for each drum.

12.0 REFERENCES

12.1 Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition, Method 8330A and 8330B, 8510.

12.2 “Guide for Implementing, SW-846 Method 8330B”, DoD Environmental Data Quality Workgroup, July 7, 2008.

12.3 Microbac SOP37 “Standard Operating Procedure for Extraction Glassware Washing”

12.4 Microbac SOP 33 “Laboratory Waste Management”

12.5 Microbac SOP LQAP “Laboratory Quality Assurance Plan”

12.6 Microbac SOP GP-CAPA “Corrective Action/Preventive Action: Initiating, Tracking and Monitoring”

12.7 Microbac SOP GP-RCA “Root Cause Analysis”

12.8 Microbac SOP 45 “Method Validation Procedures”

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STANDARD OPERATING PROCEDURE
NITROAROMATICS AND NITRAMINES BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY METHOD 8330

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1.0 SCOPE AND APPLICATION

1.1 Methods 8330A and 8330B are designed to determine trace level concentrations of explosives and their residues in solid, soil and water samples. A list of target analytes appears in Tables 1 and 2. PETN may also be analyzed by modifications of this method presented in Appendix II.

1.2 This SOP also contains special analytical procedures to comply with the unique requirements presented in DoD's "Guide for Implementing SW-846 Method 8330B", July 7, 2008. The laboratory will use the LIMS to indicate when the special Department of Defense Quality Systems Manual procedures must be followed.

1.3 The method involves analysis with a High Performance Liquid Chromatograph of samples that have been prepared using a Solid-Phase Extraction for aqueous samples or solvent extracted for soil/solid samples.

1.4 The RL for this method is approximately 0.1 mg/kg (wet weight) for soil/sediment samples and 0.25 ug/L for water samples. RLs will be proportionately higher for sample extracts that required dilution to avoid detector saturation. RLs for projects following the DoD/EDQW will be set at three times the MDL.

1.5 This method is restricted to use by or under the supervision of analysts experienced in the use of HPLC and interpretation of chromatographs. Each analyst must demonstrate the ability to generate acceptable results with this method.

1.6 Definitions and Acronyms

The following is a list of terms, definitions, and acronyms referenced in this SOP that are unique to the method.

CCV	Continuing Calibration Verification
COA	Certificate of Analysis
DoD/EDQW	Department of Defense Quality Systems Manual
HMX	Octahydo-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
HPLC	High Performance Liquid Chromatography
ICAL	Initial Calibration
ICV	Initial Calibration Verification
LCS	Laboratory Control Sample
LCV	Low Calibration Verification
LOD	Limit of Detection
LOQ	Limit of Quantitation

LQAP	Laboratory Quality Assurance Program
MDL	Method Detection Limit
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NCR	Nonconformance Report
PETN	Pentaerythritol tetranitrate
RDX	Hexahydro-1,3,5-trinitro-1,3,5-triazine
RL	Reporting Limit
RSD	Relative Standard Deviation
SOP	Standard Operating Procedure
SPE	Solid Phase Extraction
QC	Quality Control

For a more comprehensive list of common terms and definitions, consult Appendix A in Microbac SOP LQAP.

2.0 SAFETY PRECAUTIONS

2.1 Methanol and acetonitrile solvents are used in this method. Both solvents are extremely hazardous and must be used only with proper ventilation and personal protective equipment including gloves. A fume hood is in place to ensure operation safety.

2.2 Explosive Standards

The lab will only use low-level explosive standards while performing this method. The levels, which are 1000 ppm or less, should pose no danger. If neat standards are used the analyst is reminded of the dangers associated with handling high-level explosive compounds. These compounds are shock sensitive and care must be taken to ensure safe handling. Explosive shields should be used.

3.0 SAMPLE PRESERVATION AND STORAGE

3.1 Sample size and collection requirements are beyond the scope of the SOP; refer to Microbac Extraction lab SOPs and SW-846 for details.

3.2 After the samples have been extracted, they must be stored at ≤ 6° C until the instrumental analysis can proceed. The samples must be analyzed within 40 days from the day of the extraction.

4.0 METHOD PERFORMANCE

4.1 Table 1 summarizes the performance data for water analysis; Table 2 summarizes performance data for soil/solid waste analysis. These tables include the analyte list, ranges for accuracy and precision, nominal laboratory RL, and the current laboratory MDLs.

4.2 The laboratory performed an initial assessment of the MDL using the procedures outlined in 40 CFR Part 136. Results are filed electronically at H:\DATA\COMMON\MDL.

4.3 The LOD, or verified MDL, are presented in Tables 1 and 2 and were established using verification procedures outlined in Microbac SOP 45.

4.4 The LOQ are the nominal laboratory RLs and were established as per Microbac SOP 45.

4.5 Method performance data for PETN can be found in Tables 5 and 6.

4.6 Precision and accuracy data were derived from an initial demonstration of capability using spiked control samples. The laboratory uses results from LCS to assess precision/accuracy and to annually evaluate the associated control limits.

4.7 Project specific QA objectives may be found in the appropriate statement-of-work or QAPP.

5.0 INTERFERENCES AND CORRECTIVE ACTION

5.1 All possible measures are taken to eliminate interferences from glassware and other equipment. Possible interferences from this source include artifact peaks and elevated baselines.

5.2 Only HPLC grade solvents are used.

5.3 Tetryl may decompose rapidly in methanol/water solutions or with the presence of heat.

6.0 EQUIPMENT AND SUPPLIES

6.1 HPLC and related equipment:

- Agilent 1100 or 1200 series HPLC system

- Quaternary HPLC pump
- Autosampler unit
- UV-Diode Array Detector
- Vacuum Degasser
- HP 3D Chemstation Software for LC
- Primary column: Phenomenex Ultracarb 5u ODS (20) column (250 x 4.60 mm)/with guard cartridge system or equivalent
- Confirmation column: Dionex Acclaim E2 5u (250 x 4.60 mm) column or equivalent

6.2 Filter - 0.45 um

6.3 Syringe (gas tight) - 10 uL, 100 uL, 1 mL

7.0 STANDARDS AND REAGENTS

7.1 All purchased stock standards and reagents are logged into the LIMS system and assigned certificate of analysis (COA) numbers. All intermediate and working solutions are similarly logged into the LIMS and assigned STD or RGT numbers. Detailed information regarding solution concentrations, aliquot volumes and final volumes and concentrations are included under the STD or RGT number.

7.2 Water - HPLC grade (J.T. Baker 4218-03 or equivalent)
Methanol - HPLC grade (J.T. Baker 9093-33 or equivalent)
Acetonitrile - HPLC grade (J.T. Baker 9017-03 or equivalent)

7.3 Commercial surrogate stock, 1,2-dinitrobenzene, at 1000 ug/mL in MeOH is purchased from Accustandard (M-8330-SS) or equivalent.

7.4 Stock calibration standard: Commercial standards at 1000 ug/mL in MeOH:AcCN (1:1) are purchased from Accustandard: M-8330-A-10X (mix A), M-8330-B-R-10-X (mix B) and M-8330-ADD-1 (nitroglycerin).

7.4.1 50 microliters each of each standard mix and 50 microliters of surrogate stock (7.4) are added to a 10 mL volumetric flask, which is partially filled with HPLC grade acetonitrile. The flask is filled to the mark with acetonitrile, stoppered, and inverted three (3) times to mix before the contents are transferred to an amber bottle with a teflon lined cap. This intermediate alternate source standard contains 5000 ug/L of each explosive and the surrogate, 1,2-dinitrobenzene. This intermediate standard can be stored at 4° C and used for up to one month.

7.4.2 A dilution solvent, which resembles the eluent, and/or the final extract solvent is prepared for use in diluting the calibration standards. 10 mL of acetonitrile is placed into a 40 mL amber vial and mixed with 10 mL of HPLC water.

7.4.3 Calibration standards are prepared in amber vials from the intermediate standard using the following scheme:

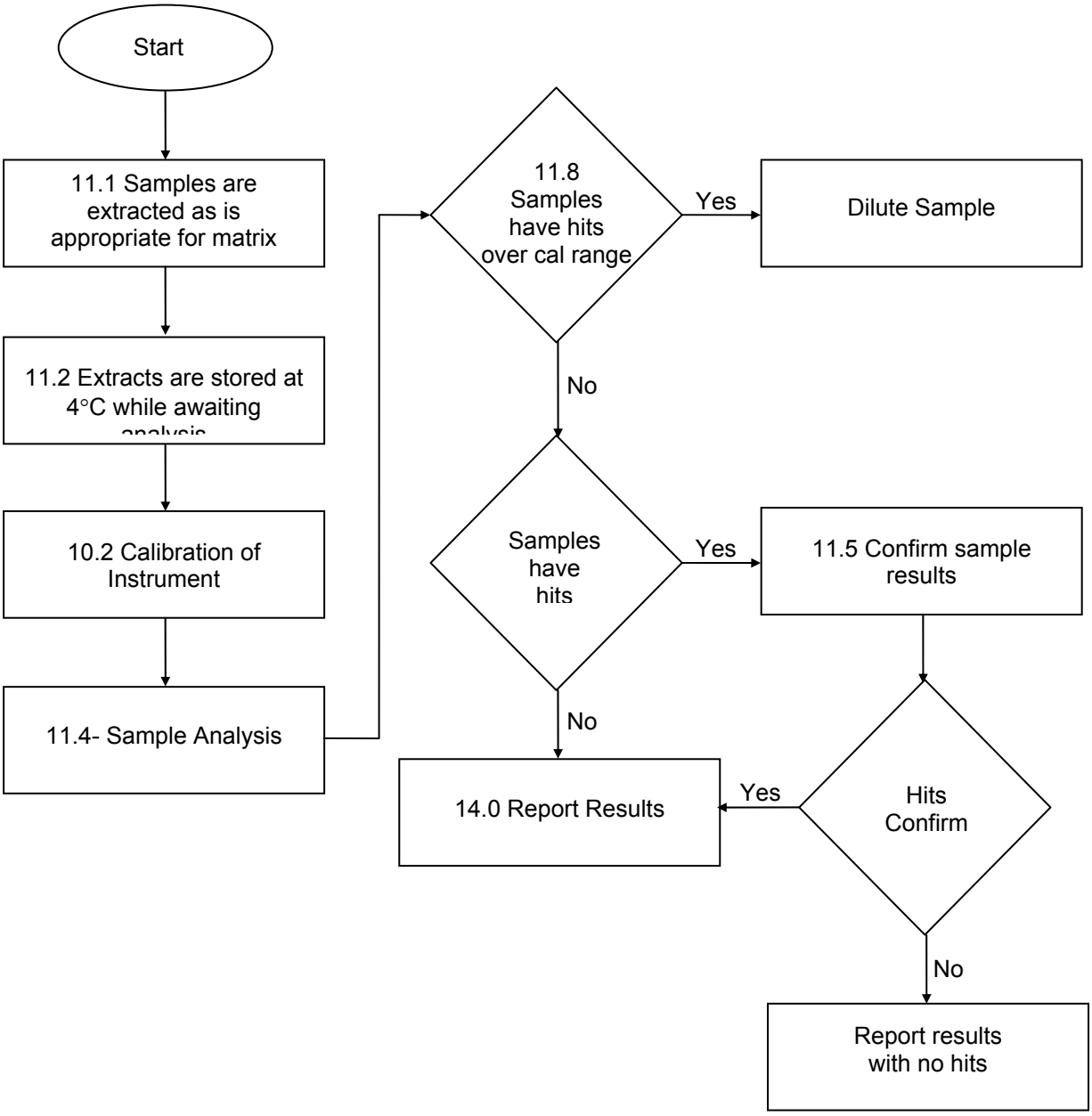
Calibration Std. #	Concentration	Preparation
6	2500 ug/L	600 uL of intermediate (7.6) plus 600 uL HPLC H_2O
5	1000 ug/L	400 uL of std. 6 plus 600 uL of solution 7.7
4	500 ug/L	400 uL of std. 5 plus 400 uL of solution 7.7
3	100 ug/L	200 uL of std. 4 plus 800 uL of solution 7.7
2	50 ug/L	100 uL of std. 4 plus 900 uL of solution 7.7
1	25 ug/L	400 uL of std. 2 plus 400 uL of solution 7.7

7.5 ICV standards at 100 ug/mL are purchased from Supelco (8330 Mix A #4-7283, 8330 Mix B #4-7284, Nitroglycerin #31498 or equivalents).

7.5.1 200 uL each of mix A, mix B and nitroglycerin (7.4) are added to a 10 mL volumetric flask, which is partially filled with HPLC grade acetonitrile. 20 uL of surrogate stock (7.5) is also added to the volumetric flask. The flask is filled to the mark with acetonitrile, stoppered, and inverted three (3) times to mix before the contents are transferred to an amber bottle with a teflon lined cap. This intermediate alternate source standard contains 2000 ug/L of each explosive and the surrogate, 1,2-dinitrobenzene. This intermediate standard can be stored at 4° C and used for up to one month.

The ICV standard is prepared in amber vials using an intermediate dilution. First, 600 uL of the intermediate alternate source standard (7.5) is added to a vial with 600 uL of HPLC grade water and mixed yielding a 1000 ug/L standard. Then, 600 uL of this 1000 ug/L standard is added to a vial with 600 uL of dilution solvent (7.4.2) and mixed yielding the 500 ug/L ICV standard.

8.0 DIAGRAM OR TABLE TO OUTLINE PROCEDURES



9.0 SAMPLE PREPARATION

9.1 The preparation of the samples is beyond the scope of this SOP. Please refer to Microbac SOP's EXTNT01 and EXTNT02 for details on sample preparation.

10.0 CALIBRATION PROCEDURES

10.1 Recommended HPLC conditions:

Column:	Ultracarb 5u ODS (250 x 4.6 mm)
Injection Volume:	100 uL
Flow Rate:	0.8 mL/min
Eluent (isocratic):	51.9% methanol/48.1% water
UV Detector	254 nm

10.2 The initial calibration is accomplished by injecting 100 uL of each calibration standard. A linear curve is determined for concentration versus peak area count for each analyte. The correlation coefficient must be ≥ 0.995. If this criteria is not met then the problem must be discerned and the calibrations repeated.

10.2.1 The use of a linear regression fit can cause significant bias at the lower calibration points. A weighing factor (1/X or $1/X^2$) may be used to minimize this bias.

10.3 LCV: For DoD projects, the low calibration standard is reanalyzed immediately following the calibration. All target analyte recoveries must be within 80-120% of the true value.

10.4 ICV: After the analysis of the calibration the second source standard at the continuing calibration level is analyzed. The ICV should have a %D ≤ 30. If corrective action is not taken and analysis proceeds with a failing ICV, results for those compounds that fail to meet the %D limit must be qualified as estimated. For DoD/EDQW projects, the %D must be less than 15% for 8330A and less than 20% for 8330B.

10.5 CCV: At the beginning of each daily analysis and after every ten (10) samples, a 500 ug/L continuing calibration verification must be analyzed. This is done to determine if the response of the analytical system has changed. Details for calculating the %D for the CCV can be found in Section 12.0 of this document. The %D should be ≤ 20%. If a CCV fails to meet this criteria, a second CCV may be analyzed. Failure of two consecutive CCV's requires that the problem be discerned and recalibration may be required. Any samples not bracketed between two passing CCV's must be re-analyzed. If only a few analytes fail the CCV

criteria, analysis may proceed but the resulting data must be qualified as estimated.

10.5.1 Projects requiring the use of Method 8330A (e.g. South Carolina) require the CCV %D to be ≤ 15%.

10.6 Recommended HPLC conditions for 2nd column confirmation:

Column:	Acclaim Explosives E2 5um 120Å (4.6 x 250mm)
Injection Volume:	100 uL
Flow Rate:	0.80 mL/min
Eluent:	48% MeOH, 17.5% AcCN, 52% water
UV Detector:	254 nm

10.7 The second column is calibrated using the same scheme as indicated for the primary analysis (10.2). The confirmation column must meet the same calibration criteria as the primary column.

NOTE: If there is insufficient resolution of analytes then it will be necessary to process two (2) separate sets of calibration standards. This can be done by modifying the preparation of the intermediate standard (7.5) and the alternate intermediate standard (7.5). In both situations two (2) intermediate standards are made; one from mix A stock standard and one from mix B stock standard. Both intermediate standards are then used to prepare six (6) calibration standards in the same scheme as 10.2.

11.0 ANALYTICAL PROCEDURES

11.1 The instrument(s) are calibrated and the analytical sequence proceeds as follows:

Analytical batch sequence:

ICAL or CCV
Method blank
LCS, LCSD
7 samples (8 if no LCSD; including MS/MSD, sample/sample duplicate)
Solvent rinse (optional)
CCV
10 samples
CCV standard
etc., with a CCV as the last injection of the sequence

11.2 A report of ND (not detected) is a form of quantitation and must therefore adhere to these rules. The list of compounds requested by the client will constitute the target compounds to be analyzed. Calibration standards which fail criteria for compounds not on the target compound list, will not be considered when interpreting the check standard. Only target compounds, as defined by the clients request will be reported.

11.3 Retention time windows are established in accordance with SW-846 Method 8000B. They are established at initial method setup and repeated when there is a column change or a major modification to the method. The width of retention time windows are defined as ± three times the standard deviation of the retention time of a standard analyzed on three consecutive days. The retention time windows are calculated by analyzing three injections of a standard over the course of a 72 hour period, calculating the standard deviation of the target analytes' retention time, and multiplying each of the standard deviations by 3. The retention time window for a particular analyte then is ± this value. The center of the retention time window is the retention time of each analyte taken from the continuing calibration verification standard run at the beginning of a daily sequence.

11.4 After sample analysis, the data system produces a quantitation report listing target analytes and concentrations found in the sample. A compound is considered tentatively identified if it falls within the calculated retention time window.

11.5 Tentatively identified compounds are confirmed either by reanalysis using an Acclaim Explosives E2 column or by UV diode array detector. Second-column confirmation is a requirement for DoD projects.

11.5.1 To confirm a tentatively identified compound using the UV diode array detector, a UV scan from 190 nm to 400 nm is stored during analysis for each chromatographic peak. Any compound, which is tentatively identified because of its presence in the retention time window of a calibrated explosive is then compared to a stored library of the explosive compounds. The Agilent software is directed to perform a spectrum search for each tentatively identified compound. This action produces a table of match quality along with an overlay of the target peak's spectrum with the library spectrum. Match quality will be a number with a maximum value of 1000. Tentatively identified compounds are confirmed if the match number is ≥ 950. If a compound does not confirm at this match level but has resulted in a spectral overlay which has similarities to the library compound then a second column confirmation will be needed. This may occur when sample matrix effects limit the resolution of the analytes spectrum from the background reference. If the match number is < 950 and no spectral similarity is seen then the compound is not confirmed.

11.5.2 To confirm a tentatively identified compound by second column the sample is re-analyzed utilizing an Acclaim Explosives E2 column which yields different retention times for the explosive compounds. If the RPD for the confirmed results are ≥ 40%, report both results and apply the "P" qualifier. For DoD/EDQW samples, report both results and apply the "J" qualifier, if the RPD exceeds 40%. Address all anomalies in the case narrative.

11.6 If the response for any target analyte exceeds the initial calibration range, the sample must be diluted. Dilutions are prepared so that the majority of compounds above the calibration range fall near the midpoint of the calibration. Dilutions are prepared in a 1:1 mix of acetonitrile: water using syringes to transfer aliquots of extract into appropriate amounts of solvent in autosampler vials. Examples are presented below:

Dilution	Amount sample extract (uL)	Amount Solvent (uL)	Final dilution volume (uL)
2x	200	200	400
5x	100	400	500
10x	100	900	1000
20x	50	950	1000

Higher dilutions are prepared by performing serial dilutions, e.g. for a 100x dilution, a 10x dilution is diluted again by a factor of 10.

11.7 After the raw data is processed, it is uploaded into the LIMS.

11.8 The analyst will perform a primary review and data verification, followed by a secondary review by a peer for quality and completeness.

12.0 DETAILS OF CALCULATIONS

12.1 The calibration factor (CF) from the initial calibration is calculated using the formula:

$$CF = \frac{C_s}{A_s}$$

where:

A_s = Peak area for the analyte or surrogate in the external standard
C_s = Concentration of the external standard (ug/L)

12.2 The slope is calculated using the formula:

$$\frac{n\left(\sum_{1}^{n}(C_s)(A_s)\right)-\left(\sum_{1}^{n}C_s\right)\left(\sum_{1}^{n}A_s\right)}{n\left(\sum_{1}^{n}C^2{}_s\right)-\left(\sum_{1}^{n}C_s\right)^2}$$

12.3 The intercept of the area axis is calculated using the formula:

$$\frac{\left(\sum_{1}^{n}A_s{}^2\right)\left(\sum_{1}^{n}C_s\right)-\left(\sum_{1}^{n}A_s\right)\left(\sum_{1}^{n}A_sC_s\right)}{n\left(\sum_{1}^{n}C_s{}^2\right)-\left(\sum_{1}^{n}C_s\right)^2}$$

12.4 The % drift is calculated using the formula:

$$\%D=\left[\frac{(C_t-C_x)}{C_t}\right]100$$

where:

C_t = True concentration of the analyte or surrogate in the standard
C_x = Measured concentration of analyte or surrogate in the standard

12.5 The % RSD is calculated using the formula:

$$RSD=\left(\frac{s}{\overline{CF}}\right)100$$

where:

s = standard deviation
$\overline{CF}$ = mean calibration factor

12.6 Linear calibration calculations (external standard method)

12.6.1 The response ratio is plotted vs. the concentration ratio giving a linear equation:

$$y = mx + b$$

where:

y = Response (area) = R
x = Concentration = C_i
And m and b are the slope and intercept from the regression equation

For a given response ratio we can solve for C_i:

12.6.2 $$C_i = [R - b]/m$$

Use equations 12.8 or 12.9 to calculate the sample concentration, C_x.

12.7 Solving for the concentration in water sample:

For a given concentration, compute the unknown, C_x

$$C_x = (C_i)\left(V_f / V_i\right)(D)(1000)$$

where:

C_i = concentration in the extract (ug/mL)
V_f = final sample (extract) volume (mL)
V_i = initial sample volume (mL)
D = dilution factor
C_x = concentration in the sample (ug/L)

12.8 Solving for the concentration in soil sample:

$$C_x = (C_i)\left(V_f / W_i\right)(D)(1000)$$

where:

C_i = concentration in the extract (ug/mL)
V_f = final sample (extract) volume (mL)
W_i = initial sample weight (g)
D = dilution factor
C_x = concentration of the sample (ug/kg) (as received)

12.9 The LCS recovery is calculated as follows:

$$\%R = \left(\frac{C_x}{C_T}\right)100$$

where:

C_x = the concentration of the analyte in the LCS.
C_t = the theoretical spike concentration.
$\%R$ = percent recovery

12.10 The % Recovery of the matrix spike is calculated using the formula:

$$\%R = \left[\frac{(C_{spk} - C_x)}{C_t}\right]100$$

where:

C_{spk} = the concentration of the analyte in the spiked sample
C_x = the concentration of the analyte in the reference (parent) sample
C_t = the theoretical spike concentration.
$\%R$ = percent recovery

12.11 The relative percent difference is calculated using the formula:

$$RPD = \left[\frac{|C_1 - C_2|}{(C_1 + C_2)}\right]200$$

where:

C_1 = Concentration of the first sample
C_2 = Concentration of the second sample

13.0 QUALITY CONTROL REQUIREMENTS

13.1 The quality control procedures discussed in this section are intended to monitor and control the entire analytical process. Batch quality samples are specified for method blanks (MB), LCS, MS, MSD and surrogate compounds. A batch is defined as a group of samples, which are extracted together. A batch contains a

maximum of 20 samples. Additional procedures were defined in Section 8.0 for initial calibration, ICV using a second source, and CCV, and are included in the overall review process. The procedures, required frequency, acceptance criteria, and the required corrective action measures are outlined in Table 4. The MS/MSD samples may be waived if insufficient sample is available. All QC samples must undergo the identical extraction and cleanup procedures as each sample in the batch. A standard containing the analytes of interest is used as the spike in the LCS, MS, and MSD. The LCS, MS and MSD will all be spiked so as to yield a concentration that falls within the mid-point of the curve.

13.2 The method blank cannot contain amounts of any target analytes, which are above the RL. If any target analytes are found in the method blank with concentrations higher than the RL, the entire batch must be re-extracted and the analysis performed again. All blanks are evaluated down to the current MDL for the presence of target analytes. Any amount of target analytes found in the blank at a level greater than the current MDL are reported in the LIMS and these values will appear on the QC summary sheet for the batch. For DoD projects, the blank is evaluated to one-half of the RL.

13.3 The LCS must be evaluated for the acceptance criteria listed in Tables 1 and 2, and for any project specific criteria which may be more, or less, stringent. Upon completion of a batch of samples, LCS summary reports are generated by the analyst, which compare the actual recoveries to the applicable acceptance ranges for the samples in the batch. The standard laboratory limits specified in Tables 1 and 2 are used in the absence of a project QAPP, or program specified control limits. If more than 10% of the LCS analytes are out of the laboratory limits, the analyst must stop the analysis, prepare an NCR, and contact the department supervisor for the appropriate corrective action. If any of the identified project specific chemicals of concern (COC) are outside the control limits, the analyst must stop the analysis and prepare an NCR to be reviewed by the department supervisor. Corrective action consists of re-extraction and re-analysis of the affected samples for, at a minimum, the COC for which a result was derived outside control limits, unless the client's representative and the Quality Assurance Officer (QAO) approve of another course of action.

13.5 A standard reference material (SRM) is used in lieu of the normal soil LCS for all DoD/EDQW projects performed under reference 17.2. The laboratory derived acceptance limits for the SRM (ERA Cat. # 093) are presented in Table 3.

13.6 In order to monitor the extraction efficiency in each sample, a surrogate solution containing 1,2-dinitrobenzene is added to each sample in the extraction batch. The recoveries for this surrogate must fall within the limits given in Tables 1 and 2. If any individual sample has the surrogate outside the given limit, then the sample must be re-extracted. Surrogate limits are listed in Tables 1 and 2.

13.7 Compounds are normally confirmed by diode array detector; however, when required by a specific project i.e. DoD they may be confirmed by re-analysis using an alternate column. If the results between the primary and secondary column vary by more than 40%, the higher of the results is reported unless sample matrix effects (e.g. interfering peaks) are present. The confirmation column must meet all quality control acceptance criteria.

13.8 Triplicate Analysis (DoD/EDQW and other projects as specified)

Selected projects that are conducted in strict accordance with the DoD/EDQW guide, may require triplicate analysis of selected samples. Normally, samples are selected by the client that are expected to contain explosives above the RL. The %RSD for these the reportable analytes must not exceed 20%. Corrective action and/or data flagging must be initiated when these criteria are not met.

13.9 Control of Nonconforming Data

The laboratory implements general procedures to be followed when departures from documented policies, procedures and quality control have occurred. The policies and procedures are found in Section 13.0 of Microbac SOP LQAP (Laboratory Quality Assurance Program), Microbac SOP GP-CAPA (Corrective Action/Preventive Action: Initiating, Tracking and Monitoring) and Microbac SOP GP-RCA (Root Cause Analysis).

13.9.1 Nonconformances Requiring Corrections

A nonconformance occurs when any aspect of the method QC in an analysis, as outlined in Table 4 does not meet acceptance criteria. When nonconforming data occurs the employee initiates an NCR and proceeds with indicated corrections as per Table 4.

All data shall be scrutinized by the analysts for method and project specific compliance. Checklists are utilized and accompany each data batch (Figure 1).

A nonconformance shall be documented in the NCR followed by one or more of the following actions.

- Reanalysis of the sample(s) in question
- Discussion and qualification of data (report and narrative)
- Client notification with approval
- Data qualification (Q-flagging)
- Re-sampling and reanalysis (client decision)

13.9.2 Nonconformances Requiring Corrective Action

Corrective action is required when a nonconformance is recurring, if the correction is ineffective or if the departure is so significant that it negatively effects data quality, sample integrity or customer satisfaction. When an event requiring corrective action is identified, the employee shall initiate a Corrective Action/ Preventive Action form as per Microbac SOP GP-CAPA. The corrective action process includes a root cause analysis as per Microbac SOP GP-RCA, corrections, corrective action(s) and evidence of effectiveness.

13.9.3 Nonconformances Not Requiring Corrections

There are some standard contingencies to the traditional corrections that may be invoked. In many situations it may not be necessary to perform sample reanalysis or re-extraction for the following quality control departures, provided they are not a chronic problem or indicative of a trend, and the laboratory provides documentation in the report narrative and project files. In addition, the employee is required to initiate a NCR to record the event. The data may be reported as per the following exceptions.

- An LCS or surrogate recovery exceeds the upper control limit, but the corresponding sample results are non-detect.
- A method blank is greater than or equal to the reporting limit, but the corresponding sample results are non-detect.
- Surrogate recovery is high and the samples are non-detect.
- The continuing calibration verification (bracketing) is biased high and the samples are non-detect.
- There is insufficient sample volume or weight to perform a corrective action.
- The sample has exceeded holding time.

14.0 DATA REVIEW AND REPORTING REQUIREMENTS

14.1 Data Review

Prior to data entry into the LIMS (either manual or automatic), all data must undergo two (2) levels of review in the department. The primary review is performed by the analyst and the secondary review is performed by either the department supervisor (or a designee) or another qualified analyst.

14.2 Data Reporting

The reporting requirements depend upon the need of the client. Microbac offers four levels of data reporting which are described in some detail below.

14.2.1 Level 1 reporting provides the client with the results for all samples submitted for analysis. No other documents or raw data are provided with this level of report.

14.2.2 Level 2 reporting provides the client with all of the information contained in a Level 1 report plus a summary of all of the QC analysis associated with the samples submitted by the client.

14.2.3 Level 3 reporting is essentially a custom report provided to the client that contains any additional data from the analysis that the client might request.

14.2.4 Level 4 reporting is provided in those cases where the client wishes to perform full data validation. All raw data, lab generated logs, and other associated data are provided.

14.2.5 Results for water samples are reported in ug/L to three significant figures.

14.2.6 Results for soil samples are reported in ug/kg, or mg/kg, on a dry weight basis to three significant figures.

15.0 PREVENTIVE MAINTENANCE

15.1 All extracts analyzed should be put through a 0.45 um filter prior to analysis.

15.2 A guard column may be used. Connect the guard column just before the analytical column.

16.0 WASTE MANAGEMENT AND POLLUTION CONTROL

16.1 Microbac is dedicated to eliminating or minimizing any and all laboratory waste, which requires disposal or contributes to pollution of any type. To that extent Microbac has implemented new technology and converted to micro techniques when available to facilitate these goals.

Each laboratory generates specific waste streams which are segregated and collected in labeled satellite containers. The analysts in each department are responsible for proper disposal of the spent samples and

chemical waste in the specified satellite waste collection vessel. The waste management technician checks the satellite containers either daily, or as needed. They are then combined into waste drums in our explosion-proof waste building located outside of the Microbac laboratory facility. These drums are labeled with start date and a manifest is created for each. They are picked up on a regular basis for disposal at a licensed disposal facility.

16.2 This method generates wastes in the form of sample extracts in vials, which are placed in the satellite waste container labeled for Waste Vials/Sample Extracts (D001, F002).

16.3 Laboratory policies and procedures for management of hazardous waste are found in Microbac SOP 33 Laboratory Waste Management and the waste management section of the analytical SOPs contain procedures specific to each method. All laboratory waste is accumulated, stored and disposed in accordance with all federal and state laws and regulations Each employee receives training in the proper handling and disposal of hazardous waste that is specific to their job description. As a hazardous generator, we are subject to inspection from the Ohio EPA.

16.4 The waste streams generated by the HPLC are as follows:

- Non – halogenated solvents (methanol and acetonitrile)
- Solid waste (auto-sampler vials)

17.0 REFERENCES

17.1 SW-846 Method 8330B, Revision 2, October 2006

17.2 Guide for Implementing EPA SW-846 Method 8330B, DoD Environmental Quality Workgroup (EDQW), July 2008.

17.3 SW-846 Method 8330A, Revision 1, February 2007.

17.4 Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Method 8000B, Revision 2, December 1996.

17.5 Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Method 8000C, Revision 3, March 2003.

17.6 Microbac SOP33, “Laboratory Waste Management”

17.7 Microbac SOP LQAP, “Laboratory Quality Assurance Plan”

17.8 Microbac SOP45, “Standard Operating Procedures for Method Validation Procedures”

17.9 Microbac SOP GC-CAPA, “Corrective Action/Preventive Action: Initiating, Tracking and Monitoring”

17.10 Microbac SOP GP-RCA, “Root Cause Analysis”

APPENDIX I
South Carolina Requirements

The state of South Carolina requires the use of Method 8330A for sample analysis.

APPENDIX II
Analysis of PETN

The following changes are made to SOP HPLC02 for the analysis of pentaerythritol tetranitrate (PETN) by HPLC:

1.0 The primary stock standard is purchased from Restek (31600) at a concentration of 1,000 ug/mL. Working standards are made as in Section 7.4 of HPLC02.

2.0 The alternate source stock standard is purchased from AccuStandard (M-8330B-ADD-2) at a concentration of 100ug/ml and prepared as in Section 7.5 of HPLC02.

3.0 Recommended HPLC conditions;

Column:	Restek Pinnacle II C18 100 mm X 4.6 mm
Injection Volume:	100 uL
Flow rate:	1.0 mL/min
Eluent:	52% H2O, 48% Methanol
UV detector:	Diode Array Detector @ 210 nm

4.0 See Table 5 for QA Objectives.

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TABLE 1
MICROBAC's OBJECTIVES AND ANALYTICAL METHODS FOR NITROAROMATIC EXPLOSIVES ANALYSES OF WATER SAMPLES

PARAMETER	CAS #	ACCURACY (% RECOVERY)*	PRECISION (% RPD)*	OBSERVED MDL WATER (ug/L)	REPORTING LIMITS WATER (ug/L)
1,3,5-trinitrobenzene	99-35-4	65-140	0-20	0.25	1
1,3-dinitrobenzene	99-65-0	45-160	0-20	0.25	1
2,4,6-trinitrotoluene	118-96-7	30-135	0-20	0.25	1
2,4-dinitrotoluene	121-14-2	60-135	0-20	0.25	1
2,6-dinitrotoluene	606-20-2	60-135	0-20	0.25	1
2-amino-4,6-dinitrotoluene	35572-78-2	50-155	0-20	0.25	1
2-nitrotoluene	88-72-2	45-135	0-20	0.25	1
3-nitrotoluene	99-08-1	50-130	0-20	0.25	1
4-amino-2,6-dinitrotoluene	19406-51-0	55-155	0-20	0.25	1
4-nitrotoluene	99-99-0	50-130	0-20	0.25	1
HMX	2691-41-0	50-125	0-20	0.25	1
Nitrobenzene	98-95-3	50-140	0-20	0.25	1
RDX	121-82-4	50-160	0-20	0.25	1
Tetryl	479-45-8	20-175	0-20	0.25	1
Nitroglycerin	55-63-0	50-150	0-20	0.25	1
1,2-dinitrobenzene (surr)	528-29-0	50-140	-	-	-

* Values are statistically derived from laboratory control samples and are evaluated annually. Actual control limits may vary.

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TABLE 2
MICROBAC's OBJECTIVES AND ANALYTICAL METHODS FOR NITROAROMATIC EXPLOSIVES ANALYSES OF SOIL SAMPLES

PARAMETER	CAS #	ACCURACY (% RECOVERY)*	PRECISION (% RPD)*	OBSERVED MDL SOIL (mg/Kg)	REPORTING LIMITS SOIL (mg/Kg)
1,3,5-trinitrobenzene	99-35-4	75-125	0-20	0.1	0.25
1,3-dinitrobenzene	99-65-0	80-125	0-20	0.1	0.25
2,4,6-trinitrotoluene	118-96-7	45-135	0-20	0.1	0.25
2,4-dinitrotoluene	121-14-2	80-125	0-20	0.1	0.25
2,6-dinitrotoluene	606-20-2	80-120	0-20	0.1	0.25
2-amino-4,6-dinitrotoluene	35572-78-2	80-125	0-20	0.1	0.25
2-nitrotoluene	88-72-2	80-125	0-20	0.1	0.25
3-nitrotoluene	99-08-1	75-120	0-20	0.1	0.25
4-amino-2,6-dinitrotoluene	19406-51-0	80-125	0-20	0.1	0.25
4-nitrotoluene	99-99-0	75-125	0-20	0.1	0.25
HMX	2691-41-0	75-125	0-20	0.1	0.25
Nitrobenzene	98-95-3	75-140	0-20	0.1	0.25
RDX	121-82-4	70-130	0-20	0.1	0.25
Tetryl	479-45-8	10-150	0-20	0.1	0.25
Nitroglycerin	55-63-0	50-150	0-20	0.1	0.25
1,2-dinitrobenzene (surr)	528-29-0	50-140	-	-	-

* Values are statistically derived from laboratory control samples and are evaluated annually. Actual control limits may vary.

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TABLE 3
STANDARD REFERENCE MATERIAL CONTROL LIMITS

PARAMETER	TRUE VALUE (ug/Kg)	ACCEPTANCE LIMITS (ug/Kg)
4-amino-2,6-dinitrotoluene	946	437-931
2-amino-4,6-dinitrotoluene	650	365-700
1,3-dinitrobenzene	1010	698-1170
2,4-dinitrotoluene	639	410-768
2,6-dinitrotoluene	1320	789-1600
HMX	620	333-715
Nitrobenzene	1400	444-1660
2-nitrotoluene	1460	685-1710
3-nitrotoluene	1020	654-1260
4-nitrotoluene	1840	1150-2270
RDX	586	349-682
1,3,5-trinitrobenzene	701	407-814
2,4,6-trinitrotoluene	810	493-842
Nitroglycerin	1000	603-1150
Pentaerythritol tetranitrate (PETN)	1000	603-1150

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TABLE 4
QUALITY CONTROL CRITERIA
NITROAROMATICS AND NITRAMINES
METHOD 8330

Control Item	Frequency	Acceptance Criteria	Corrective Action
Initial Calibration (ICAL)	Initially and upon failure of two consecutive CCV's	Correlation coefficient (R) for linear regression ≥ 0.995.	Evaluate cause; Repeat calibration; Or qualify data and discuss in narrative (1)
Second source calibration verification (ICV)	After each initial calibration	≤ 30% drift; ≤ 15% drift (DoD 8330A) ≤ 20% drift (DoD 8330B) (1)	Re-analyze ICV; upon second failure, repeat initial calibration (1)
Low calibration verification (LCV)	After each initial calibration	Recovery between 80-120% of true value.	Evaluate cause, repeat calibration.
Continuing calibration verification (CCV)	Daily, before sample analysis, every ten samples, and at the end of the analysis sequence	8330A: ≤ 15% drift; 8330B: ≤ 20% drift (1)	Samples bracketed by an unacceptable CCV must be reanalyzed. Repeat initial calibration after two consecutive failures of the CCV (1).
Method Blank (MB)	One per matrix/batch: Maximum of 20 samples per batch	< project reporting limit for each target analyte; (< 1/2 reporting limit for DoD). (1)	Notify supervisor and initiate NCR; Investigate; re-extract/ reanalyze samples or qualify data and address in the report narrative (3)
Laboratory Control Sample (LCS) or Standard Reference Material (SRM)	One per matrix/batch: Maximum of 20 samples per batch	Target compounds within the designated ranges; use project QAPP or standard control criteria (1,2)	Notify supervisor and initiate NCR; Investigate; re-extract/ reanalyze samples or qualify data and address in the report narrative (3)
Matrix Spikes/ Matrix Spike Duplicate (MS/MSD)	One per matrix/batch; maximum of 20 samples per batch	Target compounds within the designated range (1)	Qualify data and/or address in the report narrative.
Surrogate Spike	Every sample, standard, and quality control sample	Recoveries within the designated rages; use project QAPP or standard control criteria (1)	Notify supervisor and initiate NCR; investigate; re-extract/reanalyze sample(s) or qualify data and address in the report narrative (3)

(1) Evaluation criteria are often project specific. Check the project QAPP.
(2) Standard criteria are set at three standard deviations from the mean. 10% marginal failure allowed, otherwise re-extract and re-analyze batch; consult supervisor and project QAPP for any exceptions.
(3) Data will be qualified if sample volume is insufficient for re-extraction/re-analysis.

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TABLE 5
MICROBAC'S QA OBJECTIVES AND ANALYTICAL METHODS FOR THE ANALYSIS OF PETN IN WATER SAMPLES

PARAMETER	CAS #	ACCURACY (% RECOVERY)*	PRECISION (%RPD)*	VERIFIED MDL (ug/L)**	REPORTING LIMIT (ug/L)
Pentaerythritol tetranitrate (PETN)	78-11-5	40-130	0-40	0.25	1

TABLE 6
MICROBAC'S QA OBJECTIVES AND ANALYTICAL METHODS FOR THE ANALYSIS OF PETN IN SOIL SAMPLES

PARAMETER	CAS #	ACCURACY (% RECOVERY)*	PRECISION (%RPD)*	VERIFIED MDL (mg/kg)**	REPORTING LIMIT (mg/kg)
Pentaerythritol tetranitrate (PETN)	78-11-5	30-140	0-40	0.1	0.25

*Values are currently nominal, will be derived from laboratory control samples, and may be revised.
**Values are statistically verified annually.

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FIGURE 1

Checklist ID: 28305

Microbac Laboratories Inc.

Data Checklist

Date: 06-MAY-2008
Analyst: JWR
Analyst: NA
Method: 8330
Instrument: HPLC5
Curve Workgroup: NA
Runlog ID: 22091
Analytical Workgroups: 04-0001,2,3,4 (MDL-Q'S) 04-0660 (WATER & SOIL) 2ND COLUMN RUN

ANALYTICAL	
System Performance Check	X
DFTPP (MS)	NA
Endrin/DDT breakdown (8081/MS)	NA
Pentachlorophenol/benzidine tailing (MS)	NA
Eluent check (IC)/system pressure (HPLC)	X
Window standard (FID)	NA
Initial Calibration	NA
Average RF	NA
Linear regression or higher order curve	NA
Alternate source standard (ICV) % Difference	NA
Continuing Calibration (CCV)	X
% D/% Drift	X
Minimum response factors (MS)	NA
Continuing calibration blank (CCB) (IC)	NA
Special standards	NA
Blanks	X
TCL hits	X
Surrogate recoveries	X
LCS/LCSD (Laboratory Control Sample)	X
Recoveries	X
Surrogate recoveries	X
MS/MSD/Sample duplicates	NA
Recoveries	NA
%RPD	NA
Samples	X
TCL hits	X
Mass spectra (MS/HPLC)/2nd column confirmations (ECD/FID/HPLC)	X
Surrogate recoveries	X
Internal standard areas (MS)	NA
Library searches (MS)	NA
Calculations & correct factors	X
Compounds above calibration range	NA
Reruns	NA
Manual integrations	NA
Project/client specific requirements	X
REPORTING	
Upload batch form	X
KOBRA workgroup data/forms/bench sheets	X
Case narratives	X
Check for completeness	X
Primary Reviewer	JWR
SUPERVISORY/SECONDARY REVIEW	
Check for compliance with method and project specific requirements	X
Check the completeness/accuracy of reported information	X
Data qualifiers	X
Secondary Reviewer	MDC

Primary Reviewer: 08-MAY-2008 John Richards

Secondary Reviewer: 09-MAY-2008 Michael Cohen

CHECKLIST1 - Modified 03/05/2008
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Figure 2

Run Log ID: 22091

Microbac Laboratories Inc.
Instrument Run Log

Instrument: HPLC5 Dataset: 050608
Analyst1: JWR Analyst2: NA
Method: 8330 SOP: HPLC02 Rev: 10

Maintenance Log ID: 24069

Column 1 ID: ACCLAIM E2 Column 2 ID: NA
Workgroups: WG270401 WG270402
Internal STD: NA Surrogate STD: STD25780 Calibration STD

Comments: These are the Second Column Confirmations.
Nitroglycerin results were confirmed using Diode Array on the initial analysis of these samples.

Seq.	File ID	Sample Information	Mat	Dil	Reference	Date/Time
1	5L001829.F	Solvent Rinse	1	1		05/06/08 14:02
2	5L001830.F	Solvent Rinse	1	1		05/06/08 14:20
3	5L001831.F	Solvent Rinse	1	1		05/06/08 15:14
4	5L001832.F	WG270490-01 CCV	1	1		05/06/08 16:07
5	5L001833.F	WG270401-01 MRL	7	1		05/06/08 17:27
6	5L001834.F	WG269664-01 BLK	7	1		05/06/08 18:44
7	5L001835.F	WG269664-02 LCS	7	1		05/06/08 19:37
8	5L001836.F	WG269664-03 LCS2	7	1		05/06/08 20:30
9	5L001837.F	L08040003-01 MDL	7	1		05/06/08 21:23
10	5L001838.F	L08040004-01 MDL	7	1		05/06/08 22:17
11	5L001839.F	L08040660-01 10X	7	10		05/06/08 23:10
12	5L001840.F	Solvent Rinse	1	1		05/07/08 00:03
13	5L001841.F	Solvent Rinse	1	1		05/07/08 00:21
14	5L001842.F	Solvent Rinse	1	1		05/07/08 01:14
15	5L001843.F	WG270401-02 MRL	7	1		05/07/08 02:08
16	5L001844.F	WG270490-02 CCV	1	1		05/07/08 03:01
17	5L001845.F	WG270402-01 MRL	1	1		05/07/08 03:54
18	5L001846.F	WG269634-01 BLK	1	1		05/07/08 04:47
19	5L001847.F	WG269634-02 LCS	1	1		05/07/08 05:40
20	5L001848.F	WG269634-03 LCS2	1	1		05/07/08 06:33
21	5L001849.F	L08040001-01 MDL	1	1		05/07/08 07:26
22	5L001850.F	L08040002-01 MDL	1	1		05/07/08 08:18
23	5L001851.F	L08040660-02 100X	1	100		05/07/08 09:11
24	5L001852.F	Solvent Rinse	1	1		05/07/08 10:04
25	5L001853.F	Solvent Rinse	1	1		05/07/08 10:22
26	5L001854.F	Solvent Rinse	1	1		05/07/08 11:16
27	5L001855.F	WG270402-02 MRL	1	1		05/07/08 12:09
28	5L001856.F	WG270490-03 CCV	1	1		05/07/08 13:30

Comments

Seq.	Rerun	Dil.	Reason	Analytes

Page: 1 Approved: 09-MAY-08

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STANDARD OPERATING PROCEDURE
PERCHLORATE
METHOD 6850/331.0

Issue/Implementation Date: 15 April 2012

Last Review Date: 15 September 2012

Microbac Laboratories, Inc.
Ohio Valley Division
158 Starlite Drive
Marietta, Ohio 45750

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1.0 SCOPE AND APPLICATION

1.1 This method is utilized for the analysis of perchlorate (ClO_4-) in water and soil samples using High Pressure Liquid Chromatography combined with Tandem Mass Spectrometry. The procedures in this method are based on EPA method 6850 and have been modified based on the Department of Defense Perchlorate Handbook. Modifications to this SOP for the analysis of Method 331 can be found in Appendix I.

1.2 After preparation, samples are injected onto the HPLC for separation, after which the perchlorate is introduced to the first mass spectrometer and fragmented for detection in the second mass spectrometer. Water samples are a direct aqueous injection after filtration. Soil samples are prepared by vortex and sonication prior to filtration and analysis.

1.3 Definitions and Acronyms

The following is a list of terms, definitions, and acronyms referenced in this SOP that are unique to the method.

CCV	Continuing Calibration Verification
DoD	Department of Defense
HPLC	High Pressure Liquid Chromatography
ICS	Interference Check Sample
ICV	Initial Calibration Verification
LCS	Laboratory Control Sample
LCSD	LCS Duplicate
LOD	Limit of Detection
LODV	Limit of Detection Verification
LOQ	Limit of Quantitation
MB	Method Blank
MCT	Method Conductivity Threshold
MDL	Method Detection Limit
MS	Matrix Spike
MSD	Matrix Spike Duplicate
MSDS	Material Safety Data Sheets
MS/MS	Tandem Mass Spectrometry
NCR	Non Conformance Report
QA	Quality Assurance
QC	Quality Control
RL	Reporting Limit
SOP	Standard Operating Procedure

For a more comprehensive list of common terms and definitions, consult Appendix A in Microbac SOP LQAP.

2.0 SAFETY PRECAUTIONS

2.1 Concentrated standards and acetonitrile are used in this method. Contact with these chemicals must be minimized. Working under a functioning vent hood and proper safety equipment such as gloves, lab coat, and safety glasses will normally provide adequate protection from contact. The MSDS should be consulted if questions about safe handling on a particular chemical requires additional personal protective clothing.

3.0 SAMPLE PRESERVATION AND STORAGE

3.1 Water samples are collected in 125 mL polyethylene bottles and should be stored with headspace to reduce anaerobic biodegradation. No preservation is required.

3.2 Soil samples are collected in 4 oz amber glass bottles.

3.3 Soil samples must be extracted within 28 days of collection and analyzed within 28 days of preparation. Water samples must be analyzed within 28 days of collection.

3.4 Samples are stored at ≤ 6° C.

4.0 METHOD PERFORMANCE

4.1 Table 1 summarizes the performance data for water analysis; Table 2 summarizes performance data for soil analysis. These tables include ranges for accuracy and precision, nominal laboratory RLs, and the current laboratory MDLs.

4.2 The laboratory performed an initial assessment of the MDL using the procedures outlined in 40 CFR Part 136. Results are filed electronically at H:\DATA\COMMON\MDL.

4.3 The LOD, or verified MDL, are presented in Tables 1 and 2 and were established using verification procedures outlined in Microbac SOP 45.

4.4 The LOQ are the nominal laboratory RLs and were established as per Microbac SOP 45.

4.5 Precision and accuracy data were derived from an initial demonstration of capability using spiked control samples. The laboratory uses results from LCS to assess precision/accuracy and to annually evaluate the associated control limits.

5.0 INTERFERENCES AND CORRECTIVE ACTION

5.1 All possible measures are taken to eliminate interferences from glassware and other equipment. Possible interferences from this source include artifact peaks and elevated baselines.

5.2 Only HPLC grade solvents are used.

5.3 All samples are filtered through 0.45 um filters to remove particulates that may damage the column and instrumentation.

5.4 If competing ions are present in samples at sufficient concentrations, they may take up active sites on the column and cause perchlorate to elute earlier than in the calibration standards; the internal standard peak will also shift and can be used to confirm the identification of the perchlorate peak.

5.5 If high concentrations of total dissolved solids are present in samples, ionization suppression may occur in the mass spectrometer, resulting in reduced peaks for perchlorate and the internal standard. A Matrix Conductivity Threshold study is performed to determine the concentration at which suppression occurs and samples are diluted accordingly.

6.0 EQUIPMENT AND SUPPLIES

6.1 Major Instrumentation

6.1.1 High performance liquid chromatograph: Shimadzu Prominence UFLC XR

6.1.2 Analytical column: K' (Prime) Technologies, Inc. reversed-phase HPLC column, 4 x 250mm (KP-RPPX250).

6.1.3 Mass spectrometer system: Applied Biosystems API-4000 triple quadrupole mass spectrometer with TurboIonspray probe.

6.1.4 Data system: Applied Biosystems Analyst software running with a Microsoft Windows platform

6.1.5 Nitrogen generator: Parker NitroFlowLab

6.2 Apparatus or Equipment

6.2.1 Syringe pump: New Era Pump Systems NE-300 for use in mass calibration.

6.2.2 Hamilton 1001TLL 1 mL syringe, for use with syringe pump

6.2.3 Pipetter

6.2.4 Conductivity meter

6.2.5 Sonic bath: VWR Model 50T or equivalent

6.2.6 Analytical balance

6.2.7 Centrifuge

6.2.8 Vortexer

6.2.9 Centrifuge tubes – 15 mL and 50 mL

6.2.10 10 mL disposable syringes

6.2.11 PTFE syringe filters 25 mm x 0.45mm

7.0 STANDARDS AND REAGENTS

7.1 All purchased stock standards and reagents are logged into the LIMS system and assigned certificate of analysis (COA) numbers. All intermediate and working solutions are similarly logged into the LIMS and assigned STD or RGT numbers. Detailed information regarding solution concentrations, aliquot volumes and final volumes and concentrations are included under the STD or RGT number.

7.2 HPLC grade water (J.T. Baker 4218-03 or equivalent)

7.3 Deionized (DI) water (ASTM Type 2 or better)

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7.4 HPLC grade acetonitrile (J.T. Baker 9017-03 or equivalent)

7.5 Perchlorate standard: A 1000 ug/L stock standard is prepared by diluting 100 uL of a 1000 ug/mL perchlorate standard (Ultra ICC-013-5) in 100 mL of DI water.

7.5.1 A 10 ug/L intermediate standard is prepared daily from the 1000 ug/L stock standard by diluting 100 uL in 10 mL of DI water.

7.5.2 A minimum of 5 calibration standards are required, with the lowest standard at a concentration at or below the LOQ. Working calibration standards are prepared from the stock standard using the following scheme:

10 ug/L	(intermediate standard)
5.0 ug/L	(500 uL intermediate standard: 500 uL DI water)
2.0 ug/L	(200 uL intermediate standard: 800 uL DI water)
1.0 ug/L	(100 uL intermediate standard: 900 uL DI water)
0.5 ug/L	(100 uL 5.0 ug/L standard: 900 uL DI water)
0.2 ug/L	(100 uL 2.0 ug/L standard: 900 uL DI water)
0.1 ug/L	(100 uL 1.0 ug/L standard: 900 uL DI water)

7.6 Second source standard: A 1000 ug/L stock standard is prepared by diluting 100 uL of a 1000 ug/mL perchlorate standard (Accustandard IC-PER-10X-1) in 100 mL of DI water.

7.6.1 The working alternate source standard at 1.0 ug/L is prepared by diluting the alternate source stock as in Sections 7.5.1 and 7.5.2 above.

7.7 Internal standard: O18 labeled perchlorate ($Cl^{18}O_4^-$) purchased from Dionex (062923) at 1000 ug/L. Every working calibration standard and sample is spiked with this solution in the ratio of 50 uL internal standard: 10 mL sample, yielding a final concentration of 5 ug/L.

7.8 ICS solution: Dissolve 4 g NaCl, 3.72 g Na_2SO_4, 4.4 g Na_2CO_3 in 100 mL of DI water. Dilute 11 mL of this solution in 200 mL of DI water to yield a final conductivity of approximately 10,000 uS/cm. Verify the conductivity with a conductivity meter.

7.9 The internal standard solution is stored at ≤ 6° C. All other standards are stored at room temperature.

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8.0 SAMPLE PREPARATION

8.1 Samples are prepared in batches of up to 20 (twenty) field samples using the following procedures:

8.2 Water samples

8.2.1 Pour approximately 30-50 mL of sample into a disposable cup and measure the matrix conductivity of the sample using a conductivity meter.

8.2.2 Filter 5-10 mL of sample using a plastic syringe and 0.45 um nylon filter into a 15 mL disposable centrifuge tube.

8.2.3 Transfer 1 mL of sample into an autosampler vial, add 5 uL of internal standard, cap and shake well. If the conductivity measurement is >10,000 uS/cm, prepare a dilution using reagent water to achieve an acceptable level of conductivity (see 10.6).

8.2.4 With each preparation batch, include a method blank, LCS and MCT/ICS. The method blank and LCS are prepared using 10 mL of reagent water. The MCT/ICS is prepared using 10 mL of MCT solution. The LCS and MCT/ICS are spiked with 0.2 mL of the 10 ug/L intermediate standard. The blank, LCS and MCT/ICS are filtered in the same manner as field samples.

8.2.5 If a MS/MSD is included in the sample batch, they are spiked in the same manner as the LCS. If no MS/MSD are included, prepare an LCSD sample.

8.3 Soil samples

8.3.1 Sample Homogenization

8.3.1.1 Remove the sample bottle contents and place in tray lined with aluminum foil.

8.3.1.2 Mix sample with an inert rod or scoop and break up lump. Remove all large stones, sticks, leaves, etc. Do not overmix the sample.

8.3.1.3 Obtain representative sample either by random removal of 3-10 portions of the sample from the pan or by using a “standard” scoop designed to retrieve a linear cross-section of the pan contents.

8.3.1.4 The analyst will not attempt to target and exact weight once a method specified minimum amount is weighed.

8.3.1.5 The remaining sample will be returned to the sample container.

8.3.2 Weigh 5.0 g of homogenized sample into a tared 50 mL centrifuge tube and record the weight. Add enough reagent water to the tube to bring the total volume to 50 mL and add 250 uL of internal standard 018LP.

8.3.3 Invert 2-3 times to mix, then place in an ultrasonic bath for 30 min, then invert again.

8.3.4 Centrifuge the sample for 10 min to separate solids from the extract solution.

8.3.5 Transfer the extract into a 15 mL glass screw-cap vial and label.

8.3.6 Filter 5-10 mL of sample using a plastic syringe and 0.45 um PTFE filter into a 15 mL disposable centrifuge tube. Measure the matrix conductivity of remaining extract. If the conductivity measurement is > 10,000 uS/cm, prepare a dilution solution by adding 250 uL of internal standard 018LP to 50 mL of reagent water in a 50 mL centrifuge tube. Use this dilution solution to prepare a dilution on the sample extract to achieve an acceptable level of conductivity.

8.3.7 Transfer 1 mL of sample into an autosampler vial, cap and shake well.

8.3.8 With each preparation batch, include a method blank and LCS using 5.0 g lab sand spiked with 250 uL of internal standard. The LCS is also spiked with 1 mL of the 10 ug/L intermediate standard. The blank and LCS are filtered in the same manner as field samples.

8.3.9 If a MS/MSD is included in the sample batch, they are spiked in the same manner as the LCS. If no MS/MSD are included, prepare an LCSD sample.

8.3.10 Soil extract cleanup

8.3.10.1 If soil extracts are not clear or are highly colored, there may be large quantities of organic contaminants present. These may be removed using a C_{18} column and the following procedure.

8.3.10.2 Activate the C_{18} column by pushing approximately 5 mL of methanol through the column, followed by 5 mL of reagent water at a flow rate of approximately 0.5 mL/min. Do not let the column become dry.

8.3.10.3 Gently push approximately 6 mL of the extract through the column. Discard the first 2 mL and collect the remainder for analysis.

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8.4 ICS: With each preparation batch, spike a 5.0 g lab sand sample with 1 mL at the 10 ug/L intermediate standard and bring to a 50 mL final volume with the ICS solution.

8.5 If samples are not analyzed immediately after preparation, they should be stored at room temperature with headspace until analysis can proceed.

9.0 CALIBRATION PROCEDURES

9.1 Mass tuning: the MS/MS system is optimized for detection of m/z ratios 83 (ClO_3^-), 85 ($^{37}ClO_3^-$) and 89 ($Cl^{18}O_3^-$), using a syringe pump and the manufacturer's instructions.

9.2 A laboratory reagent blank, prepared by spiking 10 mL of DI water with 50 uL of internal standard, is analyzed to assess the cleanliness of the system under these circumstances:

9.2.1 Prior to initial calibration.

9.2.2 After every 10 field samples.

9.2.3 Following samples found to have perchlorate concentrations above the calibration range (unless the instrument is running unattended).

In all cases, the concentration of perchlorate in the reagent blank must be <1/2 of the RL. If not, the blank must be reanalyzed until this criteria is met. Field samples not bracketed by passing reagent blanks must be reanalyzed.

9.3 Initial calibration

9.3.1 Initial calibration recommended conditions:

9.3.1.1 HPLC system:

Mobile phase: 47% H_2O/0.1% acetic acid: 53% Acetonitrile/0.1% acetic acid
Injection volume: 10 uL
Flow rate: 0.5 mL/min

9.3.1.2 Mass spectrometer:

Interface: Turbospray ion source
Curtain gas: 105 psi

Exhaust gas:	105 psi
Gas 1/Gas 2:	50 psi
Polarity:	Negative
Resolution:	Unit
Dwell time:	200 msec

SIM parameters:

Compound	Q1 mass	Q2 mass
Perchlorate	98.8	83.2
O18LP	107.0	89.0
Perchlorate confirmation	100.8	85.2

The same conditions are used for sample analysis.

9.3.2 Inject each calibration standard into the HPLC. After analysis, establish an initial calibration curve using linear regression (see Section 11.1). The correlation coefficient (r) must be ≥ 0.995 (see Section 11.2). Because linear calibrations tend to favor numbers at the higher end of the calibration range, a weighting factor (see Section 11.3) can be used to reduce this tendency.

9.4 ICV: Following the initial calibration, inject the 1.0 ug/L secondary source standard and evaluate the % drift using the calculation in Section 11.8. The %D must be ≤15 before sample analysis can begin. If the ICV exceeds the control limit, corrective action must be taken and the instrument recalibrated.

9.5 CCV: The calibration must be verified daily prior to sample analysis and after every 10 field samples by the analysis of the 1.0 ug/L calibration standard. The %D must be ≤15 before sample analysis can begin, and samples must be bracketed by passing CCV standards. Samples not bracketed by passing CCVs must be reanalyzed.

9.5.1 If a CCV fails to meet acceptance criteria, it may be reanalyzed once. If it still fails, corrective action must be taken followed by two consecutive CCV analyses in order to demonstrate a return to control.

9.6 LODV: The 0.2 ug/L calibration standard is analyzed daily prior to sample analysis and after every 10 field samples. The %D must be ≤ 30; if not, samples bracketed by failing LODV standards must be reanalyzed unless perchlorate concentrations in the samples are above the RL.

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10.0 ANALYTICAL PROCEDURES

10.1 The instrument is calibrated as in Section 9.0.

10.2 After calibration, batch QC and up to 10 field samples are analyzed, followed by a CCV, LODV and laboratory reagent blank (batch and instrument QC need not be included in the count of 10). If the second set of standards is acceptable, analysis may continue with another set of 10 samples, etc. All samples must be bracketed by passing QC checks.

10.3 After sample analysis, the computer produces a quantitation report listing all target analytes and concentrations found in the sample. Extracted Ion Chromatograms (XIC) are generated for each analyte found at or above the minimum detection limit and are evaluated for validity.

10.4 Qualitative analysis: Perchlorate is qualitatively identified by verifying the ratios of m/z 83 and 85. The ratio must be within 2.3 to 3.8 to verify the presence of perchlorate.

10.5 If the response for perchlorate is above the upper limit of the initial calibration, a laboratory reagent blank should be analyzed and evaluated as in Section 8.2 in order to verify that no carryover is present.

10.6 Sample over the calibration range must be diluted in order to yield results within the range. Water samples are diluted using the following scheme:

Dilution	Amount Sample (mL)	Amount water (mL)	Final dilution volume (mL)	Amount ISTD (uL)
2x	0.5	0.5	1	5
5x	0.2	0.8	1	5
10x	0.1	0.9	1	5

Soil Extracts are diluted using the dilution solution described in 8.3.6 instead of water. Do not add ISTD as indicated in the table above.

Higher dilutions are prepared by using serial dilutions, e.g. for a 100x dilution, a 10x dilution is again diluted by a factor of 10.

11.0 DETAILS OF CALCULATIONS

11.1 Linear calibration calculations:

11.1.1 The response ratio is plotted vs. the concentration ratio giving a linear equation:

$$y = mx + b$$

where:

y = Response ratio = Response(x)/Response(istd) = R_x/R_{istd}
x = Concentration ratio = Conc(x)/Conc(istd) = C_x/C_{istd}
And m and b are the slope and intercept from the regression equation

11.1.2 For a given response ratio we can solve for C_x/C_{istd} :

$$C_x/C_{istd} = [R_x/R_{istd} - b]/m$$

Use equations 12.4 or 12.5 to calculate the unknown concentration, C_x.

11.2 Coefficient of correlation

$$\frac{\sum XY - \sum X \sum Y / n}{\sqrt{\left(\sum X^2 - (\sum X)^2 / n\right)\left(\sum Y^2 - (\sum Y)^2 / n\right)}}$$

where:

X = individual values of the independent variable, i.e. concentration
Y = individual values of the dependent variable, i.e. response
n = number of pairs of data

11.3 Linear regression weighing factor:

$$W_1 = 1/y_1$$

where:

w_1 = weighing factor
y_1 = instrument response

11.4 Calculating concentration from a water sample:

$$C_x = (C)(D)$$

where:

C_x = final concentration of perchlorate (ug/L)
D = dilution factor

11.5 Calculating concentration from a soil sample:

$$C_x = \frac{(C)(V_f)(D)}{V_i}$$

where:

C_x = final concentration of perchlorate (ug/g)
V_f = final volume of extract (L)
D = dilution factor
V_i = initial sample weight (g)

11.6 The dry weight concentration of a target analyte is further calculated as follows:

$$C_d = \frac{(C_x)(100)}{(\%solids)}$$

where:

C_x = The uncorrected wet weight concentration
% solids = the percent solids content of the sample

11.7 Precision

Precision is expressed as relative standard deviation

$$RSD = \left(\frac{s}{\bar{x}}\right)100$$

11.8 Accuracy as % difference:

$$\%D = \left[\frac{(C_t - C_x)}{C_t}\right]100$$

where:

C_t = True concentration of the analyte in the standard

C_x = Measured concentration of analyte in the standard

11.9 Precision of duplicate measurements

Precision of duplicate measurements is expressed as relative percent difference

$$RPD = \left[\frac{|C_1 - C_2|}{(C_1 + C_2)/2} \right] 100$$

where:

C_1 = Concentration of the first sample
C_2 = Concentration of the second sample

11.10 The LCS recovery is calculated as follows:

$$\%R = \left(\frac{C_x}{C_T} \right) 100$$

where:

C_x = the concentration of the analyte in the LCS.
C_t = the theoretical spike concentration.
$\%R$ = percent recovery

11.11 Accuracy as Percent Recovery

$$\%R = \left[\frac{(C_{spk} - C_x)}{C_t} \right] 100$$

where:

C_{spk} = the concentration of the analyte in the spiked sample
C_x = the concentration of the analyte in the reference (parent) sample
C_t = the theoretical spike concentration.
$\%R$ = percent recovery

12.0 QUALITY CONTROL REQUIREMENTS

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12.1 The quality control procedures discussed in this section are intended to monitor and control the entire analytical process. Batch quality samples are specified in Section 8.0 for MB, LCS, MS, MSD and ICS. Additional procedures were defined in Section 10.0 for initial calibration, ICV, CCV, LODV and laboratory reagent blanks and are included in the overall review process. The procedures, required frequency, acceptance criteria, and the required corrective action measures are outlined in Table 3.

12.2 The MB cannot contain a concentration of perchlorate above the one-half of the RL, or greater than 1/10 the amount measured in any sample, whichever is greater. If the blank fails to meet this criteria, the entire batch must be re-prepped and the analysis performed again. All blanks are evaluated down to the current MDL for the presents of target analytes. Any amount of target analytes found in the blank at a level greater than the current

MDLs are reported in the LIMS and these values appear on the QC summary sheet for the batch.

12.3 The LCS is spiked at 0.2 ug/L. Upon completion of a batch of samples, LCS summary reports are generated by the analyst, which compare the actual recoveries to the applicable acceptance ranges for the samples in the batch. The standard laboratory limits specified in Tables 1 and 2 are used in the absence of a project QAPP, or program specified control limits. If the LCS is beyond the laboratory limits, the analyst must stop the analysis, prepare an NCR, and contact the department supervisor for the appropriate corrective action. Corrective action will consist of re-preparation and re-analysis of the affected samples, unless the client's representative and the Quality Assurance Officer (QAO) approve of another course of action. If an LCSD is included in the preparation batch, it must meet the sample criteria as the LCS.

12.4 The MS and MSD are spiked at 0.2 ug/L. The results are included in the QC Summary Report and the data is used to monitor matrix accuracy and precision.

12.5 Internal standard areas must be between ± 50% of the average areas from the initial calibration and the relative retention times must be within 0.98-1.02. All samples failing to meet this criteria must be reanalyzed at increasing dilutions until the acceptance criteria are met.

12.6 Back Up: All raw data files are automatically saved to the Microbac server on a daily basis.

12.7 When new standards are made, they must be checked against the existing curve before they can be used. Compare with old standards.

12.8 Control of Nonconforming Data

The laboratory implements general procedures to be followed when departures from documented policies, procedures and quality control have occurred. The policies and procedures are found in Section 13.0 of Microbac SOP LQAP (Laboratory Quality Assurance Program), Microbac SOP GP-CAPA (Corrective Action/Preventive Action: Initiating, Tracking and Monitoring) and Microbac SOP GP-RCA (Root Cause Analysis).

12.8.1 Nonconformances Requiring Corrections

A nonconformance occurs when any aspect of the method QC in an analysis, as outlined in Table 3 does not meet acceptance criteria. When nonconforming data occurs the employee initiates an NCR and proceeds with indicated corrections as per Table 3.

All data shall be scrutinized by the analysts for method and project specific compliance. Checklists are utilized and accompany each data batch (Figure 1). A nonconformance shall be documented in the NCR followed by one or more of the following actions.

- Reanalysis of the sample(s) in question
- Discussion and qualification of data (report and narrative)
- Client notification with approval
- Data qualification (Q-flagging)
- Re-sampling and reanalysis (client decision)

12.8.2 Nonconformances Requiring Corrective Action

Corrective action is required when a nonconformance is recurring, if the correction is ineffective or if the departure is so significant that it negatively effects data quality, sample integrity or customer satisfaction. When an event requiring corrective action is identified, the employee shall initiate a Corrective Action/ Preventive Action form as per Microbac SOP GP-CAPA. The corrective action process includes a root cause analysis as per Microbac SOP GP-RCA, corrections, corrective action(s) and evidence of effectiveness.

12.8.3 Nonconformances Not Requiring Corrections

There are some standard contingencies to the traditional corrections that maybe invoked, provided they comply with the project QAPP requirements. In many situations it may not be necessary to perform sample reanalysis or re-extraction for the following quality control departures, provided they are not a

chronic problem or indicative of a trend, and the laboratory provides documentation in the report narrative and project files. In addition, the employee is required to initiate an NCR to record the event.

- An LCS or surrogate recovery exceeds the upper control limit, but the corresponding sample results are non-detect.
- A MB exceeds the upper limit, but the corresponding sample results are non-detect.
- A MB exceeds the upper limit, but the corresponding sample results are greater than ten (10) times the level in the blank.

13.0 DATA REVIEW AND REPORTING REQUIREMENTS

13.1 Data Review

Prior to data entry into the LIMS (either manual or automatic), all data must undergo two (2) levels of review in the department. The primary review is performed by the analyst and the secondary review is performed by either the department supervisor (or a designee) or another qualified analyst.

13.2 Data Reporting

The reporting requirements depend upon the need of the client. Microbac offers four (4) levels of data reporting which are described in some detail below.

13.2.1 Level 1 reporting provides the client with the results for all samples submitted for analysis. No other documents or raw data are provided with this level of report.

13.2.2 Level 2 reporting provides the client with all of the information contained in a Level 1 report plus a summary of all of the QC analysis associated with the samples submitted by the client.

13.2.3 Level 3 reporting is essentially a custom report provided to the client that contains any additional data from the analysis that the client might request.

13.2.4 Level 4 reporting is provided in those cases where the client wishes to perform full data validation. All raw data, lab generated logs, and other associated data are provided.

14.0 PREVENTIVE MAINTENANCE

14.1 The curtain plate and nebulizer tip must be monitored for buildup and cleaned when necessary.

14.2 The oil in the vacuum pumps should be changed every six (6) months.

14.3 The source is cleaned and mass calibration performed on an as-needed basis.

15.0 WASTE MANAGEMENT AND POLUTION CONTROL

15.1 Microbac is dedicated to eliminating or minimizing any and all laboratory waste, which requires disposal or contributes to pollution of any type. To that extent Microbac has implemented new technology and converted to micro techniques when available to facilitate these goals.

Each laboratory generates specific waste streams which are segregated and collected in labeled satellite containers. The analysts in each department are responsible for proper disposal of the spent samples and chemical waste in the specified satellite waste collection vessel. The waste management technician checks the satellite containers either daily, or as needed. They are then combined into waste drums in our explosion-proof waste building located outside of the Microbac laboratory facility. These drums are labeled with start date and a manifest is created for each. They are picked up on a regular basis for disposal at a licensed disposal facility.

15.2 This method generates wastes in the form of sample extracts in vials, which are placed in the satellite waste container labeled for Waste Vials/Sample Extracts (D001, F002).

15.3 Laboratory policies and procedures for management of hazardous waste are found in Microbac SOP 33 Laboratory Waste Management and the waste management section of the analytical SOPs contain procedures specific to each method. All laboratory waste is accumulated, stored and disposed in accordance with all federal and state laws and regulations. Each employee receives training in the proper handling and disposal of hazardous waste that is specific to their job description. As a hazardous generator, we are subject to inspection from the Ohio EPA.

16.0 REFERENCES

16.1 USEPA Method 6850, Revision 0, January 2007

16.2 USEPA Method 8000C, Revision 3, March 2003

16.3 DoD Perchlorate Handbook, Revision 1 Change 1, August 2007.

16.4 DoD Quality Systems Manual for Environmental Laboratories, Version 4.1, 5 June 2003

16.5 EPA Document #: 815-R-05-007, Method 331.0, Determination of Perchlorate in Drinking Water by Liquid Chromatography Electrospray Ionization Mass Spectrometry, Revision 1.0, January 2005

16.6 Microbac SOP LQAP “Laboratory Quality Assurance Plan”

16.7 Microbac SOP 33, “Laboratory Waste Management”

16.8 Microbac SOP 45, “Method Validation Procedures”

16.9 Microbac SOP GP-CAPA, “Corrective Action/Preventive Action: Initiating, Tracking and Monitoring”

16.10 Microbac SOP GP-RCA, “Root Cause Analysis”

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Appendix I
Method 331.0

For EPA Method 331.0 analysis, the following modifications are made to this SOP:

1.3 Additional definitions:

QCS	Quality Control Sample
LFSSM	Laboratory Fortified Synthetic Sample Matrix
LSSM	Laboratory Synthetic Sample Matrix
LSSMB	Laboratory Synthetic Sample Matrix Blank

3.1 Samples are collected in a polypropylene beaker and filtered into sterile 125 mL plastic bottles using a sterile 20 cc syringe and 0.2 um sterile syringe filter.

3.4 Sample must be received at < 10° C.

4.0 Method performance data for Method 331.0 are presented in Table 4.

6.2.10 20 cc sterile silicone free disposable syringe Fisher cat# 14-817-33

6.2.11 Sterile syringe filters Corning 26 mm surfactant free cellulose acetate 0.2 um, Fisher catalog number 09-754-13.

7.5.2

10 ug/L	(intermediate standard)
5.0 ug/L	(5000 uL intermediate standard: 5000 uL DI water)
1.0 ug/L	(1000 uL intermediate standard: 9000 uL DI water)
0.5 ug/L	(5000 uL 1.0 ug/L standard: 5000 uL DI water)
0.1 ug/L	(1000 uL 1.0 ug/L standard: 9000 uL DI water)
0.05 ug/L	(1000 uL 0.5 ug/L standard: 9000 uL DI water)
0.02 ug/L	(2000 uL 0.1 ug/L standard: 8000 uL DI water)
0.01 ug/L	(1000 uL 0.1 ug/L standard: 9000 uL DI water)

7.6.1 The working alternate source standard at 0.1 ug/L is prepared by diluting the alternate source stack as in Sections 7.4.1 and 7.4.2.

7.7 Internal Standard: O18 labeled perchlorate purchased from Dionex at 1000 ug/L is diluted 1:10 in DI water. Every working calibration standard and sample is spiked with this solution in the ratio of 50 uL internal standard: 10 mL sample, yielding a final concentration of 0.5 ug/L.

7.8 The ICS solution is not used.

7.9 LSSM: dissolve 1.40 g $NaHCO_3$, 1.48 g Na_2SO4, 1.54 g NaCl, in 1 L of reagent water.

8.2.4 With each preparation batch, include a MB, LCS and MS/MSD. The MB and LCS are prepared using 10 mL of reagent water spiked with 50 uL of internal standard solution from Section 7.6 above. The LCS, MS/MSD are spiked at rotating levels low, medium and high with the 10 ug/L intermediate standard.

A LSSMB and LFSSM are required to be analyzed quarterly and do not have to be included in each analytical batch. The LFSSM is spiked at 0.5 ug/L using the 10 ug/L intermediate standard. The LSSMB and LFSSM are prepared using 10 mL of LSSM solution from Section 7.8 above.

The method blank, LCS and LSSMB and LFSSM are filtered in the same manner as field samples.

9.2.3 In all cases, the concentration of perchlorate in the Reagent blank must be <1/3 of the method reporting limit (MRL).

9.3.1.1 Mobile phase: 60% H_20/0.1% acetic acid: 40% Acetonitrile/0.1% acetic acid

Injection volume:	100 uL
Flow rate:	0.75 mL/min

9.3.2 The validation of the calibration is determined by calculating the concentration of the analyte from each of the analyses used to generate the calibration curve. Calibration points that are ≤ MRL should calculate to be 50-150% of their true value. All other calibration points should calculate to be 80-120% of their true value. If these criteria cannot be met, the analyst will have difficulty meeting ongoing QC criteria. In this case, corrective action should be taken to reanalyze the calibration standards, restrict the range of calibration, or select an alternate method of calibration.

9.4 ICV: Analyze a QCS sample fortified near the midpoint of the calibration range. The QCS should be from a different source than the source of the calibration standards. The acceptance criterion for the QCS is that the calculated amount of perchlorate must be 80-120% of the true value. If the measured analyte concentration does not meet this criterion, check the entire analytical procedure to locate and correct the problem before analyzing any field samples.

9.5 CCV: The beginning CCV for each analysis batch must include a CCV at or below the MRL and a CCV fortified at a level near the midpoint of the curve. Subsequent CCVs should alternate between a low, medium, and high

concentration. CCVs fortified at or below the MRL must calculate to be 50-150% of the true value. CCVs fortified at all other levels must calculate to be 80-120 % of the true value.

10.2 See Table 7 for an example sequence for Method 331.0.

10.4 Perchlorate is qualitatively identified by verifying the ratio of m/z 83 and 85. The ratio must be within 25% of theoretical value of 3.08 (2.31-3.85). If this ion ratio requirement is not met in any QC sample, then all samples in the analysis batch are considered invalid and must be reanalyzed after reestablishing acceptable instrument performance.

12.1 Quality control criteria for Method 331.0 are presented in Tables 5 and 6.

12.5 The internal standard area of the first CCV should be ≥ 50% of the average IS area counts of the initial calibration standards. The internal standard area of the analysis batch must be within 30% of the internal standard area of the first CCV. Relative retention times must be within 0.98-1.02 for a peak to be identified as perchlorate.

16.0 Reference: USEPA Method 331.0, Revision 1, January 2005

TABLE 1
MICROBAC'S QA OBJECTIVES FOR
THE ANALYSIS OF METHOD 6850 WATER

PARAMETER	CAS #	ACCURACY (% RECOVERY)*	PRECISION (% RPD)*	LOD (ug/L)	LOQ (ug/L)
Perchlorate	14797-73-0	80-120	0-15	0.1	0.2

* Limits are currently multi-lab performance limits from the method, will be derived from LCS data, and may be revised.

TABLE 2
MICROBAC'S QA OBJECTIVES FOR
THE ANALYSIS OF METHOD 6850 SOIL

PARAMETER	CAS #	ACCURACY (% RECOVERY)*	PRECISION (% RPD)*	LOD (ug/Kg)	LOQ (ug/Kg)
Perchlorate	14797-73-0	80-120	0-15	1	2

* Limits are currently multi-lab performance limits from the method, will be derived from LCS data, and may be revised.

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TABLE 3
QUALITY CONTROL CRITERIA
METHOD 6850

Control Item	Frequency	Acceptance Criteria	Corrective Action
Mass Calibration	At instrument setup and as-needed thereafter.	Ions should be within +/- 0.3 m/z of masses 83, 85 and 89.	Recalibrate, contact manufacturer if necessary.
Initial Calibration	When continuing calibration is out of control or after major maintenance	r ≥ 0.995	Correct problem, repeat ICAL.
Initial Calibration Verification (ICV)	After initial calibration	≤ 15% drift	Reanalyze ICV; upon second failure, repeat initial calibration.
Continuing Calibration Verification (CCV)	At beginning of daily analytical sequence and after every 10 field samples.	≤ 15% drift	Reanalyze CCV; upon second failure perform maintenance. Two consecutive CCVs must pass following maintenance.
Limit of Detection Verification (LODV)	Daily prior to sample analysis and after every 10 field samples.	≤ 30% drift	Reanalyze samples not bracketed by passing LODV unless results >RL.
Internal Standard	Every standard, Sample and batch QC sample.	Areas within ± 50% of average ISTD areas from ICAL. RRT 1.0 +/-2% from ICAL.	Reanalyze at dilutions until area is acceptable.
Method Blank	One per matrix/batch.	Perchlorate < 1/2 RL or > 1/10 amount detected in samples.	Reprep and reanalyze blank and all associated samples
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD)	One per matrix/batch.	Recovery within 80-120%	Reprep and reanalyze LCS and all associated samples
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	One per matrix/batch if specified by client.	Recovery within 80-120%. RPD <15%.	Qualify data and/or address in the report narrative
Interference Check Sample (ICS)	Extracted with every batch of 20 samples.	≤ 30% drift	Correct problem, reprep and reanalyze samples.
Laboratory Reagent Blank	Prior to calibration, at the end of analytical sequence and after samples with perchlorate over calibration range.	Perchlorate < 1/2 RL.	Reanalyzed blank until carryover is eliminated, repeat sample analysis.

TABLE 4
MICROBAC'S QA OBJECTIVES FOR
THE ANALYSIS OF METHOD 331.0 WATER

PARAMETER	CAS #	ACCURACY (% RECOVERY)*	PRECISION (% RPD)*	LOD (ug/L)	LOQ (ug/L)
Perchlorate	14797-73-0	See Table 6	See Table 6	0.005	0.02

* Limits are currently multi-lab performance limits from the method, will be derived from LCS data, and may be revised.

TABLE 5
INITIAL DEMONSTRATION OF CAPABILITY
QUALITY CONTROL REQUIREMENTS METHOD 331.0

Requirement	Specification and Frequency	Acceptance Criteria
Demonstration of Low System Background	Analyze a Reagent blank and LSSMB prior to any other IDC steps.	Demonstrate that the target analyte is <1/3 of the MRL and that possible interferences from sampling devices do not prevent the identification and quantitation of perchlorate.
Test for System Carryover	Analyze a reagent water blank after the high ICAL standard during the IDC calibration.	Demonstrate that the target analyte is <1/3 of the MRL and that carry-over from previous samples does not prevent the identification and quantitation of perchlorate.
Demonstration of Precision	Analyze seven (7) replicate LCSs and seven (7) replicate LFSSMs fortified near the midrange concentration.	%RSD must be ≤ 20%
Demonstration of Accuracy	Calculate average recovery for replicates used in Section 11.11.	Mean recovery 80-120% of the true value
Minimum Reporting Limit (MRL) Confirmation	Fortify and analyze seven (7) replicate LCSs at the proposed MRL concentration. Calculate the mean and the Half Range (HR). Confirm that the Upper PIR and Lower PIR (Section 9.2.4.2) meet the recovery criteria.	Upper PIR ≤ 150% Lower PIR ≥ 50%

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TABLE 6
ONGOING QUALITY CONTROL REQUIREMENTS (SUMMARY) METHOD 331.0

Requirement	Specification and Frequency	Acceptance Criteria
Sample Holding Time	28 days when processed and stored according to Sections 3.0 and Appendix I.	Sample results are valid only if samples are analyzed within the sample holding time.
Initial Calibration	Use the Internal standard calibration technique to generate a linear or quadratic calibration curve. Use at least five (5) standard concentrations.	When each calibration standard is calculated as an unknown using the calibration curve, the lowest level standard should be within 50-150% of the true value. All other points should be within 80-120% of the time value.
Blank	Daily, or with each analysis batch of up to twenty (20) field samples, whichever is more frequent.	Results must be < 1/3 the MRL. If the background exceeds 1/3 the MRL, the results for Perchlorate in the analysis batch are invalid.
Continuing Calibration Check (CCC)	Verify initial calibration by analyzing a Low CCC and a Mid CCC at the beginning of each analysis batch. Subsequent CCCs are required after every ten (10) field samples, and after the last field sample in a batch.	The lowest level CCC must be within 50-150% of the true value. All other points must be within 80-120% of the true value. Results are field samples that are not bracketed by acceptable CCCs are invalid.
Laboratory Control Sample (LCS)	Daily, or with each analysis batch of up to twenty (20) field samples, whichever is more frequent.	For LCSs fortified at concentrations ≤ MRL, the result must be within 50-150% of the true value. All other LCSs must be within 80-120% of the true value.
Internal Standard (IS)	Compare IS area to the IS area of the first CCC in the analysis batch for all QC and field samples.	Peak area counts for the IS must be within ± 30% of the IS area of the first CCC of the analysis batch. If the IS area does not meet this criterion, the corresponding perchlorate results are invalid.
Isotope Area Count Ratio	Monitor the isotope ratio for all QC and field samples in the analysis batch.	The calculated area count ratio (m/z 99/101 for SIM, or m/z 85/83 MRM) must be within ± 25% (2.31-3.85) of the theoretical value of 3.086.
Relative Retention Time	Monitor the relative retention time for all QC and field samples in the analysis batch.	The relative retention time for perchlorate vs. the IS must be between 0.98-1.02.
Matrix Spike (MS)	Analyze one MS per analysis batch. Fortify the MS with perchlorate at a concentration close to but greater than the native concentration (if known). Calculate MS recoveries.	For MS fortified at concentrations ≤ MRL, the result must be within 50-150% of the true value. All other MSs must be within 80-120% of the true value.
Matrix Spike Duplicate (MSD) or Laboratory Duplicate	Analyze at least one MSD or LD daily, or with each analysis batch of up to twenty (20) field samples, whichever is more frequent.	For MSDs or LDs having perchlorate concentrations ≤2 x MRL, the RPD must be within 50-150%. All other MSDs and LDs must have RPDs within 80-120%
Quality Control Sample (QCS)	Analyzed with every new calibration curve.	Results must be 80-120% of the true value.

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TABLE 7
EXAMPLE SEQUENCE FOR
A METHOD 331.0 ANALYTICAL BATCH

Sample	Sample Description	*Acceptance Criteria
1	CCC ≤ MRL	50-150% of true value
2	Mid level CCC	80-120% of true value
3	Reagent Blank	< 1/3 MRL
4	LCS	≤ MRL 50-150% of true value > MRL 80-120% of true value
5	Field Sample 1	
6	Field Sample 2	
7	Field Sample 3	
8	Field Sample 4	
9	Field Sample 5	
10	Field Sample 6	
11	Field Sample 7	
12	Field Sample 8	
13	Field Sample 9	
14	Field Sample 10	
15	CCC (rotate level)	≤ MRL 50-150% of true value > MRL 80-120% of true value
16	MS	≤ MRL 50-150% of true value > MRL 80-120% of true value
17	MSD	≤ 2 x MRL 50-150% of true value > 2 x MRL 80-120% of true value
18	Field Sample 11	
19	Field Sample 12	
20	Field Sample 13	
21	Field Sample 14	
22	Field Sample 15	
23	Field Sample 16	
24	Field Sample 17	
25	Field Sample 18	
26	Field Sample 19	
27	Field Sample 20	
28	CCC (rotate level)	≤ MRL 50-150% of true value > MRL 80-120% of true value

* Additionally, all samples must meet the isotope area count ratio criteria and the relative retention time criteria.

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Figure 1
Checklist

Checklist ID: 40695

Microbac Laboratories Inc.

Data Checklist

Date: 06-AUG-2009
Analyst: WTD
Analyst: NA
Method: 6850
Instrument: LCMS1
Curve Workgroup: NA
Runlog ID: 29520
Analytical Workgroups: 308952

ANALYTICAL	
System Performance Check	NA
DFTPP (MS)	NA
Endrin/DDT breakdown (8081/MS)	NA
Pentachlorophenol/benzidine tailing (MS)	NA
Eluent check (IC)/system pressure (HPLC)	NA
Window standard (FID)	NA
Initial Calibration	NA
Average RF	NA
Linear regression or higher order curve	NA
Alternate source standard (ICV) % Difference	NA
Continuing Calibration (CCV)	X
% D/% Drift	X
Minimum response factors (MS)	X
Continuing calibration blank (CCB) (IC)	NA
Special standards	NA
Blanks	X
TCL hits	X
Surrogate recoveries	NA
LCS/LCSD (Laboratory Control Sample)	X
Recoveries	X
Surrogate recoveries	NA
MS/MSD/Sample duplicates	NA
Recoveries	NA
%RPD	NA
Samples	X
TCL hits	X
Mass spectra (MS/HPLC)/2nd column confirmations (ECD/FID/HPLC)	NA
Surrogate recoveries	NA
Internal standard areas (MS)	X
Library searches (MS)	NA
Calculations & correct factors	X
Compounds above calibration range	NA
Reruns	X
Manual integrations	X
Project/client specific requirements	X
REPORTING	
Upload batch form	X
KOBRA workgroup data/forms/bench sheets	X
Case narratives	NA
Check for completeness	X
Primary Reviewer	WTD
SUPERVISORY/SECONDARY REVIEW	
Check for compliance with method and project specific requirements	X
Check the completeness/accuracy of reported information	X
Data qualifiers	X
Secondary Reviewer	MDC

Primary Reviewer: 07-AUG-2009

Secondary Reviewer: 11-AUG-2009

CHECKLIST1 - Modified 03/05/2008
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Figure 2
Run Log

Run Log ID: 29520

Microbac Laboratories Inc.
Instrument Run Log

Instrument: LCMS1 Dataset: 080609.TXT
Analyst1: WTD Analyst2: NA
Method: 6850 SOP: Rev:

Maintenance Log ID: 29718

Column 1 ID: KP-RPPX250 Column 2 ID: NA
Workgroups: 308952
Internal STD: COA14015 Surrogate STD: NA Calibration STD STD34502
Comments:

Seq.	File ID	Sample Information	Mat	Dil	Reference	Date/Time
1	1LM.LM00155	CCB	1	1		08/06/09 09:23
2	1LM.LM00156	0.1 STD	1	1	STD34502	08/06/09 09:37
3	1LM.LM00157	0.2 STD	1	1	STD34502	08/06/09 09:52
4	1LM.LM00158	0.5 STD	1	1	STD34502	08/06/09 10:06
5	1LM.LM00159	1.0 STD	1	1	STD34502	08/06/09 10:21
6	1LM.LM00160	2.0 STD	1	1	STD34502	08/06/09 10:35
7	1LM.LM00161	5.0 STD	1	1	STD34502	08/06/09 10:49
8	1LM.LM00162	10.0 STD	1	1	STD34502	08/06/09 11:04
9	1LM.LM00163	ICV 1.0	1	1	STD34503	08/06/09 11:18
10	1LM.LM00164	MCT 0.2	1	1	STD34500	08/06/09 11:32
11	1LM.LM00165	CCB	1	1		08/06/09 11:47
12	1LM.LM00166	CCV 1.0	1	1	STD34502	08/06/09 12:01
13	1LM.LM00167	QCMRL 0.2	1	1	STD34502	08/06/09 12:16
14	1LM.LM00174	CCB	1	1		08/06/09 15:19
15	1LM.LM00175	QCMRL 0.2	1	1	STD34502	08/06/09 15:34
16	1LM.LM00176	CCV 1.0	1	1	STD34502	08/06/09 15:48
17	1LM.LM00177	MET BLK	1	1		08/06/09 16:02
18	1LM.LM00178	LCS	1	1	STD34502	08/06/09 16:17
19	1LM.LM00179	LCSD	1	1	STD34502	08/06/09 16:31
20	1LM.LM00180	L09070297-01 A 2X	1	2		08/06/09 16:45
21	1LM.LM00181	L09080013-01 A 2X	1	2		08/06/09 17:00
22	1LM.LM00182	L09080013-02 A 2X	1	2		08/06/09 17:14
23	1LM.LM00183	CCV 1.0	1	1	STD34502	08/06/09 17:29
24	1LM.LM00184	QCMRL 0.2	1	1	STD34502	08/06/09 17:43

Comments

Seq.	Rerun	Dil.	Reason	Analytes

Page: 1 Approved: 11-AUG-09

Microbac

Attachment D
Subcontractor Laboratory ELAP Accreditation
(Provided on CD)

CERTIFICATE OF ACCREDITATION

ANSI-ASQ National Accreditation Board/ACLASS
500 Montgomery Street, Suite 625, Alexandria, VA 22314, 877-344-3044

This is to certify that

Gulf Coast Analytical Laboratories, Inc.
7979 GSRI Avenue
Baton Rouge, LA 70820

has been assessed by ACLASS
and meets the requirements of

ISO/IEC 17025:2005 and DoD-ELAP

while demonstrating technical competence in the field(s) of

TESTING

Refer to the accompanying Scope(s) of Accreditation for information regarding the types of tests to which this accreditation applies.

ADE-1482
Certificate Number

ACLASS Approval

Certificate Valid: 08/15/2012-09/09/2014
Version No. 003 Issued: 08/29/2012

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated January 2009*).

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005 & DoD-ELAP

Gulf Coast Analytical Laboratories, Inc.

7979 GSRI Avenue, Baton Rouge, LA 70820
Karen S. Varnado Phone: 225-769-4900

TESTING

Valid to: September 9, 2014 Certificate Number: ADE- 1482

I. Environmental

MATRIX	SPECIFIC TEST or GROUP OF ANALYTES**	SPECIFICATION OR STANDARD METHOD (all EPA unless specified)	* KEY EQUIPMENT OR TECHNOLOGY USED
Water	Flashpoint / Ignitability	1010A	Automated FP Analyzer
Water	Alkalinity	SM 2320B / 310.1	Autotitrator
Water	Acidity	SM 2310B	Autotitrator
Water / Solid	Ammonia	SM 4500 NH3 B & E, 18th ed. SM 4500 NH3 B & C, 20th ed.	Autotitrator
Water	Mercury	7470A	CVAA
Solid	Mercury	7471B	CVAA
Water	Mercury	245.1 / 245.2	CVAA
Water / Solid	Cyanide	9012B	FIA
Water / Solid	Total Phenols	420.4 / 9066	FIA
Solid	Chloride	9251	FIA
Water / Solid	Chloride	9251 / 325.2 / SM 4500 Cl E	FIA
Water / Solid	Nitrate/Nitrite/N+N	353.2	FIA
Water / Solid	Total Phosphorous	365.1	FIA
Water / Solid	Reactive Cyanide	SW846 Sec 7.3	FIA
Water / Solid	Pesticides	8081A	GC-ECD
Water / Solid	PCB's	8082A	GC-ECD
Water / Solid	Herbicides	8151A	GC-ECD

MATRIX	SPECIFIC TEST or GROUP OF ANALYTES**	SPECIFICATION OR STANDARD METHOD (all EPA unless specified)	* KEY EQUIPMENT OR TECHNOLOGY USED
Water	EDB / DBCP	8011	GC-ECD
Water / Solid	DRO / ORO	8015B	GC-FID
Water / Solid	GRO	8015B	GC-FID
Water / Solid	TPH	TX 1005 / TX 1006	GC-FID
Water / Solid	TPH	Florida PRO	GC-FID
Water / Solid	Aromatic Volatile Organics	8021B	GC-FID/PID
Water	Dissolved Gases	RSK-175	GC-FID/TCD
Water / Solid	VOCs	8260B	GC-MS
Water / Solid	SVOCs	8270C / 8270D / SIM	GC-MS
Water	VOCs	624	GC-MS
Water	SVOCs	625	GC-MS
Water / Solid	OP Pesticides	8141A	GC-NPD
Water	TSS	SM 2540D / 160.2	Gravimetric
Water	TDS	SM 2540C / 160.1	Gravimetric
Water	TS	SM 2540B / 160.3	Gravimetric
Solid	TS	SM 2540B	Gravimetric
Water / Solid	Explosives	8330A	HPLC
Water / Solid	PAH's	8310	HPLC
Water	Anions	300.0	IC
Water / Solid	Anions	9056A	IC
Water	Perchlorate	314.0	IC
Water / Solid	ICP Metals	6010B / 6010C	ICP
Water	ICP Metals	200.7	ICP
Water	Volatile Fatty Acids	GCAL SOP WL-070	Ion Chromatography
Water / Solid	Ammonia	SM 4500 NH3 B & F 18th ed	Ion Selective Electrode

MATRIX	SPECIFIC TEST or GROUP OF ANALYTES	SPECIFICATION OR STANDARD METHOD (all EPA unless specified)	* KEY EQUIPMENT OR TECHNOLOGY USED
Water	Solid Phase Extraction	3535A	N/A
Water	Separatory Funnel Extraction	3510C	N/A
Water	Metals Digestion ICP	3010A	N/A
Solid	Ultrasonic Extraction for SVOA Analysis	3550C	N/A
Solid	Soxhlet Extraction for SVOA Analysis	3540C	N/A
Solid	Metals Digestion ICP	3050B	N/A
Water / Solid	TCLP	1311	N/A
Solid	Paint Filter Test	9095B	N/A
Water	pH	SM 4500 H+B / 9040C	pH Meter
Solid	pH	9045D	pH Meter
Water	VOC's	5030B	Purge and Trap
Solid	VOC's	5035	Purge and Trap
Water	Oil & Grease	1664A	SPE/Gravimetric
Water	Hexavalent Chromium	7196A	Spectrophotometer
Water	Sulfide	SM 4500 S2 D / 376.2	Spectrophotometer
Water	COD	HACH 8000	Spectrophotometer
Water / Solid	Sulfate	9038 / 375.4	Spectrophotometer
Water	Ortho Phosphate	SM 4500 P E	Spectrophotometer
Water	Silica	SM 4500 Si D	Spectrophotometer
Water/Solid	TKN	SM4500 Norg C SM4500 NH3 B SM4500NH3 E	Spectrophotometer
Water	Sulfide	SM 4500 S2 E / 376.1	Titration
Water / Solid	Reactive Sulfide	SW846 Sec 7.3	Titration
Solid	TOC	Lloyd Kahn 9060A	TOC Analyzer
Water	TOC	SM 5310B / 415.1 / 9060A	TOC Analyzer

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MATRIX	SPECIFIC TEST or GROUP OF ANALYTES	SPECIFICATION OR STANDARD METHOD (all EPA unless specified)	* KEY EQUIPMENT OR TECHNOLOGY USED
Water	TOX	9020B	TOX Analyzer
Water	Turbidity	SM2130B	Turbidimeter
Solid	Ignitability	1030	N/A
Water	Massachusetts EPH	Massachusetts EPH	GC-FID
Solid	Massachusetts EPH	Massachusetts EPH	GC-FID
Water	Massachusetts VPH	Massachusetts VPH	GC-FID/PID
Solid	Massachusetts VPH	Massachusetts VPH	GC-FID/PID
Water/Solid	ICP-MS Metals	6020A/200.8	ICP-MS
Water	ICP-MS Metals	200.8	ICP-MS

Notes:

1. ** = As Applicable*
2. ***=Refer to accredited analyte listing for exact analyte(s) in which the lab is accredited.*
3. *This scope is part of and must be included with the Certificate of Accreditation No. ADE- 1482*

Vice President

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Accredited Analytes/Methods (by matrix)

Gulf Coast Analytical Laboratories, Inc.

Baton Rouge, LA

NELAC Code	Analyte	Matrix													
		Aqueous							Solid						
1000	Aluminum	6010B	6010C	6020A	200.7	200.8			6010B	6010C	6020A				
1005	Antimony	6010B	6010C	6020A	200.7	200.8	3010 A	1311	6010B	6010C	6020A		1311	6010C	
1010	Arsenic	6010B	6010C	6020A	200.7	200.8	3010 A	1311	6010B	6010C	6020A		1311	6010C	
1015	Barium	6010B	6010C	6020A	200.7	200.8	3010 A	1311	6010B	6010C	6020A		1311	6010C	
1020	Beryllium	6010B	6010C	6020A	200.7	200.8	3010 A	1311	6010B	6010C	6020A		1311	6010C	
1025	Boron	6010B	6010C		200.7				6010B	6010C					
1030	Cadmium	6010B	6010C	6020A	200.7	200.8	3010 A	1311	6010B	6010C	6020A		1311	6010C	
1035	Calcium	6010B	6010C	6020A	200.7	200.8			6010B	6010C	6020A				
1040	Chromium	6010B	6010C	6020A	200.7	200.8	3010 A	1311	6010B	6010C	6020A		1311	6010C	
1045	Chromium VI	7196A													
1050	Cobalt	6010B	6010C	6020A	200.7	200.8			6010B	6010C	6020A				
1055	Copper	6010B	6010C	6020A	200.7	200.8			6010B	6010C	6020A				
1070	Iron	6010B	6010C	6020A	200.7	200.8			6010B	6010C	6020A				
1075	Lead	6010B	6010C	6020A	200.7	200.8	3010 A	1311	6010B	6010C	6020A		1311	6010C	
1085	Magnesium	6010B	6010C	6020A	200.7	200.8			6010B	6010C	6020A				
1090	Manganese	6010B	6010C	6020A	200.7	200.8			6010B	6010C	6020A				
1095	Mercury	7470A	245.2	245.1			3010 A	1311	7471B				1311	6010C	
1100	Molybdenum	6010B	6010C	6020A	200.7	200.8			6010B	6010C	6020A				
1105	Nickel	6010B	6010C	6020A	200.7	200.8			6010B	6010C	6020A				
1125	Potassium	6010B	6010C	6020A	200.7	200.8			6010B	6010C	6020A				
1140	Selenium	6010B	6010C	6020A	200.7	200.8	3010 A	1311	6010B	6010C	6020A		1311	6010C	
1150	Silver	6010B	6010C	6020A	200.7	200.8	3010 A	1311	6010B	6010C	6020A		1311	6010C	
1155	Sodium	6010B	6010C	6020A	200.7	200.8			6010B	6010C	6020A				
1160	Strontium	6010B	6010C	6020A	200.7	200.8			6010B	6010C	6020A				
1165	Thallium	6010B	6010C	6020A	200.7	200.8	3010 A	1311	6010B	6010C	6020A		1311	6010C	
1175	Tin	6010B	6010C	6020A	200.7	200.8			6010B	6010C	6020A				
1180	Titanium	6010B	6010C	6020A	200.7	200.8			6010B	6010C	6020A				
1185	Vanadium	6010B	6010C	6020A	200.7	200.8			6010B	6010C	6020A				
1190	Zinc	6010B	6010C	6020A	200.7	200.8	3010 A	1311	6010B	6010C	6020A		1311	6010C	
1192	Zirconium			6020A		200.8					6020A				
1500	Acidity(as CaCO3)	SM 2310B													
1505	Total Alkalinity(as CaCO3)	SM 2320B	EPA 310.1												
1515	Ammonia as N	SM4500 NH3 B & E	SM4500 NH3 B & F	SM4500 NH3 B & C					SM 4500 NH3 BE	SM 4500 NH3 BF	SM4500 NH3 B & C				
1540	Bromide	9056A	EPA 300.0						9056A						
1565	COD	HACH 8000													
1575	Chloride	9056A	EPA 300.0	9251	EPA 325.2			SM 4500 Cl E	9056A	9251					
1625	Corrosivity (pH)	9040C	SM 4500 H+B						9045D						
1645	Total Cyanide	9012B							9012B						
1730	Fluoride	9056A	EPA 300.0						9056A						
1755	Total Hardness (as CaCO3)	6020A	200.8												
1780	Ignitability	1010A							1010A						
1810	Nitrate as N	9056A	EPA 300.0	EPA 353.2					9056A	EPA 353.2					
1820	Nitrate and Nitrite as N	9056A	EPA 300.0	EPA 353.2					9056A	EPA 353.2					
1840	Nitrite as N	9056A	EPA 300.0	EPA 353.2					9056A	EPA 353.2					
1860	Oil & Grease	EPA 1664A													
1870	Orthophosphate as P	SM 4500 PE													
1895	Perchlorate	EPA 314.0							EPA 314.0						
1900	pH	9040C	SM 4500 H+B						9040C						
1905	Total Phenolics (4AAP)	9066	EPA 420.4						9066	EPA 420.4					
1910	Total Phosphorous	EPA 365.1							EPA 365.1						
1925	Reactive sulfide	SW846 Sec 7.3							SW846 Sec 7.3						
-	Reactive Cyanide	SW846 Sec 7.3							SW846 Sec 7.3						
-	Percent Moisture								SM 2540G						
1950	Total Solids	SM 2540B	EPA 160.3						SM2540 G						
1955	Total Dissolved Solids at 180° (TFR)	SM 2540C	EPA 160.1												
1960	Non-Filterable Residue (TSS)	SM 2540D	EPA 160.2												
2000	Sulfate	9056A	EPA 300.0	9038	EPA 375.4				9056A	9038	9038	EPA 375.4			

Accredited Analytes/Methods (by matrix)

Gulf Coast Analytical Laboratories, Inc.

Baton Rouge, LA

NELAC Code	Analyte	Matrix													
		Aqueous							Solid						
2005	Sulfide	SM 4500 S2 D	EPA 376.2	SM 4500 S2 E	EPA 376.1										
2040	TOC	SM 5310B	EPA 415.1	9060A					EPA 9060A						
2045	Total Organic Halides	9020B							9020B						
2055	Turbidity	SM 2130 B													
4315	Acetone	8260B	624						8260B						
4320	Acetonitrile	8260B	624						8260B						
4325	Acrolein	8260B	624						8260B						
4340	Acrylonitrile	8260B	624						8260B						
4375	Benzene	8260B	624	1311					8260B	1311					
4385	Bromobenzene	8260 B							8260 B						
4390	Bromochloromethane	8260B	624						8260B						
4395	Bromodichloromethane	8260B	624						8260B						
4400	Bromoform	8260B	624						8260B						
4410	2-Butanone (MEK)	8260B	624	1311					8260B	1311					
4435	n-Butylbenzene	8260B	624						8260B						
4440	sec-Butylbenzene	8260B	624						8260B						
4445	tert-Butylbenzene	8260B	624						8260B						
4450	Carbon disulfide	8260B	624						8260B						
4455	Carbon tetrachloride	8260B	624	1311					8260B	1311					
4475	Chlorobenzene	8260B	624	1311					8260B	1311					
4485	Chloroethane	8260B	624						8260B						
4500	2-Chloroethylvinylether	8260B	624						8260B						
4505	Chloroform	8260B	624	1311					8260B	1311					
4535	2-Chlorotoluene	8260B	624						8260B						
4540	4-Chlorotoluene	8260B	624						8260B						
4570	1,2-Dibromo-3-chloropropane (DBCP)	8260B	624	8011					8260B						
4575	Dibromochloromethane	8260B	624						8260B						
4585	1,2-Dibromoethane (EDB)	8260B	624	8011					8260B						
4595	Dibromomethane	8260B	624						8260B						
4610	1,2 Dichlorobenzene	8260B	624		8270C	8270D		625	8260B		8270C	8270D			
4615	1,3 Dichlorobenzene	8260B	624		8270C	8270D		625	8260B		8270C	8270D			
4620	1,4 Dichlorobenzene	8260B	624	1311	8270C	8270D		625	8260B	1311	8270C	8270D			
4625	Dichlorodifluoromethane	8260B	624						8260B						
4630	1,1-Dichloroethane	8260B	624						8260B						
4635	1,2 Dichloroethane	8260B	624	1311					8260B	1311					
4640	1,1-Dichloroethene	8260B	624	1311					8260B	1311					
4645	cis-1,2-Dichloroethene	8260B	624						8260B						
4655	1,2-Dichloropropane	8260B	624						8260B						
4660	1,3-Dichloropropane	8260B	624						8260B						
4665	2,2-Dichloropropane	8260B	624						8260B						
4670	1,1-Dichloropropene	8260B	624						8260B						
4680	cis-1,3-Dichloropropylene	8260B	624						8260B						
4685	trans-1,3-Dichloropropene	8260B	624						8260B						
4700	trans-1,2-Dichloroethene	8260B	624						8260B						
4740	p-Dioxane				8270C	8270D		625							
4765	Ethylbenzene	8260B	624						8260B						
4835	Hexachlorobutadiene	8260B	624	1311	8270C	8270D		625	8260B	1311	8270C	8270D			
4840	Hexachloroethane			1311	8270C	8270D		625		1311	8270C	8270D			
4860	2-Hexanone	8260B	624						8260B						
4900	Isopropylbenzene	8260B	624						8260B						
4910	p-Isopropyltoluene	8260B	624						8260B						
4950	Bromomethane	8260B	624						8260B						
4960	Chloromethane	8260B	624						8260B						
	Mrthyl Acetate	8260B							8260B						
4975	Methylene Chloride	8260B	624						8260B						
	Methylcyclohexane	8260B							8260B						
4995	4-Methyl-2-pentanone (MIBK)	8260B	624						8260B						

Accredited Analytes/Methods (by matrix)

Gulf Coast Analytical Laboratories, Inc.

Baton Rouge, LA

NELAC Code	Analyte	Matrix													
		Aqueous							Solid						
5000	Methyl tert-butyl ether (MTBE)	8260B	624						8260B						
5005	Naphthalene	8260B	624	8310	8270 C	8270D		625	8260B		8270C	8270D			8310
5015	Nitrobenzene	8330 A		1311	8270C	8270D		625		1311	8270C	8270D		8330A	
5090	n-Propylbenzene	8260B	624						8260B						
5095	Pyridine			1311	8270C	8270D		625		1311	8270C	8270D			
5100	Styrene	8260B	624						8260B						
5105	1,1,1,2-Tetrachloroethane	8260B	624						8260B						
5110	1,1,2,2-Tetrachloroethane	8260B	624						8260B						
	1,2,4,5-Tetrachlorobenzene	8260B							8260B						
5115	Tetrachloroethene	8260B	624	1311					8260B	1311					
5140	Toluene	8260B	624						8260B						
5145	o-Toluidine				8270C	8270D		625							
	1,1,2-trichloro-1,2,2-trifluoroethane	8260B							8260B						
5150	1,2,3-Trichlorobenzene	8260B	624						8260B						
5155	1,2,4-Trichlorobenzene	8260B	624		8270C	8270D		625	8260B	8270 C	8270 D				
5160	1,1,1-Trichloroethane	8260B	624						8260B						
5165	1,1,2-Trichloroethane	8260B	624						8260B						
5170	Trichloroethene	8260B	624	1311					8260B	1311					
5175	Trichlorofluoromethane	8260B	624						8260B						
5180	1,2,3-Trichloropropane	8260B	624						8260B						
5210	1,2,4-Trimethylbenzene	8260B	624						8260B						
5215	1,3,5-Trimethylbenzene	8260B	624						8260B						
5225	Vinyl acetate	8260B	624						8260B						
5235	Vinyl chloride	8260B	624	1311					8260B	1311					
5240	m+p-Xylene	8260B	624						8260B						
5250	o-Xylene	8260B	624						8260B						
5260	Xylenes, total	8260B	624						8260B						
5500	Acenaphthene	8310			8270C	8270D		625			8270C	8270D			8310
5505	Acenaphthylene	8310			8270C	8270D		625			8270C	8270D			8310
	Acetophenone				8270C						8270C				
5545	Aniline				8270C	8270D		625			8270C	8270D			
5555	Anthracene	8310			8270C	8270D		625			8270C	8270D			8310
	Benzaldehyde				8270C						8270C				
5575	Benzo(a)anthracene	8310			8270C	8270D		625			8270C	8270D			8310
5580	Benzo(a)pyrene	8310			8270C	8270D		625			8270C	8270D			8310
5585	Benzo(b)fluoranthene	8310			8270C	8270D		625			8270C	8270D			8310
5590	Benzo(g,h,i)perylene	8310			8270C	8270D		625			8270C	8270D			8310
5595	Benzidine				8270C	8270D		625			8270C	8270D			
5600	Benzo(k)fluoranthene	8310			8270C	8270D		625			8270C	8270D			8310
5610	Benzoic acid				8270C	8270D		625			8270C	8270D			
5630	Benzyl alcohol				8270C	8270D		625			8270C	8270D			
	Biphenyl				8270C						8270C				
5660	4-Bromophenyl-phenylether				8270C	8270D		625			8270C	8270D			
5670	Butyl benzyl phthalate				8270C	8270D		625			8270C	8270D			
5680	Carbazole				8270C	8270D		625			8270C	8270D			
5700	4-Chloro-3-methylphenol				8270C	8270D		625			8270C	8270D			
5745	4-Chloroaniline				8270C	8270D		625			8270C	8270D			
5760	bis(2-Chloroethoxy)methane				8270C	8270D		625			8270C	8270D			
5765	bis(2-Chloroethyl)ether				8270C	8270D		625			8270C	8270D			
5780	bis(2-Chloroiospropyl) ether				8270C	8270D		625			8270C	8270D			
5795	2-Chloronaphthalene				8270C	8270D		625			8270C	8270D			
5800	2-Chlorophenol				8270C	8270D		625			8270C	8270D			
5825	4-Chlorophenyl-phenylether				8270C	8270D		625			8270C	8270D			
5855	Chrysene	8310			8270C	8270D		625			8270C	8270D			8310
5895	Dibenzo(a,h)anthracene	8310			8270C	8270D		625			8270C	8270D			8310
5905	Dibenzofuran				8270C	8270D		625			8270C	8270D			
5925	Di-n-butylphthalate				8270C	8270D		625			8270C	8270D			

Accredited Analytes/Methods (by matrix)

Gulf Coast Analytical Laboratories, Inc.

Baton Rouge, LA

NELAC Code	Analyte	Matrix														
		Aqueous							Solid							
5945	3,3'-Dichlorobenzidine				8270C	8270D		625			8270C	8270D			
6000	2,4-Dichlorophenol				8270C	8270D		625			8270C	8270D			
6005	2,6-Dichlorophenol				8270C	8270D		625			8270C	8270D			
6070	Diethyl phthalate				8270C	8270D		625			8270C	8270D			
6130	2,4-Dimethylphenol				8270C	8270D		625			8270C	8270D			
6135	Dimethyl phthalate				8270C	8270D		625			8270C	8270D			
6160	1,3-Dinitrobenzene	8330 A							8330A						
6175	2,4-Dinitrophenol				8270C	8270D		625			8270C	8270D			
6185	2,4-Dinitrotoluene	8330 A	1311		8270C	8270D		625		1311	8270C	8270D		8330A	
6190	2,6-Dinitrotoluene	8330 A			8270C	8270D		625			8270C	8270D		8330A	
6200	Di-n-octylphthalate				8270C	8270D		625			8270C	8270D			
6255	bis(2-ethylhexyl) phthalate				8270C	8270D		625			8270C	8270D			
6265	Fluoranthene	8310			8270C	8270D		625			8270C	8270D			8310
6270	Fluorene	8310			8270C	8270D		625			8270C	8270D			8310
6275	Hexachlorobenzene		1311		8270C	8270D		625		1311	8270C	8270D			
6285	Hexachlorocyclopentadiene				8270C	8270D		625			8270C	8270D			
6315	Indeno(1,2,3, cd)pyrene	8310			8270C	8270D		625			8270C	8270D			8310
6320	Isophorone				8270C	8270D		625			8270C	8270D			
6360	2-Methyl-4,6-Dinitrophenol				8270C	8270D		625			8270C	8270D			
6380	1-Methylnaphthalene				8270C	8270D		625							
6385	2-Methylnaphthalene	8310			8270C	8270D		625			8270C	8270D			8310
6400	2-Methylphenol		1311		8270C	8270D		625		1311	8270C	8270D			
6410	4-Methylphenol (and/or 3-Methylphenol)		1311		8270C	8270D		625		1311	8270C	8270D			
6415	Tetryl (Methyl-2,4,6-trinitrophenylnitramine)	8330 A							8330 A						
6460	2-Nitroaniline				8270C	8270D		625			8270C	8270D			
6465	3-Nitroaniline				8270C	8270D		625			8270C	8270D			
6470	4-Nitroaniline				8270C	8270D		625			8270C	8270D			
6490	2-Nitrophenol				8270C	8270D		625			8270C	8270D			
6500	4-Nitrophenol	8151 A			8270C	8270D		625	8151 A		8270C	8270D			
6525	N-Nitrosodiethylamine				8270C	8270D		625			8270C	8270D			
6530	N-Nitrosodimethylamine				8270C	8270D		625			8270C	8270D			
6535	N-Nitrosodiphenylamine				8270C	8270D		625			8270C	8270D			
6545	N-Nitroso-di-n-propylamine				8270C	8270D		625			8270C	8270D			
6590	Pentachlorobenzene				8270C	8270D		625			8270C	8270D			
6605	Pentachlorophenol	8151 A	1311		8270C	8270D		625	8151 A	1311	8270C	8270D			
6615	Phenanthrene	8310			8270C	8270D		625			8270C	8270D			8310
6625	Phenol				8270C	8270D		625			8270C	8270D			
6665	Pyrene	8310			8270C	8270D		625			8270C	8270D			8310
6715	1,2,4,5-Tetrachlorobenzene				8270C	8270D		625			8270C	8270D			
6735	2,3,4,6-Tetrachlorophenol				8270C	8270D		625			8270C	8270D			
6835	2,4,5-Trichlorophenol		1311		8270C	8270D		625		1311	8270C	8270D			
6840	2,4,6-Trichlorophenol		1311		8270C	8270D		625		1311	8270C	8270D			
6885	1,3,5-Trinitrobenzene	8330 A												8330A	
7025	Aldrin	8081B											8081B		
7075	Azinphos-methyl (Guthion)	8141B							8141B						
7105	delta-BHC	8081B											8081B		
7110	alpha-BHC	8081B											8081B		
7115	beta-BHC	8081B											8081B		
7120	gamma-BHC (Lindane)	8081B	1311							1311			8081B		
7240	alpha-Chlordane	8081B											8081B		
7245	gamma-Chlordane	8081B											8081B		
7250	Chlordane (total)	8081B											8081B		
7355	DDD (4,4)	8081B											8081B		
7360	DDE (4,4)	8081B											8081B		
7365	DDT (4,4)	8081B											8081B		
7410	Diazinon	8141B							8141B						
7470	Dieldrin	8081B											8081B		

Accredited Analytes/Methods (by matrix)

Gulf Coast Analytical Laboratories, Inc.

Baton Rouge, LA

NELAC Code	Analyte	Matrix														
		Aqueous							Solid							
7510	Endosulfan I	8081B											8081B			
7515	Endosulfan II	8081B											8081B			
7520	Endosulfan sulfate	8081B											8081B			
7530	Endrin aldehyde	8081B											8081B			
7535	Endrin ketone	8081B											8081B			
7540	Endrin	8081B	1311							1311			8081B			
7685	Heptachlor	8081B	1311							1311			8081B			
7690	Heptachlor Epoxide (beta)	8081B	1311							1311			8081B			
7770	Malathion	8141B							8141B							
7775	MCPA	8151A							8151A							
7780	MCPP	8151 A							8151 A							
7810	Methoxychlor	8081B	1311							1311			8081B			
7825	Parathion, methyl	8141B							8141B							
7955	Parathion, ethyl	8141B							8141B							
7985	Phorate	8141B							8141B							
8110	Ronnel	8141B							8141B							
8200	Stirophos	8141B							8141B							
8250	Toxaphene (total)	8081B											8081B			
8505	Acifluorfen	8151 A							8151 A							
8530	Bentazon	8151 A							8151 A							
8540	Chloramben	8151 A							8151 A							
8545	2,4-D	8151 A	1311						8151A	1311						
8550	Dacthal (DCPA)	8151 A							8151 A							
8555	Dalapon	8151 A							8151 A							
8560	2,4-DB	8151 A							8151A							
8595	Dicamba	8151 A							8151A							
8600	3,5-Dichlorobenzoic acid	8151 A							8151 A							
8605	2,4-DP (Dichlorprop)	8151 A							8151 A							
8620	Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	8151 A							8151A							
8625	Disulfoton	8141B							8141B							
8645	Picloram	8151 A							8151 A							
8650	2,4,5-TP (Silvex)	8151 A	1311							1311			8151A			
8655	2,4,5-T	8151 A							8151A							
8880	Aroclor 1016	8082A							8082A							
8885	Aroclor 1221	8082A							8082A							
8890	Aroclor 1232	8082A							8082A							
8895	Aroclor 1242	8082A							8082A							
8900	Aroclor 1248	8082A							8082A							
8905	Aroclor 1254	8082A							8082A							
8910	Aroclor 1260	8082A							8082A							
9303	2-Amino-4,6-dinitrotoluene	8330 A												8330A		
9306	4-Amino-2,6-dinitrotoluene	8330 A												8330A		
9369	Diesel range organics (DRO)	8015C							8015C							
9432	RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine)	8330 A												8330A		
9507	2-Nitrotoluene	8330 A												8330A		
9510	3-Nitrotoluene	8330 A												8330A		
9513	4-Nitrotoluene	8330 A												8330A		
9522	HMX (Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine)	8330 A												8330A		
9651	2,4,6-Trinitrotoluene	8330 A												8330A		
	Methane	RSK-175														
	Ethane	RSK-175														
	Ethene	RSK-175														
	Carbon Dioxide	RSK-175														
	Lactic Acid	GCAL SOP WL-070														
	Formic Acid	GCAL SOP WL-070														
	Acetic Acid	GCAL SOP WL-070														
	Proprionic Acid	GCAL SOP WL-070														

Accredited Analytes/Methods (by matrix)

Gulf Coast Analytical Laboratories, Inc.

Baton Rouge, LA

NELAC Code	Analyte	Matrix													
		Aqueous							Solid						
	Butyric Acid	GCAL SOP WL-070													
	1-Chlorohexane	8260B													
	1-Chlorohexane								8260B						
	1,2-Diphenylhydrazine	8270C	8270D												
	1,2-Diphenylhydrazine								8270C	8270D					
	Chlordane	8082B	1311						1311	8082B					
	Toxaphene	8082 A	1311						1311	8082 A					
	Paint Filter Test	9095B							9095B						
	Oil Range Organics	8015C							8015C						
	Petroleum Hydrocarbons	Florida PRO							Florida PRO						
	Ignitability								1030						
9408	Gasoline	8015C							8015C						
4375	Benzene	8021B							8021B						
4765	Ethyl Benzene	8021B							8021B						
5140	Toluene	8021B							8021B						
5260	Xylene	8021B							8021B						
9375	DIPE	8260B							8260B						
4770	ETBE	8260B							8260B						
5000	MTBE	8260B							8260B						
4370	TAME	8260B							8260B						
4420	tert-Butyl alcohol	8260B							8260B						
9369	Diesel	8015C							8015C						
2050	Total Petroleum Hydrocarbon	TNRCC 1005							TNRCC 1005						
	Total Petroleum Hydrocarbon	TNRCC 1006							TNRCC 1006						
	GRO-Total	TNRCC 1006							TNRCC 1006						
	DRO-Total	TNRCC 1006							TNRCC 1006						
	ORO-Total	TNRCC 1006							TNRCC 1006						
	DRO-Total	TNRCC 1006							TNRCC 1006						
	ORO-Total	TNRCC 1006							TNRCC 1006						
	GRO-aliphatic	TNRCC 1006							TNRCC 1006						
	DRO-alphativ	TNRCC 1006							TNRCC 1006						
	ORO-aliphatic	TNRCC 1006							TNRCC 1006						
	GRO-aromatic	TNRCC 1006							TNRCC 1006						
	DRO-aromatic	TNRCC 1006							TNRCC 1006						
	ORO-aromatic	TNRCC 1006							TNRCC 1006						
-	C5-C8 Alliphatic Hydrocarbons	MADEP VPH							MADEP VPH						
-	C9-C12 Alliphatic Hydrocarbons	MADEP VPH							MADEP VPH						
-	C9-C10 Aromatic Hydrocarbons	MADEP VPH							MADEP VPH						
-	C9-C18 Alliphatic Hydrocarbons	MADEP EPH							MADEP EPH						
-	C19-C36 Alliphatic Hydrocarbons	MADEP EPH							MADEP EPH						
-	C11-C22 Aromatic Hydrocarbons	MADEP EPH							MADEP EPH						

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

MICROBAC LABORATORIES, INC.
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ENVIRONMENTAL

Valid To: December 31, 2013 Certificate Number: 2936.01

In recognition of the successful completion of the A2LA evaluation process, (including an assessment of the laboratory's compliance with ISO IEC 17025:2005, the 2003 NELAC Chapter 5 Standard, and the requirements of the DoD Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in version 4.2 of the DoD Quality Systems Manual for Environmental Laboratories) accreditation is granted to this laboratory to perform recognized EPA methods using the following testing technologies and in the analyte categories identified below:

Testing Technologies

Atomic Absorption/ICP-AES Spectrometry, ICP/MS, Gas Chromatography, Gas Chromatography/Mass Spectrometry, Gravimetry, High Performance Liquid Chromatography, LC/MS/MS, Ion Chromatography, Misc.-Electronic Probes (pH, O_2), Oxygen Demand, Hazardous Waste Characteristics Tests, Spectrophotometry (Visible), Spectrophotometry (Automated), IR Spectrometry, Titrimetry, Total Organic Carbon

Parameter/Analyte	**Nonpotable Water (1)**	**Solid and Chemical Materials (2)**
Metals		
Aluminum	EPA 200.7 EPA 3005A/6010B EPA 3015/6010B EPA 3015A/6010B EPA 3005A/6010C EPA 3015/6010C EPA 3015A/6010C	EPA 3051/6010B EPA 3051A/6010B EPA 3051/6010C EPA 3051A/6010C

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
Antimony	EPA 200.7 EPA 200.8 EPA 3005A/6010B EPA 3015/6010B EPA 3015A/6010B EPA 3005A/6010C EPA 3015/6010C EPA 3015A/6010C EPA 3015/6020 EPA 3015A/6020 EPA 3015/6020A EPA 3015A/6020A	EPA 3051/6010B EPA 3051A/6010B EPA 3051/6010C EPA 3051A/6010C EPA 3051/6020 EPA 3051A/6020 EPA 3051/6020A EPA 3051A/6020A
Arsenic	EPA 200.7 EPA 200.8 EPA 3005A/6010B EPA 3015/6010B EPA 3015A/6010B EPA 3005A/6010C EPA 3015/6010C EPA 3015A/6010C EPA 3015/6020 EPA 3015A/6020 EPA 3015/6020A EPA 3015A/6020A	EPA 3051/6010B EPA 3051A/6010B EPA 3051/6010C EPA 3051A/6010C EPA 3051/6020 EPA 3051A/6020 EPA 3051/6020A EPA 3051A/6020A
Barium	EPA 200.7 EPA 200.8 EPA 3005A/6010B EPA 3015/6010B EPA 3015A/6010B EPA 3005A/6010C EPA 3015/6010C EPA 3015A/6010C EPA 3015/6020 EPA 3015A/6020 EPA 3015/6020A EPA 3015A/6020A	EPA 3051/6010B EPA 3051A/6010B EPA 3051/6010C EPA 3051A/6010C EPA 3051/6020 EPA 3051A/6020 EPA 3051/6020A EPA 3051A/6020A
Beryllium	EPA 200.7 EPA 3005A/6010B EPA 3015/6010B EPA 3015A/6010B EPA 3005A/6010C EPA 3015/6010C EPA 3015A/6010C	EPA 3051/6010B EPA 3051A/6010B EPA 3051/6010C EPA 3051A/6010C

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
Boron	EPA 200.7 EPA 3005A/6010B EPA 3015/6010B EPA 3015A/6010B EPA 3005A/6010C EPA 3015/6010C EPA 3015A/6010C	EPA 3051/6010B EPA 3051A/6010B EPA 3051/6010C EPA 3051A/6010C
Cadmium	EPA 200.7 EPA 200.8 EPA 3005A/6010B EPA 3015/6010B EPA 3015A/6010B EPA 3005A/6010C EPA 3015/6010C EPA 3015A/6010C EPA 3015/6020 EPA 3015A/6020 EPA 3015/6020A EPA 3015A/6020A	EPA 3051/6010B EPA 3051A/6010B EPA 3051/6010C EPA 3051A/6010C EPA 3051/6020 EPA 3051A/6020 EPA 3051/6020A EPA 3051A/6020A
Calcium	EPA 200.7 EPA 3005A/6010B EPA 3015/6010B EPA 3015A/6010B EPA 3005A/6010C EPA 3015/6010C EPA 3015A/6010C	EPA 3051/6010B EPA 3051A/6010B EPA 3051/6010C EPA 3051A/6010C
Chromium	EPA 200.7 EPA 200.8 EPA 3005A/6010B EPA 3015/6010B EPA 3015A/6010B EPA 3005A/6010C EPA 3015/6010C EPA 3015A/6010C EPA 3015/6020 EPA 3015A/6020 EPA 3015/6020A EPA 3015A/6020A	EPA 3051/6010B EPA 3051A/6010B EPA 3051/6010C EPA 3051A/6010C EPA 3051/6020 EPA 3051A/6020 EPA 3051/6020A EPA 3051A/6020A
Cobalt	EPA 200.7 EPA 200.8 EPA 3005A/6010B EPA 3015/6010B EPA 3015A/6010B EPA 3005A/6010C EPA 3015/6010C EPA 3015A/6010C EPA 3015/6020 EPA 3015A/6020 EPA 3015/6020A	EPA 3051/6010B EPA 3051A/6010B EPA 3051/6010C EPA 3051A/6010C EPA 3051/6020 EPA 3051A/6020 EPA 3051/6020A EPA 3051A/6020A

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
	EPA 3015A/6020A	
Copper	EPA 200.7 EPA 200.8 EPA 3005A/6010B EPA 3015/6010B EPA 3015A/6010B EPA 3005A/6010C EPA 3015/6010C EPA 3015A/6010C EPA 3015/6020 EPA 3015A/6020 EPA 3015/6020A EPA 3015A/6020A	EPA 3051/6010B EPA 3051A/6010B EPA 3051/6010C EPA 3051A/6010C EPA 3051/6020 EPA 3051A/6020 EPA 3051/6020A EPA 3051A/6020A
Iron	EPA 200.7 EPA 3005A/6010B EPA 3015/6010B EPA 3015A/6010B EPA 3005A/6010C EPA 3015/6010C EPA 3015A/6010C	EPA 3051/6010B EPA 3051A/6010B EPA 3051/6010C EPA 3051A/6010C
Lead	EPA 200.7 EPA 200.8 EPA 3005A/6010B EPA 3015/6010B EPA 3015A/6010B EPA 3005A/6010C EPA 3015/6010C EPA 3015A/6010C EPA 3015/6020 EPA 3015A/6020 EPA 3015/6020A EPA 3015A/6020A	EPA 3051/6010B EPA 3051A/6010B EPA 3051/6010C EPA 3051A/6010C EPA 3051/6020 EPA 3051A/6020 EPA 3051/6020A EPA 3051A/6020A
Lithium	EPA 200.7 EPA 3005A/6010B EPA 3015/6010B EPA 3015A/6010B EPA 3005A/6010C EPA 3015/6010C EPA 3015A/6010C	EPA 3051/6010B EPA 3051A/6010B EPA 3051/6010C EPA 3051A/6010C
Magnesium	EPA 200.7 EPA 3005A/6010B EPA 3015/6010B EPA 3015A/6010B EPA 3005A/6010C EPA 3015/6010C EPA 3015A/6010C	EPA 3051/6010B EPA 3051A/6010B EPA 3051/6010C EPA 3051A/6010C

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
Manganese	EPA 200.7 EPA 200.8 EPA 3005A/6010B EPA 3015/6010B EPA 3015A/6010B EPA 3005A/6010C EPA 3015/6010C EPA 3015A/6010C EPA 3015/6020 EPA 3015A/6020 EPA 3015/6020A EPA 3015A/6020A	EPA 3051/6010B EPA 3051A/6010B EPA 3051/6010C EPA 3051A/6010C EPA 3051/6020 EPA 3051A/6020 EPA 3051/6020A EPA 3051A/6020A
Mercury	EPA 245.1 EPA 7470A	EPA 7471A EPA 7471B
Molybdenum	EPA 200.7 EPA 3005A/6010B EPA 3015/6010B EPA 3015A/6010B EPA 3005A/6010C EPA 3015/6010C EPA 3015A/6010C	EPA 3051/6010B EPA 3051A/6010B EPA 3051/6010C EPA 3051A/6010C
Nickel	EPA 200.7 EPA 200.8 EPA 3005A/6010B EPA 3015/6010B EPA 3015A/6010B EPA 3005A/6010C EPA 3015/6010C EPA3015A/6010C EPA 3015/6020 EPA 3015A/6020 EPA 3015/6020A EPA 3015A/6020A	EPA 3051/6010B EPA 3051A/6010B EPA 3051/6010C EPA 3051A/6010C EPA 3051/6020 EPA 3051A/6020 EPA 3051/6020A EPA 3051A/6020A
Phosphorus	EPA 200.7 EPA 3005A/6010B EPA 3015/6010B EPA 3015A/6010B EPA 3005A/6010C EPA 3015/6010C EPA 3015A/6010C	EPA 3051/6010B EPA 3051A/6010B EPA 3051/6010C EPA 3051A/6010C
Potassium	EPA 200.7 EPA 3005A/6010B EPA 3015/6010B EPA 3015A/6010B EPA 3005A/6010C EPA 3015/6010C EPA 3015A/6010C	EPA 3051/6010B EPA 3051A/6010B EPA 3051/6010C EPA 3051A/6010C

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
Selenium	EPA 200.7 EPA 200.8 EPA 3005A/6010B EPA 3015/6010B EPA 3015A/6010B EPA 3005A/6010C EPA 3015/6010C EPA 3015A/6010C EPA 3015/6020 EPA 3015A/6020 EPA 3015/6020A EPA 3015A/6020A	EPA 3051/6010B EPA 3051A/6010B EPA 3051/6010C EPA 3051A/6010C EPA 3051/6020 EPA 3051A/6020 EPA 3051/6020A EPA 3051A/6020A
Silicon	EPA 200.7 EPA 3005A/6010B EPA 3015/6010B EPA 3015A/6010B EPA 3005A/6010C EPA 3015/6010C EPA 3015A/6010C	----------
Silver	EPA 200.7 EPA 200.8 EPA 3005A/6010B EPA 3015/6010B EPA 3015A/6010B EPA 3005A/6010C EPA 3015/6010C EPA 3015A/6010C EPA 3015/6020 EPA 3015A/6020 EPA 3015/6020A EPA 3015A/6020A	EPA 3051/6010B EPA 3051A/6010B EPA 3051/6010C EPA 3051A/6010C EPA 3051/6020 EPA 3051A/6020 EPA 3051/6020A EPA 3051A/6020A
Sodium	EPA 200.7 EPA 3005A/6010B EPA 3015/6010B EPA 3015A/6010B EPA 3005A/6010C EPA 3015/6010C EPA 3015A/6010C	EPA 3051/6010B EPA 3051A/6010B EPA 3051/6010C EPA 3051A/6010C
Strontium	EPA 200.7 EPA 3005A/6010B EPA 3015/6010B EPA 3015A/6010B EPA 3005A/6010C EPA 3015/6010C EPA 3015A/6010C	EPA 3051/6010B EPA 3051A/6010B EPA 3051/6010C EPA 3051A/6010C

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
Thallium	EPA 200.7 EPA 200.8 EPA 3005A/6010B EPA 3015/6010B EPA 3015A/6010B EPA 3005A/6010C EPA 3015/6010C EPA 3015A/6010C EPA 3015/6020 EPA 3015A/6020 EPA 3015/6020A EPA 3015A/6020A	EPA 3051/6010B EPA 3051A/6010B EPA 3051/6010C EPA 3051A/6010C EPA 3051/6020 EPA 3051A/6020 EPA 3051/6020A EPA 3051A/6020A
Tin	EPA 200.7 EPA 3005A/6010B EPA 3015/6010B EPA 3015A/6010B EPA 3005A/6010C EPA 3015/6010C EPA 3015A/6010C	EPA 3051/6010B EPA 3051A/6010B EPA 3051/6010C EPA 3051A/6010C
Titanium	EPA 200.7 EPA 3005A/6010B EPA 3015/6010B EPA 3015A/6010B EPA 3005A/6010C EPA 3015/6010C EPA 3015A/6010C	EPA 3051/6010B EPA 3051A/6010B EPA 3051/6010C EPA 3051A/6010C
Uranium	EPA 200.8 EPA 3015/6020 EPA 3015A/6020 EPA 3015/6020A EPA 3015A/6020A	EPA 3051/6020 EPA 3051A/6020 EPA 3051/6020A EPA 3051A/6020A
Vanadium	EPA 200.7 EPA 200.8 EPA 3005A/6010B EPA 3015/6010B EPA 3015A/6010B EPA 3005A/6010C EPA 3015/6010C EPA 3015A/6010C EPA 3015/6020 EPA 3015A/6020 EPA 3015/6020A EPA 3015A/6020A	EPA 3051/6010B EPA 3051A/6010B EPA 3051/6010C EPA 3051A/6010C EPA 3051/6020 EPA 3051A/6020 EPA 3051/6020A EPA 3051A/6020A

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
Zinc	EPA 200.7 EPA 200.8 EPA 3005A/6010B EPA 3015/6010B EPA 3015A/6010B EPA 3005A/6010C EPA 3015/6010C EPA 3015A/6010C EPA 3015/6020 EPA 3015A/6020 EPA 3015/6020A EPA 3015A/6020A	EPA 3051/6010B EPA 3051A/6010B EPA 3051/6010C EPA 3051A/6010C EPA 3051/6020 EPA 3051A/6020 EPA 3051/6020A EPA 3051A/6020A
Zirconium	EPA 200.7 EPA 3005A/6010B EPA 3015/6010B EPA 3015A/6010B EPA 3005A/6010C EPA 3015/6010C EPA 3015A/6010C	EPA 3051/6010B EPA 3051A/6010B EPA 3051/6010C EPA 3051A/6010C
Nutrients		
Ammonia (as N)	EPA 350.1 SM 4500-NH3 B	EPA 350.1 SM 4500-NH3 B
Kjeldahl nitrogen	EPA 351.2	----------
Nitrate (as N)	EPA 300.0 EPA 9056 EPA 9056A EPA 353.2	EPA 9056 EPA 9056A
Nitrate-nitrite (as N)	EPA 300.0 EPA 9056 EPA 9056A EPA 353.2	EPA 9056 EPA 9056A
Nitrite (as N)	EPA 300.0 EPA 9056 EPA 9056A EPA 354.1	EPA 9056 EPA 9056A
Orthophosphate (as P)	EPA 365.2 SM 4500-P E	EPA 365.2
Total phosphorus	EPA 365.4	----------
Demands		
Biochemical oxygen demand	SM 5210 B	----------
Chemical oxygen demand	EPA 410.4 HACH 8000	----------
Total organic carbon	EPA 415.1 EPA 9060A SM5310 C	LLOYDKAHN

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
Wet Chemistry		
Alkalinity	EPA 310.1 EPA 310.2 SM 2320 B	----------
Bromide	EPA 300.0 EPA 9056 EPA 9056A	EPA 9056 EPA 9056A
Chloride	EPA 300.0 EPA 9056 EPA 9056A EPA 325.2 SM 4500-CL E	EPA 9056 EPA 9056A EPA 325.2 SM 4500-CL E
Cyanide	SM 4500 CN-C,E EPA 9010C/9014	EPA 9010C/9014
Amenable Cyanide	SM 4500 CN-G EPA 9010C/9014	EPA 9010C/9014
Fluoride	EPA 300.0 EPA 9056 EPA 9056A SM 4500 F,C	EPA 300.0 EPA 9056 EPA 9056A SM 4500 F,C
pH	SM 4500-H^+ B EPA 9040C	EPA 9040C EPA 9045D
Oil and Grease	EPA 1664A	EPA 1664A
Phenols	EPA 420.1	EPA 420.1
Total residue	EPA 160.3 SM 2540 B	----------
Filterable residue	EPA 160.1 SM 2540 C	----------
Nonfilterable residue	EPA 160.2 SM 2540 D	----------
Sulfate	EPA 300.0 EPA 9056 EPA 9056A EPA 375.4 SM 426C	EPA 9056 EPA 9056A EPA 375.4 SM 426 C
Sulfide	EPA 376.1 SM 4500-S F	EPA 9030B/9034
Flashpoint	EPA 1010A	EPA 1010A
Ferrous Iron	SM 3500-Fe B	----------
Hexavalent chromium	SM 3500-Cr D 19th Ed SM 3500-Cr B 20th and 21st Ed EPA 7196A	SM 3500-Cr D 19th Ed SM 3500-Cr B 20th and 21st Ed

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
Purgeable Organics (Volatiles)		
Acetone	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Acetonitrile	EPA 624 EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Acrolein	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Acrylonitrile	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Allyl chloride	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
T-amylmethylether	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Benzene	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Bromobenzene	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Bromochloromethane	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Bromodichloromethane	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Bromoform	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Bromomethane	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
1,3-Butadiene	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
2-Butanone	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
n-Butyl alcohol	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
tert-Butyl alcohol	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
n-Butylbenzene	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Sec-Butylbenzene	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Tert-Butylbenzene	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Carbon disulfide	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Carbon tetrachloride	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Chlorobenzene	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Chloroethane	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
2-Chloroethyl vinyl ether	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Chloroform	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Chloroprene	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
1-Chlorohexane	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Chloromethane	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
2-Chlorotoluene	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
4-Chlorotoluene	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Cyclohexane	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
Cyclohexanone	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Dibromochloromethane	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Dibromofluoromethane	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
1,2-Dibromo-3-chloropropane (DBCP)	EPA 624 EPA 5030B/8260B EPA 5030C/8260B EPA 8011	EPA 5035/8260B EPA 5035A/8260B
Dibromomethane	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
1,2Dibromomethane (EDB)	EPA 624 EPA 5030B/8260B EPA 5030C/8260B EPA 8011	EPA 5035/8260B EPA 5035A/8260B
1,2-Dichlorobenzene	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
1,3-Dichlorobenzene	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
1,4-Dichlorobenzene	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Trans-1,4-Dichloro-2-butene	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Dichlorodifluoromethane	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
1,1-Dichloroethane	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
1,2-Dichloroethane	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
1,1-Dichloroethene	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
cis-1,2-Dichloroethene	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
trans-1,2-Dichloroethene	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
1,2-Dichloropropane	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
1,3-Dichloropropane	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
2,2-Dichloropropane	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
1,1-Dichloropropene	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
cis-1,3-Dichloropropene	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
trans-1,3-Dichloropropene	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Diethyl ether	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Di-isopropyl ether	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Dimethyldisulfide	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Dimethyl sulfide	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
1,4-Dioxane	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Ethyl acetate	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Ethyl –t-butyl ether	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Ethyl methacrylate	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Ethyl benzene	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
Gas Range Organics (GRO)	EPA 5030B/8015B EPA 5030C/8015B EPA 5030B/8015C EPA 5030C/8015C EPA 5030B/8015D EPA 5030C/8015D NWTPH GX WADOE VPH MA VPH C5-C8 Aliphatics MA VPH C9-C12 Aliphatics MA VPH C9-C10 Aromatics	EPA 5035/8015B EPA 5035/8015C EPA 5035/8015D EPA 5035A/8015B EPA 5035A/8015C EPA 5035A/8015D NWTPH GX WADOE VPH MA VPH C5-C8 Aliphatics MA VPH C9-C12 Aliphatics MA VPH C9-C10 Aromatics
2-Hexanone	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Hexachlorobutadiene	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Isoprene	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Isopropylbenzene	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
1,4-Isopropyltoluene	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Iodomethane	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Isobutyl alcohol	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Isopropyl alcohol	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Methacrylonitrile	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Methyl acetate	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Methylcyclohexane	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Methyl methacrylate	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Alpha-Methylstyrene	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
Methyl tert-butyl ether	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Methylene chloride	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
4-Methyl-2-pentanone	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Naphthalene	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
2-Nitropropane	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
n-Propylbenzene	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Propionitrile	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Styrene	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
1,1,1,2-Tetrachloroethane	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
1,1,2,2-Tetrachloroethane	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Tetrachloroethene	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Tetrahydrofuran	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Toluene	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
1,1,1-Trichloroethane	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
1,1,2-Trichloroethane	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Trichloroethene	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
Trichlorofluoromethane	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
1,2,3-Trichlorobenzene	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
1,2,3-Trichloropropane	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
1,2,4-Trichlorobenzene	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
1,2,4-Trimethylbenzene	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
1,3,5-Trimethylbenzene	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Vinyl acetate	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Vinyl chloride	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Xylenes, total	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
1,2-Xylene	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
1,3-Xylene	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
1,4-Xylene	EPA 624 EPA 5030B/8260B EPA 5030C/8260B	EPA 5035/8260B EPA 5035A/8260B
Headspace Organics		
Carbon dioxide	EPA 5021/RSK175	----------
Methane	EPA 5021/RSK175	----------
Ethane	EPA 5021/RSK175	----------
Ethene	EPA 5021/RSK175	----------
Acetylene	EPA 5021/RSK175	----------

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
Acenaphthene	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Acenaphthylene	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Acetophenone	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
2-Acetylaminofluorene	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
4-Aminobiphenyl	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Anilene	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Anthracene	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Aramite	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
Benzidine	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Benzoic acid	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Benzo (a) anthracene	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Benzo (b) fluoranthene	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
Benzo (k) fluoranthene	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Benzo (ghi) fluoranthene	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Benzo (a) pyrene	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Benzyl alcohol	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
Benzaldehyde	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Biphenyl	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Bis(2-chloroethoxy) methane	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Bis (2-chloroethyl) ether	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
Bis(2-chloroisopropyl) ether	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Bis (2-ethylhexyl) phthalate	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
4-Bromophenylphenylether	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Butyl benzyl phthalate	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
Caprolactam	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Carbazole	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
4-Chloroaniline	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Chlorobenzilate	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
4-Chloro-3-methylphenol	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
1-Chloronaphthalene	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
2-Chloronaphthalene	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
2-Chlorophenol	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
4-Chlorophenylphenyl ether	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Chrysene	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Cresols	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Diallate	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
Dibenzo (a,c) anthracene	EPA 625 EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Dibenzo (a,h) anthracene	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Dibenzofuran	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
1,2-Dichlorobenzene	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
1,3-Dichlorobenzene	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
1,4-Dichlorobenzene	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
3,3'-Dichlorobenzidine	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
2,4-Dichlorophenol	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
2,6-Dichlorophenol	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Diethyl phthalate	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Dimethoate	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
4-Dimethylaminoazobenzene	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
7,12-Dimethylbenz(a)anthracene	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
3,3'-Dimethylbenzidine	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Alpha-,alpha-Dimethylphenethylamine	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
2,4-Dimethylphenol	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
Dimethyl phthalate	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Di-n-butyl phthalate	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Di-n-octyl phthalate	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
2,4-Dinitrophenol	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
2,4-Dinitrotoluene	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
2,6-Dinitrotoluene	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
1,4-Dioxane	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Diphenylamine	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
1,2-Diphenylhydrazine	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Disulfoton	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
DRO/ORO	EPA 3510C/8015B EPA 3510C/8015C EPA 3510C/8015D NWTPH DX WADOE EPH MA EPH C9-C18 Aliphatics MA EPH C19-C36 Aliphatics MA EPH C11-C22 Aromatics, Unadjusted	EPA 3545/8015B EPA 3545A/8015B EPA 3550B/8015B EPA 3550C/8015B EPA 3545/8015C EPA 3545A/8015C EPA 3550B/8015C EPA 3550C/8015C EPA 3545/8015D EPA 3545A/8015D EPA 3550B/8015D EPA 3550C/8015D EPA 3546/8270C EPA 3546/8270D NWTPH DX WADOE EPH MA EPH C9-C18 Aliphatics MA EPH C19-C36 Aliphatics MA EPH C11-C22 Aromatics, Unadjusted

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
Ethyl methanesulfonate	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Ethyl parathion	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Famphur	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Fluoroanthene	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
Fluorene	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Hexachlorobenzene	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Hexachlorobutadiene	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Hexachlorocyclopentadiene	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
Hexachloroethane	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Hexachlorophene	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Hexachloropropene	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Indeno (1,2,3-cd) pyrene	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
Isodrin	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Isophorone	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Isosafrole	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Kepone	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
Methapyrilene	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
3-Methylcholanthrene	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
2-Methyl-4,6-Dinitrophenol	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Methyl methanesulfonate	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
1-Methylnaphthalene	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
2-Methylnaphthalene	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Methyl parathion	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Naphthalene	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
1,4-Naphthoquinone	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
1-Naphthylamine	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
2-Naphthylamine	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
2-Nitroaniline	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
3-Nitroaniline	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
4-Nitroaniline	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Nitrobenzene	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
5-Nitro-o-toluidine	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
2-Nitrophenol	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
4-Nitrophenol	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Nitroquinoline-1-oxide	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
n-Nitrosodiethylamine	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
n-Nitrosodimethylamine	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
n-Nitroso-di-n-butylamine	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
n-Nitrosodi-n-propylamine	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
n-Nitrosodiphenylamine	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
n-Nitrosomorpholine	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
n-Nitrosopiperidine	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
n-Nitrosopyrrolidine	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Pentachlorobenzene	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
Pentachloroethane	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Pentachloronitobenzene	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Pentachlorophenol	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Perylene	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
Phenacetin	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Phenanthrene	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Phenol	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
1,4-Phenylenediamine	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
Phorate	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
2-Picoline	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Pronamide	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Pyrene	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
Pyridine	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Safrole	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Sulfotepp	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
1,2,4,5-Tetrachlorobenzene	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
2,3,4,6-Tetrachlorophenol	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
o,o,o-Triethyl phosphorothioate	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Thionazin	EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
1,2,4-Trichlorobenzene	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
2,4,5-Trichlorophenol	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
2,4,6-Trichlorophenol	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
O-Toluidine	EPA 625 EPA 3510C/8270C EPA 3520C/8270C EPA 3510C/8270D EPA 3520C/8270D	EPA 3545/8270C EPA 3545A/8270C EPA 3550B/8270C EPA 3550C/8270C EPA 3580A/8270C EPA 3545/8270D EPA 3545A/8270D EPA 3550B/8270D EPA 3550C/8270D EPA 3580A/8270D EPA 3546/8270C EPA 3546/8270D
Pesticides/Herbicides/PCBs		
Aldrin	EPA 608 EPA 3510C/8081A EPA 3510C/8081B	EPA 3550B/8081A EPA 3550C/8081A EPA 3580A/8081A EPA 3550B/8081B EPA 3550C/8081B EPA 3580A/8081B
alpha-BHC	EPA 608 EPA 3510C/8081A EPA 3510C/8081B	EPA 3550B/8081A EPA 3550C/8081A EPA 3580A/8081A EPA 3550B/8081B EPA 3550C/8081B EPA 3580A/8081B

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
Beta-BHC	EPA 608 EPA 3510C/8081A EPA 3510C/8081B	EPA 3550B/8081A EPA 3550C/8081A EPA 3580A/8081A EPA 3550B/8081B EPA 3550C/8081B EPA 3580A/8081B
delta-BHC	EPA 608 EPA 3510C/8081A EPA 3510C/8081B	EPA 3550B/8081A EPA 3550C/8081A EPA 3580A/8081A EPA 3550B/8081B EPA 3550C/8081B EPA 3580A/8081B
gamma-BHC	EPA 608 EPA 3510C/8081A EPA 3510C/8081B	EPA 3550B/8081A EPA 3550C/8081A EPA 3580A/8081A EPA 3550B/8081B EPA 3550C/8081B EPA 3580A/8081B
Chlordane (technical)	EPA 608 EPA 3510C/8081A EPA 3510C/8081B	EPA 3550B/8081A EPA 3550C/8081A EPA 3580A/8081A EPA 3550B/8081B EPA 3550C/8081B EPA 3580A/8081B
alpha-chlordane	EPA 608 EPA 3510C/8081A EPA 3510C/8081B	EPA 3550B/8081A EPA 3550C/8081A EPA 3580A/8081A EPA 3550B/8081B EPA 3550C/8081B EPA 3580A/8081B
gamma-chlordane	EPA 608 EPA 3510C/8081A EPA 3510C/8081B	EPA 3550B/8081A EPA 3550C/8081A EPA 3580A/8081A EPA 3550B/8081B EPA 3550C/8081B EPA 3580A/8081B
4,4'-DDD	EPA 608 EPA 3510C/8081A EPA 3510C/8081B	EPA 3550B/8081A EPA 3550C/8081A EPA 3580A/8081A EPA 3550B/8081B EPA 3550C/8081B EPA 3580A/8081B
4,4'-DDE	EPA 608 EPA 3510C/8081A EPA 3510C/8081B	EPA 3550B/8081A EPA 3550C/8081A EPA 3580A/8081A EPA 3550B/8081B EPA 3550C/8081B EPA 3580A/8081B

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
4,4',-DDT	EPA 608 EPA 3510C/8081A EPA 3510C/8081B	EPA 3550B/8081A EPA 3550C/8081A EPA 3580A/8081A EPA 3550B/8081B EPA 3550C/8081B EPA 3580A/8081B
Dieldrin	EPA 608 EPA 3510C/8081A EPA 3510C/8081B	EPA 3550B/8081A EPA 3550C/8081A EPA 3580A/8081A EPA 3550B/8081B EPA 3550C/8081B EPA 3580A/8081B
Endosulfan I	EPA 608 EPA 3510C/8081A EPA 3510C/8081B	EPA 3550B/8081A EPA 3550C/8081A EPA 3580A/8081A EPA 3550B/8081B EPA 3550C/8081B EPA 3580A/8081B
Endosulfan II	EPA 608 EPA 3510C/8081A EPA 3510C/8081B	EPA 3550B/8081A EPA 3550C/8081A EPA 3580A/8081A EPA 3550B/8081B EPA 3550C/8081B EPA 3580A/8081B
Endonsulfan sulfate	EPA 608 EPA 3510C/8081A EPA 3510C/8081B	EPA 3550B/8081A EPA 3550C/8081A EPA 3580A/8081A EPA 3550B/8081B EPA 3550C/8081B EPA 3580A/8081B
Endrin	EPA 608 EPA 3510C/8081A EPA 3510C/8081B	EPA 3550B/8081A EPA 3550C/8081A EPA 3580A/8081A EPA 3550B/8081B EPA 3550C/8081B EPA 3580A/8081B
Endrin aldehyde	EPA 608 EPA 3510C/8081A EPA 3510C/8081B	EPA 3550B/8081A EPA 3550C/8081A EPA 3580A/8081A EPA 3550B/8081B EPA 3550C/8081B EPA 3580A/8081B
Endrin ketone	EPA 3510C/8081A EPA 3510C/8081B	EPA 3550B/8081A EPA 3550C/8081A EPA 3580A/8081A EPA 3550B/8081B EPA 3550C/8081B EPA 3580A/8081B

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
Heptachlor	EPA 608 EPA 3510C/8081A EPA 3510C/8081B	EPA 3550B/8081A EPA 3550C/8081A EPA 3580A/8081A EPA 3550B/8081B EPA 3550C/8081B EPA 3580A/8081B
Heptachlor epoxide	EPA 608 EPA 3510C/8081A EPA 3510C/8081B	EPA 3550B/8081A EPA 3550C/8081A EPA 3580A/8081A EPA 3550B/8081B EPA 3550C/8081B EPA 3580A/8081B
Methoxychlor	EPA 3510C/8081A EPA 3510C/8081B	EPA 3550B/8081A EPA 3550C/8081A EPA 3580A/8081A EPA 3550B/8081B EPA 3550C/8081B EPA 3580A/8081B
Toxaphene	EPA 608 EPA 3510C/8081A EPA 3510C/8081B	EPA 3550B/8081A EPA 3550C/8081A EPA 3580A/8081A EPA 3550B/8081B EPA 3550C/8081B EPA 3580A/8081B
PCB-1016 (Aroclor)	EPA 608 EPA 3510C/8082 EPA 3510C/8082A	EPA 3550B/8082 EPA 3550C/8082 EPA 3580A/8082 EPA 3550B/8082A EPA 3550C/8082A EPA 3580A/8082A
PCB-1221	EPA 608 EPA 3510C/8082 EPA 3510C/8082A	EPA 3550B/8082 EPA 3550C/8082 EPA 3580A/8082 EPA 3550B/8082A EPA 3550C/8082A EPA 3580A/8082A
PCB-1232	EPA 608 EPA 3510C/8082 EPA 3510C/8082A	EPA 3550B/8082 EPA 3550C/8082 EPA 3580A/8082 EPA 3550B/8082A EPA 3550C/8082A EPA 3580A/8082A
PCB-1242	EPA 608 EPA 3510C/8082 EPA 3510C/8082A	EPA 3550B/8082 EPA 3550C/8082 EPA 3580A/8082 EPA 3550B/8082A EPA 3550C/8082A EPA 3580A/8082A

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
PCB-1248	EPA 608 EPA 3510C/8082 EPA 3510C/8082A	EPA 3550B/8082 EPA 3550C/8082 EPA 3580A/8082 EPA 3550B/8082A EPA 3550C/8082A EPA 3580A/8082A
PCB-1254	EPA 608 EPA 3510C/8082 EPA 3510C/8082A	EPA 3550B/8082 EPA 3550C/8082 EPA 3580A/8082 EPA 3550B/8082A EPA 3550C/8082A EPA 3580A/8082A
PCB-1260	EPA 608 EPA 3510C/8082 EPA 3510C/8082A	EPA 3550B/8082 EPA 3550C/8082 EPA 3580A/8082 EPA 3550B/8082A EPA 3550C/8082A EPA 3580A/8082A
2,4-D	EPA 8151A	EPA 8151A
Dalapon	EPA 8151A	EPA 8151A
2,4-DB	EPA 8151A	EPA 8151A
Dicamba	EPA 8151A	EPA 8151A
Dichloroprop	EPA 8151A	EPA 8151A
Dinoseb	EPA 8151A	EPA 8151A
MCPA	EPA 8151A	EPA 8151A
MCPP	EPA 8151A	EPA 8151A
Pentachlorophenol	EPA 8151A	EPA 8151A
2,4,5-T	EPA 8151A	EPA 8151A
2,4,5-TP	EPA 8151A	EPA 8151A
HPLC		
1,3,5-Trinitrobenzene	EPA 3535A/8330A EPA 3535A/8330B	EPA 8330A EPA 8330B
1,3-Dinitrobenzene	EPA 3535A/8330A EPA 3535A/8330B	EPA 8330A EPA 8330B
2,4,6-Trinitrotoluene	EPA 3535A/8330A EPA 3535A/8330B	EPA 8330A EPA 8330B
2,4-Dinitrotoluene	EPA 3535A/8330A EPA 3535A/8330B	EPA 8330A EPA 8330B
2,6-Dinitrotoluene	EPA 3535A/8330A EPA 3535A/8330B	EPA 8330A EPA 8330B
2-Amino-4,6-dinitrotoluene	EPA 3535A/8330A EPA 3535A/8330B	EPA 8330A EPA 8330B
2-Nitrotoluene	EPA 3535A/8330A EPA 3535A/8330B	EPA 8330A EPA 8330B
3-Nitrotoluene	EPA 3535A/8330A EPA 3535A/8330B	EPA 8330A EPA 8330B
4-Amino-2,6-dinitrotoluene	EPA 3535A/8330A EPA 3535A/8330B	EPA 8330A EPA 8330B

Parameter/Analyte	Nonpotable Water (1)	Solid and Chemical Materials (2)
4-Nitrotoluene	EPA 3535A/8330A EPA 3535A/8330B	EPA 8330A EPA 8330B
Nitrobenzene	EPA 3535A/8330A EPA 3535A/8330B	EPA 8330A EPA 8330B
Nitroglycerin	EPA 3535A/8330A EPA 3535A/8330B	EPA 8330A EPA 8330B
HMX	EPA 3535A/8330A EPA 3535A/8330B	EPA 8330A EPA 8330B
PETN	EPA 3535A/8330A EPA 3535A/8330B	EPA 8330A EPA 8330B
RDX	EPA 3535A/8330A EPA 3535A/8330B	EPA 8330A EPA 8330B
Tetryl	EPA 3535A/8330A EPA 3535A/8330B	EPA 8330A EPA 8330B
Nitroglycerin	EPA 3535A/8330A EPA 3535A/8330B	EPA 8330A EPA 8330B
Nitroguanidine	EPA 3535A/8330A EPA 3535A/8330B	EPA 8330A EPA 8330B
Nitrocellulose	EPA USATHAMA/353.2/353.3	EPA USATHAMA/353.2/353.3
Hazardous Waste Characteristics		
Corrosivity	EPA 9040C	EPA 9040C EPA 9045D
Ignitibility	EPA 1010A	EPA 1010A
Reactivity	EPA SW 846 Ch 7	EPA SW 846 Ch 7
Synthetic Precipitation Leaching Procedure (SPLP)	EPA 1312	EPA 1312
Toxicity Characteristic Leaching Procedure (TCLP)	EPA 1311	EPA 1311
LC/MS/MS		
Perchlorate	EPA 6850 EPA 331	EPA 6850
PFOA/PFOS	EPA 8321B	EPA 8321B
Benzotriazole	EPA 8321B	----------
Tolytriazole	EPA 8321B	----------

(1) Method List includes Clean Water Act and RCRA water parameters.
(2) Method List includes RCRA parameters only.

The American Association for Laboratory Accreditation

World Class Accreditation

Accredited DoD ELAP Laboratory

A2LA has accredited

MICROBAC LABORATORIES, INC.
OHIO VALLEY DIVISION

Marietta, OH

for technical competence in the field of

Environmental Testing

In recognition of the successful completion of the A2LA evaluation process that includes an assessment of the laboratory's compliance with ISO/IEC 17025:2005, the 2003 NELAC Chapter 5 Standard, and the requirements of the Department of Defense Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in version 4.2 of the DoD Quality System Manual for Environmental Laboratories (QSM); accreditation is granted to this laboratory to perform recognized EPA methods as defined on the associated A2LA Environmental Scope of Accreditation. This accreditation demonstrates technical competence for this defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009*).

Presented this 30th day of January 2012.

President & CEO
For the Accreditation Council
Certificate Number 2936.01
Valid to December 31, 2013
Revised June 1, 2012

For the tests or types of tests to which this accreditation applies, please refer to the laboratory's Environmental Scope of Accreditation.

Appendix F

Contractor Forms

Form
Drum Container Sampling Log
EID-MR-FRM-01_0 Demolition Operations Health and Safety checklist
EID-MR-FRM-02_0 Disposal Operation Checklist
EID-MR-FRM-03_0 Demolition Equipment Checklist
EID-MR-FRM-04_0 Demolition Notification Checklist
EID-MR-FRM-05_0 MEC/MDEH Disposal Log
EID-MR-FRM-06_0 General Demolition Safety Precautions
EID-MR-FRM-07_0 Magazine Inspection Checklist
EID-MR-FRM-08_0 Magazine Inventory Card
EID-MR-FRM-09_0 Documentation of Receipt/Disposal of Explosives
EID-MR-10.01_0 MDAS Certification
EID-MR-10.01_0 Non-Hazardous MD/Range Residue Scrap Certification
Electric Misfire Procedures Checklist
Field Work Variance
MDAS Container Open/Closure Log
DD Form 626 & Explosives Vehicle Safety Inspection Checklist
Material Receiving Report
Material Courier Receipt
ATF Form 5400.5 - Report of Theft or Loss of Explosives Materials
MPPEH Waste Tracking
Non-Conformance Report
Daily Construction Quality Control Report
Corrective Action Request Form
Overage/Shortage/Damage Report
Loss/Damage/Destruction Report

Shaw
Shaw Environmental & Infrastructure, Inc.

DRUM/CONTAINER SAMPLING LOG

DRUM NO. _____
PROJECT NO. _____
PAGE _____ OF _____

Project Location _____ Logger _____ Date _____
Project Contact _____ Sampler _____ Time _____
Phone _____ Weather _____

Drum Type: Fiber ☐ Poly Lined ☐ Steel ☐ Poly ☐ Stainless Steel ☐ Nickel ☐
Lid Type: Ringtop ☐ Closed Top ☐
Drum Condition: Meet DOT Spec. ☐ Good ☐ Fair ☐ Poor ☐
Drum Size: 110 ☐ 85 ☐ 55 ☐ 42 ☐ 30 ☐ 16 ☐ 10 ☐ 5 ☐ Other _____
Drum Contents: Volume Full ☐ 3/4 ☐ 1/2 ☐ 1/4 ☐ < 1/4 ☐ MT ☐
Overpacked: No ☐ Yes ☐ Overpack Type: Fiber ☐ Steel ☐ Poly ☐

	Phys. State				Color	Clarity			Layer Thickness	Field Analysis
	LIQUID	SOLID	GEL	SLUDGE		CLEAR	CLOUDY	OPAQUE		
LAYERS					Use STD Colors				Inches	pH _____ Su PID _____ ppm Dosimeter _____ Other _____
T										
M										**Drum Labels / Markings**
B										DOT Haz _____ UN / NA _____

MFG Name _____
Chemical Name _____
Additional Information _____

LABORATORY COMPATABILITY DATA

☐ Mark if physical state and color matches the above information. If not, stop analysis and notify Project Contact. Further work will not be paid for.

Drum Cat: _____
Analyst: _____
Date Performed: _____

Radiation Pos ☐ Neg ☐ _____ mRem / Hr

	Phys. State				Color	Clarity			Layer Thickness	Water Solubility	React	pH	Hex Sol	Per	Oxid	CN	Sul	Beil-stein	Flash Point	PCBs (25ppm)	Layer Class
	LIQUID	SOLID	GEL	SLUDGE		CLEAR	CLOUDY	OPAQUE													
LAYERS					Use STD Colors				Inches	Solubility S, PS, I Density H or L	A= Air W= Water	Std. Units	S or I	+ or -	+ or -	+ or -	+ or -	+ or -	< 60 C 140 F + or -	+ or -	
T																					
M																					
B																					

Comments: _____

PCB Conc. _____ ppm Flash Point _____ C/F Compatability Composite Bulk No. _____
Data Reviewer: _____ Data Review Date: _____

Field Reviewer: _____ Field Review Date: _____

Transfer Number	Transfers Relinquished By	Transfers Accepted By	Date	Time
1				
2				
3				

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Demolition Operations Health and Safety Checklist

Equipment List		
Equipment	**Quantity**	**Comments**
Air Horn, Emergency		
Bloodborne Pathogen Kit		
Burn Blanket		
Burn Kit		
Copper Sulfate (WP Operations)		
Face Shield(s)		
Fire Blanket		
Fire Extinguisher, 10 lb. ABC		
Gloves, leather		
Goggles		
Rain Suit(s) (as required)		
Safety Vest(s)		
Stretcher		
Water, 5-gal. bottle (emergency shower)		
Water, drinking, 1-liter per person		
Welders' Aprons (as required)		
Welders' Gloves (as required)		
Other:		
PPE		
Safety Glasses		
Cotton Clothing		
Work Boots		
Leather Apron		WP Operations
Leather Gauntlets		WP Operations
Face Shield		WP Operations
UXOSO Printed Name and Signature:		*Date:*

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Disposal Operations Checklist

Function	Date/Time	Signature
Senior UXO Supervisor		
Assign Disposal Team		
Brief Disposal Team: Review emergency procedures Discuss MEC/MDEH/MC to be disposed Describe disposal procedures		
Inspect Range/Exclusion zone after operation		
Disposal Supervisor		
Verify Bravo Flag is hoisted (if used)		
Verify affected roads are closed and barricaded/manned		
Verify exclusion zone (EZ) boundaries are in place		
Complete health/safety and demolition equipment checklists		
Ensure Command Center has made required notifications: Client (if required) Responsible activity (base operations, etc.) Base Security/Police Department Base Fire Department Medical Facility		
Disposal Supervisor tailgate safety brief: Review disposal procedures Designate emergency vehicles/drivers Discuss emergency evacuation route Review emergency response procedures Review safety precautions		
Verify communications (radios, cell phones) are operable		
Verify daily equipment inspection has been completed		
Verify caps/detonators are separated from explosives		
Complete required equipment testing has been completed		
Reconfirm EZ is not occupied by non-essential personnel		
Notify Command Center disposal operations are commencing		
Commence disposal operations		
Inspect shot after designated wait time		
Collect all metal fragments for later disposal		
QC Check performed		
QA check (if required)		
Command Center notify upon completion: Client Responsible activity (base operations, etc.) Base Security/Police Department Base Fire Department Medical Facility		
Complete MEC/MDEH/MC Accountability Log		
Demobilize		
Record data in Explosives Disposal Log		
Demolition Supervisor Signature:		Date:

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Demolition Equipment Checklist

Equipment List		
Equipment	**Quantity**	**Comments**
Explosive Vehicle(s)		
Personnel Vehicle(s)		
Camcorder/Digital Camera		
Siren		
Air Horn		
Bravo Flag		
Handheld radio(s)		
Cellular telephone(s)		
Remote Firing Device		
Shock Cord initiator		
HR3-SS Non Electric Shock Cord Initiator		
Schonstedt (or equivalent) locator		
Shovel(s), round point, long handle		
Shovel(s), round point, short handle		
Tape, duct		
Tape, electrical		
Tape, measuring, 50 or 100 foot		
Galvanometer (if firing electric)		
Blasting Machine		
Firing wire (if firing electric)		
Demolition Kit		
Knife		
Shock Cord Connectors		
Binoculars		
Note: Tailor to meet		
Explosives		
Nonel		
Perforators (size)		
Detonating Cord		
Boosters		
Smokeless Powder		
Demolition Supervisor Printed Name and Signature:		

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Demolition Notification

Function	Phone	Date/Time	Initials	
Senior UXO Supervisor				
Pre Operation Notifications				
USACE PM:	Landline: _____ Cell: _____		_____ _____	
USACE OESS:	Landline: _____ Cell: _____		_____ _____	
Shaw PM:	Landline: _____ Cell: _____		_____ _____	
Shaw UXOQCS:	Landline: _____ Cell: _____		_____ _____	
Shaw UXOSO:	Landline: _____ Cell: _____		_____ _____	
Security:	Landline: _____ Cell: _____		_____ _____	
Range Control:	Landline: _____ Cell: _____		_____ _____	
Medical:	Landline: _____ Cell: _____		_____ _____	
Fire Department:	Landline: _____ Cell: _____		_____ _____	
Range Control	Landline: _____ Cell: _____		_____ _____	
Local Public Officials if Required	Landline: _____ Cell: _____		_____ _____	
DCD	Landline: _____ Cell: _____		_____ _____	
Optional	Landline: _____ Cell: _____		_____ _____	
Optional	Landline: _____ Cell: _____		_____ _____	
Optional	Landline: _____ Cell: _____		_____ _____	
Optional	Landline: _____ Cell: _____		_____ _____	
Optional	Landline: _____ Cell: _____		_____ _____	
Senior UXO Supervisor Signature:			Date:	

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MEC/MDEH Disposal Log

Project Information			
Project Name:			
Project Location:			
Shot/Burn Initiation Time:	Shot/Burn #	Date	
	MEC Disposed of This Date: (List items and quantity of each)		
Nomenclature	**ID Number**	**Quantity**	**NEW (lbs)**
	Donor Explosives Used (List types and quantity)		
Lot or ID Number From Inventory	**Nomenclature**	**Quantity**	**NEW (lbs)**
	Remarks:		
	Approval		
Demolition Supervisor:			Date:

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General Demolition Safety Precautions

1. Carry blasting caps in approved containers and keep them out of the direct rays of the sun. Keep the caps located at least 25 feet from other explosives until they are needed for priming.

2. Do not work with electric blasting caps or other electro-explosive devices while wearing clothing prone to producing static electricity such as nylon, silk, synthetic hair, etc.

3. Do not use explosives or accessory equipment that are obviously deteriorated or damaged. They may cause premature detonation or fail completely.

4. Always point the explosive end of blasting caps, detonators, and explosive devices away from the body during handling.

5. Use only standard blasting caps of at least the equivalent of a commercial No. 8 blasting cap.

6. Use electric blasting caps of the same manufacturer for each demolition shot involving more than one cap.

7. Do not use improvised methods for initiating blasting caps.

8. Do not bury blasting caps. Use detonating cord to transmit the explosive wave from the blasting caps, on the surface, to a buried/tamped explosive charge. Buried blasting caps are subject to unobserved pressures and movement, which could lead to premature firing or misfires.

9. Test electric-blasting caps for continuity at least 50 feet from any other explosives prior to connecting them to the firing circuit. Upon completion of testing, the lead wires will be shunted by twisting the bare ends of the wires together. The wires will remain shunted until ready to be connected to the firing circuit.

10. In the event of a misfire when disposing of explosives by detonation, do not approach the disposal site for at least 60 minutes after the expected detonation time, when firing electrically. When conducting non-electric procedures, the wait time will be at least one hour from the expected time of detonation.

11. Items with lugs, strong backs, tail-booms, base plates, etc., should be oriented away from personnel locations.

12. Consideration should be given to tamping the UXO to control fragments, if the situation warrants. Fragments will be minimized not only to protect personnel but also property, such as buildings, trees, etc.

13. Avoid inhaling the smoke, dust or fumes of burning pyrotechnic or incendiary materials. The smoke, dust and fumes from many of these materials are irritating and/or toxic if inhaled.

14. Do not use water on incendiary fires. Water may induce a violent reaction or be completely ineffective, depending on the mixture.

15. Anticipate a high order detonation when burning pyrotechnic or incendiary-loaded MEC. Safety measures for personnel and property must be based upon this possibility.

16. Inert ordnance will not be disposed of, or sold for scrap, until the internal fillers have been exposed and unconfined. Heat generated during a reclamation operation can cause the inert filler, moisture, or air to expand and burst the sealed casings. Venting or exposure may be accomplished in any way necessary to preclude rupture due to pressure from being confined. All requirements of the UXO

Procedure for the Management and Disposition of Material Potentially Presenting an Explosive Hazard (MPPEH) will be met prior to releasing any inert ordnance material.

17. Do not conduct blasting or demolition operations during an electrical, dust, sand or snowstorm severe enough to produce atmospheric static electrical charges, or when such a storm is nearby (within 10 miles). Under such conditions, all operations will be suspended or terminated, cap and lead wires shunted, and personnel removed from the demolition area. Demolition operations will also be terminated if visibility becomes less than 600 feet.

18. Loose initiating explosives: lead azide, mercury fulminate, lead styphnate, and tetracene. These explosives manifest extreme sensitivity to friction, heat, and impact. Extra precautions are required when handling these types of explosives. Keep initiating explosives in a water-wet condition at all times until ready for final preparation for detonation. Sensitivity of these explosives is greatly increased when dry.

19. Exercise extreme care when handling and preparing high explosives for detonation. They are subject to detonation by heat, shock or friction.

20. Do not pack bomb fuze wells with explosives unless it can be positively confirmed that the fuze well does not contain any fuze components.

21. Photo flash bombs must be handled with the same care as black powder filled munitions.

22. MEC containing white phosphorous will not be detonated into the ground. White phosphorous munitions will be counter-charged on the bottom centerline (CCBC) when possible.

23. A search of the detonation site, after the demo operation, will be conducted to assure complete disposal was accomplished.

24. Do not abandon any explosives.

25. Do not leave explosives, empty cartridges, boxes, liners or other materials used in the packing of explosives lying around where children, unauthorized persons or livestock can get at them.

26. Do not allow any wood, paper or other materials used in packing explosives to be burned in a stove, fireplace or other confined space, or be re-used for any other purpose. Such materials will be destroyed by burning at an isolated location out of doors, with no one allowed within 100 feet of the burning operation.

27. Do not fight fires involving explosive material. Evacuate all personnel to a safe location and secure the area.

28. Know and observe federal, state, and local laws/regulations, which apply to the transportation, storage and use of explosives.

29. Do not permit metal, except approved metal truck bodies, to contact explosive containers.

30. Do not transport metal, flammable, or corrosive substances with explosives.

31. Do not allow smoking, or the presence of unauthorized personnel, in vehicles transporting explosives.

32. Carefully load and unload explosives from vehicles. Never throw or drop explosives from the vehicle.

33. Assure the load is blocked and braced to prevent it from movement and displacement.

34. Do not drive vehicles containing explosives over public highways until all permits and certifications have been obtained from the state enforcement agencies.

35. All routes must be approved in writing prior to transporting explosive materials over public highways.

36. Licensed commercial carriers will conduct the shipment of explosive materials over public highways unless Shaw UXO personnel have been specifically licensed and certified to make the shipment.

37. Never leave vehicle loaded with explosives unattended.

38. Do not store blasting caps, detonators, or other items containing initiating explosives in the same box, container or magazine with other explosives.

39. Store explosive materials in military or ATF approved magazines only. Ensure the magazines used for the storage comply with quantity distance requirements, for the class of explosive material they contain. Reference documents include: OP-5, TM 9-1300-206, AMCR 385-100, ATF - Explosives Law and Regulation, ATF P 5400.7 and 49 CFR.

40. Do not store spark-producing metal/tools in an explosive magazine.

41. Do not permit smoking, matches or any source of fire or flame within 100 feet of an explosive magazine.

42. Do not allow leaves, grass, brush or debris to accumulate within 50 feet of an explosive magazine.

43. Do not permit the discharge of firearms within 300 feet of an explosive magazine.

44. Do not use any alkaline material such as lye, washing soda, or soap to remove TNT exudate. Alkaline materials will react with TNT to render it more sensitive.

45. Do not permit smoking, matches or other sources of fire or flame within 100 feet of an area in which explosives are being handled.

46. Do not expose explosives or devices containing explosive to prolonged exposure to direct sun light. Such exposure can increase sensitivity and deterioration.

47. Ensure all unused explosives are returned to their proper containers and the container closed after use.

48. Do not carry explosives or explosive components in pockets or on the body.

49. Do not insert anything but time fuse or detonating cord into the open end of a blasting cap.

50. Do not strike, tamper with, or attempt to remove or investigate the contents of an electric/non-electric blasting cap, detonator or other explosive initiating device. A detonation may occur.

51. Do not pull on the electrical lead wires of electric blasting caps, detonators or their electro-explosive devices. A detonation may occur.

52. Do not attempt to remove an unfired or misfired primer or blasting cap from a base coupling. There is a high risk of an explosion.

53. Do not allow unauthorized or unnecessary personnel to be present when explosives are being handled.

54. Always point the explosive end of blasting caps, detonators and other explosive devices away from the body.

55. Do not use pull rings or safety pins to lift or handle explosive devices.

56. Work involving priming devices and explosives shall be planned and organized so as to prevent injury or damage to personnel and surroundings. The main responsibility for such a task shall devolve upon one person. Among other things, this person shall ensure that all participants receive necessary information concerning the preconditions for the task and that explosives are handled and stored in a correct and safe manner.

57. If the main person responsible does not herself/himself participate in the work task (s)he shall appoint a deputy who thus also bears responsibility for the practical performance of the task.

58. Never handle damaged detonators. Undamaged detonators can be repacked in packages similar to original boxes.

60. Never use damaged products or partially damaged products (that have been shocked or submitted to excessive temperatures, etc.) During handling and transport of explosives only those personnel who are essential for the performance of the work involved shall be present.

61. Any explosive temporarily stored at a work site shall be protected against mechanical influences, heat, etc. that could conceivably cause unintentional detonation.

62. Different classes and types of dangerous goods shall be stored and transported separately.

63. To avoid the risk of unintentional injury and/or damage to surroundings a triggering method that enables full control over the instant of detonation is recommended. The firing system shall initiate the charge reliably and immediately upon triggering.

64. When triggering exposed firing systems (detonators and surface connectors) ensure that they cannot cause injury or damage to property. As a guideline there should be a safety distance of at least 20 meters.

65. Damaged, undetonated detonators are safety hazards and shall be handled with the utmost care. If possible, they should be neutralized *in situ* by being blasted to destruction by an explosive charge. Damaged, undetonated detonators shall under no circumstances be put together with other explosive goods in any way.

66. Handle with care, avoid all forms of commotion, impact and friction on products and their packages, keep products and packages away from heat, flames and sparks.

67. Keep far from children.

68. The control and implementation of pyrotechnic articles must be done by authorized staff.

69. For shock tube only, consider initial isolation of at least 15 meters (50 feet) in all directions.

70. Fight fire with normal precautions and methods used for plastic fires from a reasonable distance. **IF DETONATORS OR OTHER EXPLOSIVES ARE PRESENT, DO NOT FIGHT FIRE.**

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I have read, understand, and agree to follow the General Demolition Safety Precautions.

Printed Name	Signature	Representing	Date

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Magazine Inspection Checklist

Project Information

Project Name: _____ **Date:** _____

Location: _____ **CTO Number:** _____

Inspection Checklist Items *(Check Items Complete)*

Inspected by: _____

- ☐ Ensure the area around the magazine is free of debris, flammable materials, and tall vegetation
- ☐ Ensure the general magazine is in good condition (Doors, Ventilation, Locks)
- ☐ Check for signs of unauthorized entry (*Locks, fence, structural damage, etc.)*
- ☐ Ensure items in the magazine are properly stored (*check separation, aisle space and stacks*)
- ☐ Ensure no fire hazards are present (*fire breaks, dry vegetation, firefighting equipment, etc.)*
- ☐ Ensure lightning protection is in place and properly configured
- ☐ Confirm the compatibility of magazine contents
- ☐ Check for unusual odors, abnormal temperatures, or leaking materials
- ☐ Ensure that placards and warning notices are posted (including NEW limits)
- ☐ Ensure that safety information is posted
- ☐ Ensure first aid equipment is present at the identified location near the magazine

Comments (Note any actions needed or taken)

_____

_____

_____

_____

Verification of Completion

SUXOS Signature _____ Date _____

UXOQCS Signature _____ Date _____

1. Project Name, Location:		2. Project Number:		3. Explosive Manufacturer		4. Marks of Identification:
5. Storage Location:		6. Explosive Description:				
7. Date	8. Action/Purpose	9. Qty In	10. Qty Out	11. Balance	12. Printed Name	13. Signature

1. Project Name, Location:	2. Project Number:	3. Explosive Manufacturer	4. Marks of Identification:
5. Storage Location:	6. Explosive Description:		
	7. Name, Address, and License Number of Vendor		

8. Date	9. Quantity Received	10. Date of Final Disposal	11. Date of Noted Discrepancy	12. Balance	13. Printed Name	14. Signature

Comments:

This form must be completed within 24 hours of receipt and final disposal of explosives.

The original and copies of this form must be distributed as follows (See EIP-MR-460)

- Original to project file
- Copy to project PBA
- Copy to project SCA
- Copy to the Executive Assistant, Applied Science & Engineering

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INERT/DEMILIZATIZATION/CHAIN OF CUSTODY CERTIFICATION for Nonhazardous Munitions Debris/Range Residue Scrap

Load No.

GENERAL

1. Releasing Generators (RG) Name and Mailing Address	1a. RG's Phone No.	2. RG's Site Manager
3. Releasing Generators (RG) Project Name and Location	3a. RG Project Phone No.	4. RG's SUXOS
5. Transporter Name and Mailing Address	5a. Transporter Phone No.	6. Dispatcher Name

RELEASING GENERATOR

7. Processor/Recycler/Demilitarization – Qualified Recycler	7a. QR Phone No.	8. QRQC's Manager

9. Box No.	10. Seal Nos.		11. Gross Weight	12. Tare Weight	13. Net Weight

14. Description	15. Material Type	16. Units (Wt, Volume)

Inert Certification: "**This certifies that the material listed has been 100 percent properly inspected and, to the best of our knowledge and belief, are free of explosive hazards, engine fluids, illuminating dials and other visible liquid HTRW materials**"

17. Inspector/Certified Project UXO/QC

Print/Type Name	Signature	Month/Date Year
		____/____/____

18. Inspector/Certifier Site Senior UXP Supervisor (SUXOS)

Print/Type Name	Signature	Month/Date Year
		____/____/____

19. Material Released to the Transport By RG's Site Manager

RELEASED BY: Print/Type Name	Signature	Month/Date Year
		____/____/____

TRANSPORTER

20. Transporter: I ACKNOWLEDGE THE RECEIPT OF MATERIAL (Receiving Signature Verifies that Seals are Intact)

RECEIVED BY: Print/Type Name/Company	Signature	Month/Date Year
		____/____/____

21. Material Released by Transporter

RELEASED BY: Print/Type Name/Company	Signature	Month/Date Year
		____/____/____

RECEIVING PROCESSOR – RECYCLER

22. Storage Manager: I ACKNOWLEDGE THE RECEIPT OF MATERIAL (Receiving Signature Verifies that Seals are Intact)

RECEIVED BY: Print/Type Name/Company	Signature	Month/Date Year
		____/____/____

23. Material Released CRRRT to new CRRRT (if needed)

RELEASED BY: Print/Type Name	Signature	Month/Date Year
		____/____/____

24. Current CRRRT: I ACKNOWLEDGE THE RECEIPT OF MATERIAL

RECEIVED BY: Print/Type Name	Signature	Month/Date Year
		____/____/____

Demilitarization/Destruction Certification: "I CERTIFY THAT EACH ITEM OR ITEMS LISTED HEREON WERE DEMILITARIZED/DESTROYED, SO AS TO NO LONGER RESEMBLE MUNITIONS/ORDNANCE, BEYOND THE REQUIREMENTS LISTED IN DoD 4160.21-M-1."

25. Qualified Recycling Manager

Print/Type Name	Signature	Month/Date Year
		____/____/____

26. List Discrepancy Indication Here

	Title: Inert/Demilitarization/Chain of Custody Certification for Nonhazardous Munitions Debris/Range Residue Scrap	Form No: EID-MR-10.01_0

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GENERAL	INERT/DEMILIZATIZATION/CHAIN OF CUSTODY CERTIFICATION for Nonhazardous Munitions Debris/Range Residue Scrap				Load No.
	1. Releasing Generators (RG) Name and Mailing Address		1a. RG's Phone No.		2. RG's Site Manager
	3. Releasing Generators (RG) Project Name and Location		3a. RG Project Phone No.		4. RG's SUXOS
	5. Transporter Name and Mailing Address		5a. Transporter Phone No.		6. Dispatcher Name
RELEASING GENERATOR	7. Processor/Recycler/Demilitarization – Qualified Recycler		7a. QR Phone No.		8. QRQC's Manager
	9. Box No.	10. Seal Nos.	11. Gross Weight	12. Tare Weight	13. Net Weight
	14. Description	15. Material Type	16. Units (Wt, Volume)		
	Inert Certification: "**This certifies that the material listed has been 100 percent properly inspected and, to the best of our knowledge and belief, are free of explosive hazards, engine fluids, illuminating dials and other visible liquid HTRW materials**"				
	17. Inspector/Certified Project UXO Site Senior UXO Supervisor (SUXOS)				
	Print/Type Name	Signature	Month/Date Year ____/____/____		
	18. Inspector/Certifier OESS or Designated Certifier				
	Print/Type Name	Signature	Month/Date Year ____/____/____		
	19. Material Released to the Transport By RG's Site Manager				
	RELEASED BY: Print/Type Name	Signature	Month/Date Year ____/____/____		
TRANSPORTER	20. Transporter: I ACKNOWLEDGE THE RECEIPT OF MATERIAL (Receiving Signature Verifies that Seals are Intact)				
	RECEIVED BY: Print/Type Name/Company	Signature	Month/Date Year ____/____/____		
	21. Material Released by Transporter				
	RELEASED BY: Print/Type Name/Company	Signature	Month/Date Year ____/____/____		
RECEIVING PROCESSOR – RECYCLER	22. Storage Manager: I ACKNOWLEDGE THE RECEIPT OF MATERIAL (Receiving Signature Verifies that Seals are Intact)				
	RECEIVED BY: Print/Type Name/Company	Signature	Month/Date Year ____/____/____		
	23. Material Released CRRRT to new CRRRT (if needed)				
	RELEASED BY: Print/Type Name	Signature	Month/Date Year ____/____/____		
	24. Current CRRRT: I ACKNOWLEDGE THE RECEIPT OF MATERIAL				
	RECEIVED BY: Print/Type Name	Signature	Month/Date Year ____/____/____		
	Demilitarization/Destruction Certification: "I CERTIFY THAT EACH ITEM OR ITEMS LISTED HEREON WERE DEMILITARIZED/DESTROYED, SO AS TO NO LONGER RESEMBLE MUNITIONS/ORDNANCE, BEYOND THE REQUIREMENTS LISTED IN DoD 4160.21-M-1."				
	25. Qualified Recycling Manager				
	Print/Type Name	Signature	Month/Date Year ____/____/____		
	26. List Discrepancy Indication Here				

Shaw a world of Solutions	Title: Electric Misfire Procedures Checklist	Date:_____ Time:_____

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1. Check the continuity of the firing wire system with the Galvanometer.
    a. ___ If there is continuity re connect the firing wire to the blasting machine and attempt to fire the system.
    b. ___ If the system again fails, go to step d.
    c. ___ If there is no continuity, go to step d.
    d. ___Wait 60 Minutes.
    e. ___ After 60 minutes the demolition supervisor with one additional UXO Technician to act as safety will travel down range inspecting the firing system.

2. If the electric caps failed to function;
    a. _____ Disconnect the original caps and shunt.
    b. _____Check the firing wire with a Galvanometer.
    c. _____ Place a new set of electric caps.
    d. _____ Leave the old caps on the shot.
    e. _____ Return to the safe area.

3. If the electric caps functioned;
    a. _____ Shunt the functioned Caps
    b. _____ Check the firing wire with a Galvanometer.
    c. _____ Place a new set of electric caps.
    d. _____ Return to the safe area.

Demo Supervisor Signature_____

Shaw® Shaw Environmental, Inc.

Field Work Variance No. 144717-

Page _____ of _____

FIELD WORK VARIANCE

Project Name/Number **Seneca Army Depot Activity OD Grounds** Task Order **0005**

Applicable Document Date

Problem Description:

Recommended solution:

Impact on present and completed work:

Requested by:

Recommended solution disposition:

Clarification ☐ Minor Change ☐ Major Change ☐

Signature _____ Date _____

Technical Reviewer

Shaw Environmental Inc, Approvals: *If Major Change:*

Signature _____ Date _____ Signature _____ Date _____

Technical Manager *Project Manager*

Signature _____ Date _____

QC Manager

USACE Approval:

Approved ☐ Rejected ☐ Signature _____ Date _____

SEDA Approval (*If Major Change:*

Approved ☐ Rejected ☐ Signature _____ Date _____

Final Description

Signature Date

_____ _____

Shaw® Shaw Environmental, Inc.

Field Work Variance No. 144717-

Page _____ of _____

FIELD WORK VARIANCE CONTINUATION SHEET

Continue FWV discussions below by noting section title(s) to be continued (i.e., Problem Description, Solution/disposition, Final Disposition, etc). Use additional continuation sheets as needed.

PROBLEM DESCRIPTION:

RECOMMENDED SOLUTION:

Attachments:

References:

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Open/Closure Log

Page _____ of _____

Project Information			
Project Name:			
Project Location:			
Container #:			Date First Closed:
	To be completed each time a MDAS container is Opened or Closed Must have two personnel, one of which must be either the UXOQCS or SUXOS to open		
Date	**Time Opened**	**Time Closed**	**Signature of UXOQCS/SUXOS:**
Custody Seal # on Final Closure:			
Remarks/Comments			

MOTOR VEHICLE INSPECTION (TRANSPORTING HAZARDOUS MATERIALS)

(Read Instructions before completing this form.)

This form applies to all vehicles which must be marked or placarded in accordance with Title 49 CFR.

1. BILL OF LADING/TRANSPORTATION CONTROL NUMBER

SECTION 1 - DOCUMENTATION	ORIGIN a.	DESTINATION b.
2. CARRIER/GOVERNMENT ORGANIZATION		
3. DATE/TIME OF INSPECTION		
4. LOCATION OF INSPECTION		
5. OPERATOR(S) NAME(S)		
6. OPERATOR(S) LICENSE NUMBER(S)		
7. MEDICAL EXAMINER'S CERTIFICATE*		

8. *(X if satisfactory at origin)*

a. HAZMAT ENDORSEMENT		d. ERG OR EQUIVALENT COMMERCIAL:		YES		NO			
b. VALID LEASE*		e. DRIVER'S VEHICLE INSPECTION REPORT*							
c. ROUTE PLAN		f. COPY OF 49 CFR PART 397							

9. CVSA DECAL DISPLAYED ON COMMERCIAL EQUIPMENT*

	YES	NO
a. TRUCK/TRACTOR		
b. TRAILER		

SECTION II - MECHANICAL INSPECTION

All items shall be checked on empty equipment prior to loading. Items with an asterisk shall be checked on all incoming loaded equipment.

10. TYPE OF VEHICLE(S)	11. VEHICLE NUMBER(S)

12. PART INSPECTED *(X as applicable)*	ORIGIN (1) SAT	ORIGIN (1) UNSAT	DESTINATION (2) SAT	DESTINATION (2) UNSAT		ORIGIN (1) SAT	ORIGIN (1) UNSAT	DESTINATION (2) SAT	DESTINATION (2) UNSAT	COMMENTS (3)
a. SPARE ELECTRICAL FUSES					k. EXHAUST SYSTEM					
b. HORN OPERATIVE					l. BRAKE SYSTEM*					
c. STEERING SYSTEM					m. SUSPENSION					
d. WINDSHIELD/WIPERS					n. COUPLING DEVICES					
e. MIRRORS					o. CARGO SPACE					
f. WARNING EQUIPMENT					p. LANDING GEAR*					
g. FIRE EXTINGUISHER*					q. TIRES, WHEELS, RIMS					
h. ELECTRICAL WIRING					r. TAILGATE/DOORS*					
i. LIGHTS AND REFLECTORS					s. TARPAULIN*					
j. FUEL SYSTEM*					t. OTHER *(Specify)*					

13. INSPECTION RESULTS *(X one)* **ACCEPTED** ☐ **REJECTED** ☐

(If rejected give reason under "Remarks". Equipment will be approved if deficiencies are corrected prior to loading.)

14. SATELLITE MOTOR SURVEILLANCE SYSTEM: *(X one)* **ACCEPTED** ☐ **REJECTED** ☐

15. REMARKS

16. INSPECTOR SIGNATURE *(Origin)*	17. INSPECTOR SIGNATURE *(Destination)*

SECTION III - POST LOADING INSPECTION

This section applies to Commercial and Government/Military vehicles. All items will be checked prior to release of loaded equipment and shall be checked on all incoming loaded equipment.

	ORIGIN (1) SAT	ORIGIN (1) UNSAT	DESTINATION (2) SAT	DESTINATION (2) UNSAT	COMMENTS (3)
18. LOADED IAW APPLICABLE SEGREGATION/COMPATIBILITY TABLE OF 49 CFR					
19. LOAD PROPERLY SECURED TO PREVENT MOVEMENT					
20. SEALS APPLIED TO CLOSED VEHICLE; TARPAULIN APPLIED ON OPEN EQUIPMENT					
21. PROPER PLACARDS APPLIED					
22. SHIPPING PAPERS/DD FORM 2890 FOR GOVERNMENT VEHICLE SHIPMENTS					
23. COPY OF DD FORM 626 FOR DRIVER					
24. SHIPPED UNDER DOT SPECIAL PERMIT 868					

25. INSPECTOR SIGNATURE *(Origin)*	26. DRIVER(S) SIGNATURE *(Origin)*
27. INSPECTOR SIGNATURE *(Destination)*	**28. DRIVER(S) SIGNATURE** *(Destination)*

INSTRUCTIONS

SECTION I - DOCUMENTATION

General Instructions.

All items (2 through 9) will be checked at origin prior to loading. Items with an asterisk (*) apply to commercial operators or equipment only. Only Items 2 through 7 are required to be checked at destination.

Items 1 through 5. Self explanatory.

Item 6. Enter operator's Commercial Driver's License (CDL) number or Military OF-346 License Number. CDL and OF-346 must have the HAZMAT and other appropriate endorsements IAW 49 CFR 383.

Item 7. *Enter the expiration date listed on the Medical Examiner's Certificate.

Item 8.a. Hazardous Materials Certification. In accordance with applicable service regulations, ensure operator has been certified to transport hazardous materials. Check the expiration date on driver's HAZMAT Certification.

b. *Valid Lease. Shipper will ensure a copy of the appropriate contract or lease is carried in all leased vehicles and is available for inspection. (49 CFR 376.12 and 376.11(c)(2)).

c. Route Plan. Prior to loading any Hazard Class/Division 1.1, 1.2, or 1.3 (Explosives) for shipment, ensure that the operator possesses a written route plan in accordance with 49 CFR Part 397. Route Plan requirements for Hazard Class 7 (Radioactive) materials are found in 49 CFR 397.101.

d. Emergency Response Guidebook (ERG) or Equivalent. Commercial operators must be in possession of an ERG or equivalent document. Shipper will provide applicable ERG page(s) to military operators.

e. *Driver's Vehicle Inspection Report. Review the operator's Vehicle Inspection Report. Ensure that there are no defects listed on the report that would affect the safe operation of the vehicle.

f. Copy of 49 CFR Part 397. Operators are required by regulation to have in their possession a copy of 49 CFR Part 397 (Transportation of Hazardous Materials Driving and Parking Rules). If military operators do not possess this document, shipper will provide a copy to operator.

Item 9. *Commercial Vehicle Safety Alliance (CVSA) Decal. Check to see if equipment has a current CVSA decal and mark applicable box. Vehicles without CVSA, check documentation of the last vehicle periodic inspection and perform DD Form 626 inspection.

SECTION II - MECHANICAL INSPECTION

General Instructions.

All items (12.a. through 12.t.) will be checked on all incoming empty equipment prior to loading. All UNSATISFACTORY conditions must be corrected prior to loading. Items with an asterisk (*) shall be checked on all incoming loaded equipment. Unsatisfactory conditions that would affect the safe off-loading of the equipment must be corrected prior to unloading.

SECTION II *(Continued)*

Item 12.a. Spare Electrical Fuses. Check to ensure that at least one spare fuse for each type of installed fuse is carried on the vehicle as a spare or vehicle is equipped with an overload protection device (circuit breaker). (49 CFR 393.95)

b. Horn Operative. Ensure that horn is securely mounted and of sufficient volume to serve purpose. (49 CFR 393.81)

c. Steering System. The steering wheel shall be secure and must not have any spokes cracked through or missing. The steering column must be securely fastened. Universal joints shall not be worn, faulty or repaired by welding. The steering gear box shall not have loose or missing mounting bolts or cracks in the gear box mounting brackets. The pitman arm on the steering gear output shaft shall not be loose. Steering wheel shall turn freely through the limit of travel in both directions. All components of a power steering system must be in operating condition. No parts shall be loose or broken. Belts shall not be frayed, cracked or slipping. The power steering system shall not be leaking. (49 CFR 396 Appendix G)

d. Windshield/Wipers. Inspect to ensure that windshield is free from breaks, cracks or defects that would make operation of the vehicle unsafe; that the view of the driver is not obscured and that the windshield wipers are operational and wiper blades are in serviceable condition. Defroster must be operative when conditions require. (49 CFR 393.60, 393.78 and 393.79)

e. Mirrors. Every vehicle must be equipped with two rear vision mirrors located so as to reflect to the driver a view of the highway to the rear along both sides of the vehicle. Mirrors shall not be cracked or dirty. (49 CFR 393.80)

f. Warning Equipment. Equipment must include three bidirectional emergency reflective triangles that conform to the requirements of FMVSS No. 125. FLAME PRODUCING DEVICES ARE PROHIBITED. (49 CFR 393.95)

g. Fire Extinguisher. Military vehicles must be equipped with one serviceable fire extinguisher with an Underwriters Laboratories rating of 10 BC or more. (Commercial motor vehicles must be equipped with one serviceable 10 BC Fire Extinguisher). Fire extinguisher must be located so that it is readily accessible for use and securely mounted on the vehicle. The fire extinguisher must be designed, constructed and maintained to permit visual determination of whether it is fully charged. (49 CFR 393.95)

h. Electrical Wiring: Electrical wiring must be clean and properly secured. Insulation must not be frayed, cracked or otherwise in poor condition. There shall be no uninsulated wires, improper splices or connections. Wires and electrical fixtures inside the cargo area must be protected from the lading. (49 CFR 393.28)

INSTRUCTIONS

SECTION II *(Continued)*

i. Lights/Reflectors. (Head, tail, turn signal, brake, clearance, marker and identification lights, Emergency Flashers). Inspect to see that all lighting devices and reflectors required are operable, of proper color and properly mounted. Ensure that lights and reflectors are not obscured by dirt or grease or have broken lenses. High/Low beam switch must be operative. Emergency Flashers must be operative on both the front and rear of vehicle. (49 CFR 393.24, 25, and 26)

j. Fuel System. Inspect fuel tank and lines to ensure that they are in serviceable condition, free from leaks, or evidence of leakage and securely mounted. Ensure that fuel tank filler cap is not missing. Examine cap for defective gasket or plugged vent. Inspect filler necks to see that they are in completely serviceable condition and not leaking at joints. (49 CFR 393.83)

k. Exhaust System. Exhaust system shall discharge to the atmosphere at a location to the rear of the cab or if the exhaust projects above the cab, at a location near the rear of the cab. Exhaust system shall not be leaking at a point forward of or directly below the driver compartment. No part of the exhaust system shall be located where it will burn, char or damage electrical wiring, fuel system or any other part of the vehicle. No part of the exhaust system shall be temporarily repaired with wrap or patches. (49 CFR 393.83)

l. Brake System (to include hand brakes, parking brakes and Low Air Warning devices). Check to ensure that brakes are operational and properly adjusted. Check for audible air leaks around air brake components and air lines. Check for fluid leaks, cracked or damaged lines in hydraulic brake systems. Ensure that parking brake is operational and properly adjusted. Low Air Warning devices must be operative. (49 CFR 393.40, 41, 42, 43, 44, 45, 47, 48, 49, 50, 51, 52, 53, and 55)

m. Suspension. Inspect for indications of misaligned, shifted or cracked springs, loosened shackles, missing bolts, spring hangers unsecured at frame and cracked or loose U-bolts. Inspect for any unsecured axle positioning parts, and sign of axle misalignment, broken torsion bar springs (if so equipped). (49 CFR 393.207)

n. Coupling Devices (Inspect without uncoupling). Fifth Wheels: Inspect for unsecured mounting to frame or any missing or damaged parts. Inspect for any visible space between upper and lower fifth wheel plates. Ensure that the locking jaws are around the shank and not the head of the kingpin. Ensure that the release lever is seated properly and safety latch is engaged. Pintle Hook, Drawbar, Towbar Eye and Tongue and Safety Devices: Inspect for unsecured mounting, cracks, missing or ineffective fasteners (welded repairs to pintle hook is prohibited). Ensure safety devices (chains, hooks, cables) are in serviceable condition and properly attached. (49 CFR 393.70 and 71)

o. Cargo Space. Inspect to ensure that cargo space is clean and free from exposed bolts, nuts, screws, nails or inwardly projecting parts that could damage the lading. Check floor to ensure it is tight and free from holes. Floor shall not be permeated with oil or other substances. (49 CFR 393.84)

p. Landing Gear. Inspect to ensure that landing gear and assembly are in serviceable condition, correctly assembled, adequately lubricated and properly mounted.

SECTION II *(Continued)*

q. Tires, Wheels and Rims: Inspect to ensure that tires are properly inflated. Flat or leaking tires are unacceptable. Inspect tires for cuts, bruises, breaks and blisters. Tires with cuts that extend into the cord body are unacceptable. Thread depth shall not be less than: 4/32 inches for tires on a steering axle of a power unit, and 2/32 inches for all other tires. Mixing bias and radial on the steering axle is prohibited. Inspect wheels and rims for cracks, unseated locking rings, broken, loose, damaged or missing lug nuts or elongated stud holes. (49 CFR 393.75)

r. Tailgate/Doors. Inspect to see that all hinges are tight in body. Check for broken latches and safety chains. Doors must close securely. (49 CFR 177.835(h))

s. Tarpaulin. If shipment is made on open equipment, ensure that lading is properly covered with fire and water resistant tarpaulin. (49 CFR 177.835(h))

t. Other Unsatisfactory Condition. Note any other condition which would prohibit the vehicle from being loaded with hazardous materials.

Item 14. For AA&E and other shipments requiring satellite surveillance, ensure that the Satellite Motor Surveillance System is operable. The DTTS Message Display Unit, when operative, will display the signal "DTTS ON". The munitions carrier driver, when practical, will position the DTTS message display unit in a manner that allows the shipping inspector or other designated shipping personnel to observe the "DTTS ON" message without climbing aboard the cab of the motor vehicle.

SECTION III - POST LOADING INSPECTION

General Instructions.

All placarded quantities items will be checked prior to the release of loaded equipment. Shipment will not be released until deficiencies are corrected. All items will be checked on incoming loaded equipment. Deficiencies will be reported in accordance with applicable service regulations.

Item 18. Check to ensure shipment is loaded in accordance with 49 CFR Part 177.848 and the applicable Segregation or Compatibility Table of 49 CFR 177.848.

Item 19. Check to ensure the load is secured from movement in accordance with applicable service outload drawings.

Item 20. Check to ensure seal(s) have been applied to closed equipment; fire and water resistant tarpaulin applied on open equipment.

Item 21. Check to ensure each transport vehicle has been properly placarded in accordance with 49 CFR 172.504.

Item 22. Check to ensure operator has been provided shipping papers that comply with 49 CFR 172.201 and 202. For shipments transported by Government vehicle, shipping paper will be DD Form 2890.

Item 23. Ensure operator(s) sign DD Form 626, are given a copy and understand the hazards associated with the shipment.

Item 24. Applies to Commercial Shipments Only. If shipment is made under DOT Special Permit 868, ensure that shipping papers are properly annotated and copy of Special Permit 868 is with shipping papers.

Item 26. Ensure driver/operator signs DD Form 626 at origin.

Item 28. Ensure driver/operator signs DD Form 626 at destination.

Explosives Transportation Vehicle Safety Checklist[1]

This checklist will be satisfactorily completed prior to loading an explosives transportation vehicle. The completed and signed checklist will be kept on the on-site safety files.

Senior UXO Supervisor (authorizing transportation of explosives) _____

Explosives to be transported: _____

_____

Check the following items to ensure they are in good working order:

Initials	Item
1.	Vehicle body (including non-sparking bed or transportation box)
2.	Tires
3.	Windshield and wipers
4.	Rear view mirrors
5.	Placarding (as required by cargo)
6.	2 ABC fire extinguishers
7.	Lights (emergency, head, parking, running, interior, backing, turn signals)
8.	Engine (oil, coolant, belts, battery, brake fluid, wiper fluid)
9.	Horn
10.	Fuel
11.	Brakes
12.	Operational radio (successful communication check performed)
13.	Driver know the route to be taken (attach map if required)
14.	Load properly segregated and secured
15.	Permission received from Senior UXO Supervisor to transport explosives
16.	Perform notification of departure
17.	Perform notification on arrival at destination

Emergency Phone Numbers: _____

Driver _____ **Safety Observer** _____

[1] This checklist is for on-site explosives transportation only.

Shaw Environmental & Infrastructure, Inc.

MATERIAL RECEIVING REPORT

Date: _____

Client Name: _____

Contract/Order: _____

Job Title/Location: _____

PO/OER NO	PO LINE ITEM NO	SERIAL NUMBER	PART NO	DESCRIPTION	QUANTITY	CONDITION

REMARKS: _____

Date Received: _____

Time Received: _____

Received by: _____ _____

(Printed Name) (Signature)

MATERIEL COURIER RECEIPT

SHIPPER	SHIPPER'S CONTROL/DOCUMENT NO.
	SUPPLY ACCOUNT NUMBER
DESTINATION	SUPPLY ACCOUNT NUMBER

I certify by my signature that I have received the materiel listed on this form and am aware of the applicable safety and security requirements.

SHIPMENT TRANSFERS

FIRST	LOCATION OF TRANSFER	DATE *(YYYYMMDD)*
RECIPIENT'S PRINTED NAME *(Last, First, Middle Initial)*	ORGANIZATION OR ACCOUNT NO.	
SIGNATURE		
SECOND	LOCATION OF TRANSFER	DATE *(YYYYMMDD)*
RECIPIENT'S PRINTED NAME *(Last, First, Middle Initial)*	ORGANIZATION OR ACCOUNT NO.	
SIGNATURE		
THIRD	LOCATION OF TRANSFER	DATE *(YYYYMMDD)*
RECIPIENT'S PRINTED NAME *(Last, First, Middle Initial)*	ORGANIZATION OR ACCOUNT NO.	
SIGNATURE		
FOURTH	LOCATION OF TRANSFER	DATE *(YYYYMMDD)*
RECIPIENT'S PRINTED NAME *(Last, First, Middle Initial)*	ORGANIZATION OR ACCOUNT NO.	
SIGNATURE		
FIFTH	LOCATION OF TRANSFER	DATE *(YYYYMMDD)*
RECIPIENT'S PRINTED NAME *(Last, First, Middle Initial)*	ORGANIZATION OR ACCOUNT NO.	
SIGNATURE		

SHIPMENT DESCRIPTION

LINE NUMBER	QUANTITY	SERIAL NUMBERS	REMARKS

U.S. Department of Justice
Bureau of Alcohol, Tobacco, Firearms and Explosives

OMB No. 1140-0026 (04/30/2012)

Report of Theft or Loss - Explosive Materials

For ATF Use Only

Date Received	Date Faxed to JSOC & Field Division	Unique Identifier
		Case Number

To Be Completed By Person Making Report

Upon discovery of any theft or loss of any of your explosive materials:
- First, contact ATF toll free at 1-800-461-8841 between 8:00 a.m. - 5:00 p.m. EST or after hours and weekends contact ATF at 1-800-800-3855 to report the theft or loss;
- Second, contact your local law enforcement office to report the theft or loss to obtain a police report; and
- Third, complete this form and attach any additional reports, sheets or invoices necessary to provide the required information, and fax the form with additional material(s) to the ATF U.S. Bomb Data Center (USBDC) at 866-927-4570.

1. Date	2. Type of Report *(Check one)*: **Theft** ☐ **Loss** ☐ **Supplement** ☐
3. Full Name of Person Making the Report *(Last, First, Middle)*	4. Corporate or Business Name *(If applicable)*
5a. Office Address *(Street Address, City, State, and Zip Code)*	5b. Telephone Number
6. Actual Location of Theft or Loss *(if different from item 5a)*	

7. Theft or Loss	Date	Time	8. Name of Local Law Enforcement Officer to Whom Reported
a. Discovered			9. Agency Name and Address of Local Authority to Whom Reported
b. Occurred *(Show approximate if exact not known)*			
c. Reported to ATF by Telephone			10. Telephone Number:
d. Reported to Local Authorities			11. Police Report Number:

12. Explosive Materials Lost or Stolen *(Attach invoices or additional sheets, if necessary)*

a. Manufacturer	b. Brand Name	c. Date Shift Code	d. Size	e. Quantity *(Pounds of Explosives, Number of Dets)*	f. Type and Description *(Dynamite, Blasting Agents, Detonators, etc. Include for each type, size, MS delay or length of legwire, as applicable)*

13. Theft or Loss Occurred From *(Check applicable box)*

Permanent Magazine ☐ Portable Magazine ☐ **Truck** ☐ **Work Site** ☐ **Other *(Explain)*** ☐ _____

ATF E-Form 5400.5
Revised March 2008

14. Method of Entry *(Complete if applicable)*				15. Hood Defeated *(If yes, check the applicable box below)* Yes ☐ No ☐	
Locks Cut	☐	Inside Help	☐	Broken	☐
Locks Picked	☐	Wall Entry	☐	Cut	☐
Door Unlocked	☐	Key Stolen/ Used	☐	Removed	☐
Door Blown Open	☐			Inadequate for Lock Used	☐

16. Other Information Pertinent to the Theft or Loss

17. Signature and Title of Person Making Report	Date	18. Federal Explosives License or Permit Number

Reporting Instructions

Fax this completed form to the ATF address listed below or call if no fax is available:

Bureau of Alcohol, Tobacco, Firearms and Explosives
U.S. Bomb Data Center
99 New york Ave., N.E. 8S 295
Washington, DC 20226
Toll Free Fax: 1-866-927-4570

Questions regarding the completion of this form should be referred to the U.S. Bomb Data Center toll free at 1-800-461-8841.

Privacy Act Information

The following information is provided pursuant to section 3 of the Privacy Act of 1974 (5 U.S.C. § 522a(e)(3))

1. **Authority.** Solicitation of this information is made pursuant to Title XI of the Organized Crime Control Act of 1970 (18 U.S.C. Chapter 40). Disclosure of a theft or loss of explosive materials is mandatory pursuant to 18 U.S.C. § 842(k) for any person who has knowledge of such theft or loss from his stock.

2. **Purpose.** The purpose for the collection of this information is to give ATF notice of the theft or loss of explosive materials, and to furnish ATF with the pertinent facts surrounding such theft or loss. In addition, the information is used to confirm and verify prior notification of this theft or loss of explosive materials.

3. **Routine Uses.** The information will be used by ATF to aid in the administration of laws within its jurisdiction concerning the regulation of explosive materials and other related areas. In addition, the information may be disclosed to other Federal, State, foreign, and local law enforcement of laws within their jurisdiction.

4. **Effects of not supplying information requested.** 18 U.S.C. § 842(k) makes it unlawful for any person, who has knowledge of the theft or loss of explosive materials from his stock, to fail to report such theft or loss within twenty-four hours of discovery thereof, to the Secretary and to appropriate local authorities. The penalty for violation of this section is a fine of not more than $1,000 or imprisonment for not more than one year, or both. 18 U.S.C. § 844(b)

Paperwork Reduction Act Notice

This request in accordance with the Paperwork Reduction Act of 1995. The purpose of this information collection is to report the theft or loss of explosive materials. The information is used for investigative purposes by ATF officials. This information is mandatory by statute. (18 U.S.C. § 842)

The estimated average burden associated with this collection of information is 1 hour and 48 minutes per respondent or recordkeeper, depending on individual circumstances. Comments concerning the accuracy of this burden estimate and suggestions for reducing this burden should be addressed to Reports Management Officer, Document Services Branch, Bureau of Alcohol, Tobacco, Firearms and Explosives, Washington, DC 20226.

An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

ATF E-Form 5400.5
Revised March 2008

Material Potentially Presenting an Explosive Hazard (MPPEH) Tracking System for Conventional Munitions

Contractor: _____ **Dates:** _____

Site: _____

1 Control No.	2 MPPEH Item Description	3 Location (UTM/GPS Coordinates)	4 Disposition (BIP, OD, or OB)	5 Date of Determination	6 Explosive Operator (SUXO)	7 Total NEW (pounds)	8 Date of Action/Treatment	9 Location of Action/Treatment

Tracking System Notes/Instructions

1 - Control No. Unique number assigned to each item of MPPEH. The first two digits of the control number correspond to the year and items sequentially; or consistent with contractor forms.

2 - Specific description of item. Example: M-42 round, M-55 rocket.

3 - Location should include UTM/GPS coordinates for where the item(s) was found.

4 - Disposition

- "BIP" - if item is blown in place.
- "OD" - if the item is moved to a treatment area to be treated via Detonation (OD).
- "OB" - if the item is moved to a treatment area to be treated for Burning (OB).

5 - Date of determination. Enter date that Explosive Operator (SUXO) made the determination of whether item should be BIP, OD, or OB.

6 - Explosive Operator. Enter name of person who made the determination of whether item requires BIP, OD or OB.

7 - Net Explosive Weight (NEW) in pounds. This is inclusive of the weight of the item plus any donor material used in treatment.

8 - Date that item was treated.

- Enter date of treatment via BIP, OD, or OB.

9 - Location of Action/Treatment.

- Enter "BIP" if blown in place. Location of treatment should be same as coordinates in column 3.
- Enter "OD" if detonated and indicate location or coordinates.
- Enter "OB" if burned and indicate location or coordinate..

	Title: Nonconformance Report	Form No: EIG-Q-007.01_2

Uncontrolled when printed: Verify latest version on ShawNet/Governance

1) NCR Number:	**2) Project Name and Number (include location):**	**3) Date:**

4) Nonconformance Description And Reference: (Specification __ Drawing __ Code __)

Identified by: _____ **Date**_____

Reviewed By: _____ **Date**_____

(Project Quality Representative)

5) Disposition of Nonconforming Condition (Indicate disposition type):
1) Rework, 2) Repair, 3) Use As Is, 4)Reject/Scrap (Note: Use-As-Is or Repair determinations must be technically justified)5)Other (e.g., Return to Supplier)

Evaluated by: _____ **Date**_____

Responsible Manager

Concurrence: _____ **Date** _____

Quality Representative

6) Corrective Action(s) to be taken (include date when action(s) will be complete):

Corrective Action to be Performed by: _____**Due Date**_____

Responsible Manager: _____**Date**_____

Reviewed by: _____ **Date** _____

Quality Representative

7) Client Notification Required: _____ **Yes** _____**No** **Date Notified:** _____

8) Corrective Action Completion

Comments:

Responsible Manager: _____**Date**_____

9) Corrective Action(s) Completion Verification and Date:

Comments:

Reviewed and Closed By: _____ **Date**_____

(Project Quality Representative)

Shaw Shaw Environmental & Infrastructure,

DAILY CONSTRUCTION QUALITY CONTROL REPORT

Project Name: _____

Project Location: _____ Project Number: _____

Report No. _____

Contract No. _____ Date: _____

Weather: ☐ Clear ☐ Partly Cloudy ☐ Cloudy Wind _____

Temperature: High _____ Low _____

Precipitation: Today _____ Previous Period (e.g., weekend) _____

Site Conditions:

Lost Time Due to Inclement Weather: _____ %

Prime Contractor/Subcontractors And Areas Of Responsibility/Labor Count:
(Include number, trade, hours, employer, location, and description of work)

a.	
b.	
c.	
d.	
e.	
f.	

Work Performed: (Include location and description of work performed including equipment used. Refer to work performed by prime and/or subcontractors as previously designated by letter above. Attached subcontractor daily activity reports when applicable)

Materials And/Or Equipment Delivered:
(Include a description of materials and/or equipment, quantity, date/hours used, date of safety check, and supplier)

DAILY CONSTRUCTION QUALITY CONTROL REPORT

Results Of Surveillance: (Include satisfactory work completed or deficiencies with action to be taken)

a. Preparatory Inspection: (Attach minutes)

b. Initial Inspection: (Attach minutes)

c. Follow-Up Inspection: (List results of inspection compared to specification requirements)

d. Safety Inspection: (Include safety violations and corrective actions taken)

Off-Site Surveillance Activities: (Include action taken)

QC Tests Performed And Results: (As required by plans and/or specifications)

Verbal Instructions Received Or Given: (List any instructions received from client personnel or given by SHAW on construction deficiencies identified, required retesting, etc., and the corresponding action to be taken)

Changed Conditions/Delays/Conflicts Encountered: (List any conflicts with the delivery order [e.g., scope of work and/or drawings], delays to the project attributable to site, and weather conditions, etc.)

DAILY CONSTRUCTION QUALITY CONTROL REPORT

Submittals Reviewed: (Include submittal number, specification reference, and name of submitter)

Meetings: (List the meetings, e.g., Health and Safety, Site Operations, Cost/Schedule, etc.)

Visitors:

Remarks: (Any additional information pertinent to the project not defined by the previous entries)

Contractor's Verification: The above report is complete and correct. All materials and equipment used and work performed during this reporting period are in compliance with the contract plans and specifications except as noted above:

QC Representative: _____

Uncontrolled when printed: Verify latest version on ShawNet/Governance

PROJECT OR ACTIVITY:	**CORRECTIVE ACTION REQUEST**	CAR No. (Assigned by Quality):

CONDITION DESCRIPTION:

COMPLETED BY: _____

Name/Signature/Title | Date | Employee No.

ASSIGNED TO: _____ _____ _____

Name/Signature/Title | Date | Employee No.

CAUSE, CORRECTIVE & PREVENTIVE ACTION:

DUE DATE for Completion: _____

RESPONSIBLE MANAGER: _____

Name/Signature | Date | Employee No.

QUALITY MANAGER APPROVAL: _____

Name/Signature | Date | Employee No.

CORRECTIVE AND PREVENTIVE ACTION VERIFICATION:

Comments:

_____ _____ _____

Name/Signature/Title | Date | Employee No.

QUALITY MANAGER CLOSE OUT:

Comments:

_____ _____ _____

Name/Signature | Date | Employee No.

Shaw Environmental & Infrastructure, Inc.

O S D
Over, Short, or Damage Report

From:_____ (Preparer Name) To:_____ (Buyer for Project) Vendor / Shipper: _____ Pt of Origin: _____ Rec. Point:_____ Carrier Name: _____ Unit No._____ (Trucking, Railroad, Airline, Vessel Name) (Truck, Car, flight or voyage No) Carrier's No _____ Date Rec'd_____ (Frt. Bill, Waybill, B/L, Etc.)	Report No _____ Date _____ P.O. No_____ Job No_____ MRR No_____

ABOVE SHIPMENT RECEIVED IN FOLLOWING CONDITION

☐ Overage ☐ Substitution ☐ Acceptable ☐ Not Acceptable

☐ Shortage Description

_____

_____

☐ Damaged Visible Damage to Equipment or Material

_____

_____

GIVE DETAILS OF OVER, SHORT OR DAMAGE ITEMS – DESCRIBE DAMAGE

P.O. Item	Qty Shipped	Qty Received	Unit Cost	Description of Material and Damage

Exception Taken on Delivery Document ☐ Yes ☐ No Carrier Notified On

_____

DO NOT DISPOSE OF CONTAINERS OR PACKING UNTIL AFTER INSPECTION BY CLAIM AGENT.

Prepared by _____Approved by _____

Shaw Environmental & Infrastructure, Inc.

SHAW ENVIRONMENTAL & INFRASTRUCTURE, INC.
Lost, Damaged & Destroyed Report

Contract No.		**Project No.**	
Item Description:		**Date of Loss:**	
Vendor:		**Condition at Time of LDD:**	
PO Number:		**Date of Last Inventory:**	
Order Date:		**Estimated Cost of Repair/Replacement:**	
Property ID:		**Cost of Item:**	
Manufacturer:		**Serial No:**	

Report of Incident

Corrective Action

Investigation Performed By:

Signature Title

Review/Approval By:

Signature Title

These standard policies and procedures are applicable to all members of Shaw Environmental & Infrastructure, Inc., except where superseded or modified by the member Company.

Appendix G

Explosives Safety Submission (ESS)

DEPARTMENT OF THE ARMY
HUNTSVILLE CENTER, CORPS OF ENGINEERS
P.O. BOX 1600
HUNTSVILLE, ALABAMA 35807-4301

REPLY TO
ATTENTION OF:

CEHNC-EMM

28 September 2011

MEMORANDUM FOR Commander, US Army Engineering and Support Center, Huntsville, (CEHNC-ED-CS-G/Mr. Kevin Healy), 4820 University Square, Huntsville, AL 35816

SUBJECT: Explosives Safety Submission (ESS), Amendment 2, for Ordnance and Explosives Removal at the Open Detonation Ground SEAD 45/115, Seneca Army Depot, Romulus, NY, August 2011

1. References:

a. ER 385-1-95, Safety and Health Concerns for Munitions and Explosives of Concern (MEC) Projects, March 2007.

b. DOD 6055.09-M, Ammunition and Explosives Safety Standards, February 2008.

2. This ESS has been reviewed for technical adequacy and to insure compliance with US Army Corps of Engineers (USACE), Department of the Army (DA), and Department of Defense (DoD) requirements.

3. All minimum separation distances will be revised and adjusted in accordance with (IAW) DoD Technical Paper 16, Fragmentation Data Review Forms, dated 24 May 2011, prior to any further MEC operations.

4. All other stipulations of the ESS, Amendment 2, are IAW USACE, DA, and DoD guidance.

5. If you have any questions, please contact Mr. Walt Zange at (256) 895-1586 or Mr. Dave Becker at (256) 895-1513.

for SANDRA M. ZEBROWSKI, P.E.
Director, Environmental and
Munitions Center of Expertise

CF: (electronically w/o encls)
HQUSACE, (CESO-SWD/Ms. Blanca Roberts)

DEPARTMENT OF DEFENSE EXPLOSIVES SAFETY BOARD
2461 EISENHOWER AVENUE
ALEXANDRIA, VIRGINIA 22331-0600

DDESB-PE

SEP 10 2010

MEMORANDUM FOR DIRECTOR, U.S. ARMY DEFENSE AMMUNITION CENTER
ATTENTION: JMAC-ESM

SUBJECT: DDESB Approval of Amendment 2 to the Explosives Safety Submission for Ordnance and Explosives Removal at the Open Detonation Grounds SEAD 45/155 Seneca Army Depot, Romulus, NY

References: (a) DAC JMAC-ESM Memorandum of 25 August 2010, Subject: Amendment 2 to the Explosives Safety Submission (ESS) for Ordnance and Explosives Removal at the Open Detonation Grounds SEAD 45/155 Seneca Army Depot, Romulus, NY

(b) DoDM 6055.09-M, DoD Ammunition and Explosives Safety Standards, 29 February 2008, Administratively Reissued 4 August 2010

The Department of Defense Explosives Safety Board (DDESB) Staff has reviewed the subject Amendment 2 to the explosives safety submission (ESS) forwarded by reference (a), against the requirements of reference (b). Based on the information provided, approval is granted for removal and treatment of material potentially presenting an explosive hazard and munitions and explosives of concern at Open Detonation Grounds SEAD 45/155 Seneca Army Depot, Romulus, NY. This approval is based on the following:

a. This amendment adds the donut hole area (i.e., OD Hill out to 1,500 feet).

b. All other stipulations and requirements established via the original ESS and subsequent amendment remain in effect.

The point of contact for this action is Mr. Tony Dunay, (703) 325-3513, DSN 221-3513, E-mail address: tony.dunay@ddesb.osd.mil.

CURTIS M. BOWLING
Chairman
DDESB

DEPARTMENT OF THE ARMY
SENECA ARMY DEPOT ACTIVITY
5786 STATE RTE 96, P.O. BOX 9
ROMULUS NY 14541-0009

REPLY TO
ATTENTION OF

DAIM-ODB-SE

24 August 2010

MEMORANDUM FOR Director, Defense Ammunition Center, ATTN SIOAC-ESL (Mr. Clifford Doyle), Building 35, IC Tree Road, McAlester, Ok 74501-9053

SUBJECT: Amendment 2 to the Explosives Safety Submission (ESS) for Ordnance and Explosives Removal at the Open Detonation Grounds SEAD 45/115, Seneca Army Depot, Romulus, NY

1. References.

a. Memorandum, DDESB-KO, 18 April 2003, SAB.

b. Memorandum, DDESB-PE, 5 June 2009, SAB.

c. DODM 6055.09, DOD Ammunition and Explosives Safety Standards, 29 February 2008, Administratively Reissued 4 August 2010.

2. This is the third and final submission for subject site. The first two submissions addressed removal in the kickout area (the "doughnut ring") and intrusive investigation inside the doughnut ring. This third submission addresses removal inside the doughnut ring.

3. Here is a recap of the basic ESS and Amendment 1:

a. In the basic ESS (reference 1.a), DDESB approved a removal of MEC in the "kickout zone" of the subject Seneca Open Detonation (OD) Grounds.

b. In Amendment 1 (reference 1.b), DDESB approved the following:

(1) A change to the size of the doughnut ring.

(2) Use of anomaly discrimination.

(3) Use of transect investigation followed by "mag and flag" removal in areas that are too steep or vegetated for geophysical mapping.

(4) Amendment 1 also asked DDESB to approve an anticipated removal approach inside the doughnut ring, but DDESB neither approved nor disapproved this approach.

4. The purposed of this Amendment, Amendment 2, is to request DDESB to approve the removal approach inside the doughnut ring.

a. It is the same approach as detailed in Amendment 1, paragraph 4.c. Rather than repeat the approach, we attach Amendment 1 for your convenience.

b. All MSD, MGFD, shield thicknesses, engineering controls, and explosives storage location remain the same.

5. Amendment 1 says that after the MEC removal, processed and inspected soils (these will be non-explosive soils) will be left on-site or disposed off-site depending upon environmental sampling results. For your information, if the soil remains on-site, the decision may be to cap it. If it goes off-site, it will either be disposed (land filled) or treated.

The Point of contact for Seneca Army Depot Activity is the undersigned at (607) 869-1309.

Stephen M. Absolom
Installation Manager

CF:
Thomas Battaglia, USACE-Seneca

Explosives Safety Submission

Munitions Response

at the Open Detonation (OD) Grounds,

Seneca Army Depot Activity,

Romulus, New York

August 2010

Prepared by

US ARMY CORPS OF ENGINEERS
New York District

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INTRODUCTION

This Explosive Safety Submission is for the final (Phase III) Munitions Response at the Open Detonation (OD) Area (SEAD-45/115) of the Seneca Army Depot Activity (SEDA), Romulus, NY 14541. SEDA is a former US Army ammunition storage depot encompassing approximately 10,600 acres (Appendix A). It is bounded on the west by State Route 96A and on the east by State Route 96. The cities of Geneva and Rochester are located to the northwest (14 and 50 miles, respectively); Syracuse is 53 miles to the northeast and Ithaca is 31 miles to the south. The surrounding area is generally used for farming.

SEDA was included on the Federal Facilities National Priorities List on 13 July 1989. Consequently, all work to be performed under this contract will be performed according to Comprehensive Environmental Response Compensation and Liability Act (CERCLA) and the "Federal Facility Agreement under CERCLA Section 120 in the matter of Seneca Army Depot, Romulus, New York,".

SEDA was included on the 1995 Base Realignment and Closure List and has been closed. The Seneca County Industrial Development Agency (IDA) has prepared a reuse report entitled "Seneca Army Depot Reuse Plan and Implementation Strategy". The majority of the installation will be used for housing developments, industrial development, institutional and conservation/recreation uses upon transfer.

The OD Area is within the area designated for "Conservation/Recreation" in the reuse plan. The intended use is for public access for surface activities such as hiking and wildlife viewing. This ESS covers the proposed munitions response for the area within 1500 feet of the detonation hill and the finalCERCLA Remedial Action for the soils impacted by past munitions disposal operations.

1.0 REASON FOR OE.

Open detonation/open burning operations have been conducted for more than 60 years in the munitions destruction area or Demolition Grounds (440 acres) in the northwest portion of the installation. The area was administratively subdivided into the Open Burning and Open Detonation Grounds in the 1970's for environmental permit applications.

The Open Detonation (OD) Area currently consists of 158 acres that remains within a 1500 foot radius of the primary detonation area referred to as the "Hill". This area is bounded by the SEAD 45/115 Phase II MEC Removal (2500-1500') completed in 2006, as well as the Open Burning (OB) Grounds and SEAD 57 Munitions Area responses completed in 2002 and in 2007. These sites were cleared of MPPEH (as described in previous ESS's) after mapping the surface with geophysical instruments, intrusive investigation of targets, and the excavation, removal, and processing of soils necessary for the removal of metals, munitions debris, and MPPEH.

This ESS covers the surface and subsurface MPPEH removal for the inner most area within a 1500 ft radius of, and including, the "Hill" itself. It also presents the two feasible remedial action alternatives to address soil contamination levels remaining after the MPPEH removal. The final soil alternative will be chosen based upon environmental regulatory agency concurrence, CERCLA constraints, and cost. Approval of both alternatives for soil remediation is requested at this time.

2.0 MAPS.

Maps detailing the location and extent of the area of concern and presenting the relevant Public Withdrawal Distances, Q-D Distances, etc., are presented in Appendix A to this submission.

3.0 AMOUNT AND TYPE OF MEC.

Past Munitions disassembly and disposal operations at the site generated Munitions Debris, Discarded Military Munitions (Inert), and MPPEH/MEC (See Appendix C, pages C-9 through C-23).

Most of the MPPEH encountered during the Removal Projects referenced above has consisted of various projectiles and fuzes subsequently determined to be MD. During the OD Area Phase II MEC removal effort, 15,851 metal objects were removed. 1,187 were considered MPPEH and inspected. 71were determined to be MEC (5 UXO). MEC found include smaller 20 mm, 37 mm projectiles, fuzes, rocket warheads, grenades, and Munitons Constituents. The largest UXO encountered to date is the 37 mm projectile. Except for distinct, identifiable, man made burial pits, no MPPEH was found deeper than 24 " below the surface.

Based upon the results of the previous MEC removals, two Most Probable Munitions (MPM) were chosen for this site. One was chosen for determination of the safe Public Withdrawal Distance and barricade thickness. This is the M374, 81mm Mortar. The Net Explosive Weight (NEW) is 2.09 lbs. of Composition B. The Public Withdrawal Distance (PWD) for this MPM is 1233 feet, which was computed using HNC-ED-CS-S-98-1 (approved by DDESB on 6 April 1998) by Ms.Sherene Rizvi, USAESC, Huntsville, Engineering Division, Structures Branch, November 2001.

Engineering controls: Miniature Open Front Barricade (MOFB) thickness is 1.43 inches of Aluminum. Sand bag enclosure for intentional detonations is 20 inches thick with 6 inch standoff between munition and sand bags. Sand Bag throw distance=125 ft. Minimum Separation Distances for both the MOFB and Sand Bag enclosure = 200 ft. A professional engineer design of an alternative plexi-glass barricade is included for approval, in Appendix B.

During all MEC operations Steel, Lexan, or Plexiglass shields will protect earthmoving and soil processing equipment operators. Shield thickness has been calculated to be a minimum of 2.77 inches of Plexiglas or 4.26 inches of Lexan (by Ms. Sherene Rizvi, Structures Branch, USAESC, Huntsville, using THOR equations for fragment penetration from TM 5-1300) using the 81mm M374 Mortar on 29 November 2002 and verified by Dr. Michelle Crull, USAEC, Huntsville, on 10 September 2002.

If however, a larger, live or suspected live OE item is encountered, its withdrawal distances will be determined in accordance with the procedures defined in 98-01 and adjustments will be made accordingly. Until the appropriate distances are determined by 98-01, the default distances in DoD 6055.9-STD (Chapter 5, Paragraph E.4.a) will be used.

The second MPM was chosen for the purpose of determining the limitations and effectiveness of geophysical investigation equipment with respect to the smallest MPPEH found. This is the 20mm projectile. Local soils and current detection capabilities allow a detection depth of 14 inches under the worse case orientation.

4.0 START DATE.

Work will begin in ***October 2010*** beginning with survey work and progressing to intrusive investigation work.

5.0 FROST LINE DEPTH.

The design frost depth for this site is 40 inches.

6.0 CLEARANCE TECHNIQUES.

This section presents information concerning the techniques to be used during the removal of MPPEH at this site.

General Progression.

Open areas between 1500-1000feet:

Brush removal and intrusive investigation of targets in open areas between 1500 and 1000' radius from the center of the OD Hill. These targets were previously identified during Phase II but not investigated.

Wooded/severe slope areas:

Brush removal, grid layout, manual survey (mag and flag), and intrusive investigation of all wooded areas within 1500 feet and remaining wooded areas identified during Phase II (located beyond 1500').

Open area within 1000 ft:

Alternative I- Regulatory agencies approve engineered cover and permanent interment of residual soils on site and at a cost less than Alternative II. Excavation, consolidation, and grading of contaminated soils inside 1000 feet, and adjacent to and including the Hill soils based upon soil contamination levels (Environmental). Geophysical mapping, intrusive investigation, and MPPEH removal will be conducted prior to the construction of a final engineered cover. The final cover may include impervious barriers, selected protective or drainage layers, and top soils placed over the contaminated soil.

-OR-

Alternative II- Regulatory agencies require excavation and off site disposal of contaminated soils (or this option costs less than Alternative I). Excavation, staging, processing (Magnetic separation) of contaminated soils to remove all MPPEH prior to shipment off site to commercial landfill. Geophysical mapping, intrusive investigation, and MPPEH removal of the area from 1,000' to the former center of the OD Hill (now removed).

Discussion of Project-Specific Procedures.

All geophysical mapping, surveying, and brush clearing activities will be conducted utilizing a UXO Tech II escort who will provide OE avoidance services so that grid stakes/flags/markers can be placed in the ground. Surveying activities will consist of the location of soil excavation points, site grids, control points and verification of payment quantities.

For surface clearance, each grid will be walked and visually checked for the presence of MPPEH. Instrument assistance may be used as required.

For area mapping performed using digital geophysical instruments, each grid will be divided into 2, 2.5 or 3-foot lanes depending upon which spacing provides the best detection capability as demonstrated in the geophysical prove-out. For manual surveys performed using analog, handheld instruments, each grid will be divided into 5 foot transects or lanes.

The geophysical mapping specification includes the requirements for a Test Plot sufficient to calibrate the instruments daily as well as to validate the capability of detecting a 20 mm projectile at a 14 " depth, with the specified positional accuracy and quality controls.

EM-61 or newer models will be towed in multiple instrument arrays in the open areas; the survey teams will be provided with UXO avoidance support. The contractor will perform periodic QC during the mapping of all grids in accordance with Quality Control for OE Digital Geophysical Mapping, USAESC, Huntsville. 100 % detection of all QA targets (placed by USACE prior to the mapping efforts) is required for acceptance of the geophysical mapping and the start of intrusive investigations.

Targets with a signal response greater than 50 mv will be chosen and assigned to UXO teams for investigation. The team will re-acquire the target at the location coordinates provided and confirm previous response signal magnitudes and coordinates. If within the QC specification, intrusive investigation and removal will occur. Targets that fail QC require a root cause analysis of the failure mode. At the completion of intrusive investigations, the SUXOS or UXO QC manager will perform a re-inspection of all

target locations were MPPEH was recovered or, no object was found. All other targets will receive a 10% inspection by the SUXOS/QCM.

Heavy brush/forest areas require manual surface and subsurface clearance. UXO personnel will locate and record the position of anomalies in the heavy brush/forest acreage using approved handheld detection equipment and a Trimble GPS. The SUXOS or UXO QC Manager will perform QC on 10% of the areas mapped in this manner.

In addition, 100% detection of the USACE QA targets is required for acceptance of all target identification efforts. Failure to detect a placed QA target will require rework of the identification task for that area.

All targets identified will be excavated to the depth necessary to determine their identity. Earth moving equipment may be utilized to excavate soils one foot on each side of the marker flag. UXO techs will remove the remaining soil using hand tools. The MOFB will be utilized whenever there is less than 1233 ft. distance to the Army property line or an inhabited building.

In general, in areas of low density, individual targets will be reacquired and intrusively investigated. The high density or saturated response areas (SRAs) may be excavated and screened to remove MPPEH instead of the investigation of individual targets. The use of this method is at the discretion of the contractor for soils that are scheduled to remain on site. For soils to be removed from SEDA, this process is mandatory.

The perimeter of each SRA area will be staked with a 10' off set using established coordinates from the DGM. RTK GPS will be used to install grade stakes and perimeter markers. After the SRA area has been established, an initial surface sweep of the area will be conducted by UXO personnel. If MPPEH is identified during the surface sweep, it will be transported to the onsite storage at the designated site storage bunker for future disposal. If the MEC cannot be safely moved, the area will be cleared and it will be detonated in place by UXO personnel.

The area will then be excavated to a six (6) inch depth using a shielded grader which will stockpile the material in a windrow to remove moisture. The windrowed material will be loaded out with a shielded rubber tired loader and transported to the processing area. The operators of the grader, loader and trucks will operate behind shielding in accordance with the standard outlined in Appendix D.

The stockpiled material will be processed through a screening plant similar to a Trommel™ screen or shaker screen. The following equipment will be used:

- A grizzly sized at greater then 6"
- A de-lumper
- Vibrating 5/8" harp screen deck
- Cross belt magnet
- Magnetic head pulley
- Stack-out conveyors

The material will be taken from the stockpile area by a shielded loader and placed into the 6" grizzly screen where all material greater than 6" will be retained. The material passing through the grizzly will continue to a low speed de-lumper for further size reduction. Once the material has been homogenized by the de-lumper, the material will than pass to a vibrating 5/8" Harp screen. The 5/8" screen size was selected because the smallest munitions found at the site was a 20 mm which has a least dimension of 0.78" which is larger than the 5/8" harp screen. The material retained by the 5/8" Harp screen will pass onto a sorting conveyor with an active cross belt magnet and a magnetic head pulley. The cross belt magnet will remove all large ferrous items from the conveyor and drop them into a steel container. The out-feed material on the conveyor from the harp screen will be maintained at a maximum of five inches for efficient cross belt magnet operation. Any smaller ferrous material in the out-feed material not removed by the cross belt magnet will be retained by a magnetic head pulley. This unit has a strong electromagnet built into the final pulley on the conveyor. As the material leaves the out-feed conveyor, the ferrous material is attracted to the magnetic head pulley and dropped into a container below the head pulley. Both of the magnetic separators are self cleaning magnets that will remove the ferrous material from the oversize (greater than 5/8") output. The remaining non-ferrous soil and remaining munitions debris that pass the magnetic separation system will be conveyed to a stockpile by a stack out conveyor. This material will be the secondary oversize material

The entire mechanical sorting operation will be observed by a UXO Technician located in a Blast Shield Protective Device- See Appendix D. The UXO observer will have a remote kill switch to stop the out-feed conveyors if a dangerous item (e.g. smoking WP) is observed in the process. If a potential MEC item is observed in the process stream, the process equipment will be stopped with the kill switch and all personnel moved to a safe withdrawal distance. The MEC will be removed and placed into a dedicated storage container. If the round is smoking it will be allowed to react unless it is deemed to be safe to remotely start up the conveyor and discharge the round into a bucket containing water to stop the reaction.

The screening process will generate four separate material streams that will be treated as follows:

- Material 6" and greater (gross oversize): This material will consist of large rocks, vegetation and metal scrap that do not pass through the "Grizzly" screen. This material will be sorted daily by the UXO technicians for possible MEC. The remaining oversize rocks and vegetation will be separated from the munitions debris and used as onsite backfill. Once the MEC and munitions debris are removed, the remaining scrap metal will be stockpiled until it is disposed of at the scrap dealer upon completion of the project

- Material >5/8" and <6": The secondary oversize stockpile will periodically be mechanically laid down in 6-inch to 12-inch lifts in a previously cleared area surrounded by silt fence. Once the material is laid out it will be swept for MEC by the UXO Technicians using a Fisher™ or similar all metal detector. All anomalies identified by the sweep team will be investigated by hand digging. Any MEC encountered that can be transported will be removed and placed into the onsite storage bunker for future disposal. Any item deemed unsafe to move will be BIP in the lay down area before the remainder of the area can be swept. All remaining MPPEH will be demilitarized and certified clean before being sent off-site for disposal at a smelter.

- Material <5/8": The material that passes through the harp screen will be used as site backfill. At this point, the material that has passed through the 5/8-inch screen will be considered free of MPPEH and available for backfill as determined by the analytical results of the soil sampling effort.

- Ferrous Removed by Magnet: This material will be laid down in a previously cleared area in a 6-inch lift where it will be visually inspected for MEC and munitions debris by UXO technicians. MEC material will be removed and placed into storage in the onsite storage bunker for further disposal. Munitions debris will be de-militarized as required and along with the scrap will be sent to an off-site smelter for disposal.

MPPEH will be destroyed, or certified as munitions debris, on a weekly basis.

The contractor will provide explosives for destruction operations. It is anticipated that demolition materials and perforating charges, as appropriate, will be used. These are considered Class 1.1 and 1.4 explosives.

Explosives will be stored in the SEDA OB/OD area double igloo type, earthen-covered magazine. The storage igloo locations are shown on Figure 1. The existing magazine is constructed to DDESB and Army standards and is complete with the required lightning protection and current ground testing certification. The contractor will store detonating cord, perforators and time fuse in one half of one of the magazines. In the other half of the first magazine, the contractor will store initiators. A sandbag wall (minimum two feet wide and at least as high as materials stacked on either side) will separate the two halves of this magazine. In the second of the magazines, MEC (which was located and is awaiting the weekly demolition operation) will be stored. Each of the two magazines is designed for storage of a maximum NEW not to exceed 450 pounds. At no time will the contractor store more than 100 pounds NEW in either magazine.

Magazine A0705, which is approved for up to 250,000 lbs HC 1.1 explosives, will be used to store any recovered MEC that exceeds the 100 lb limit for the OB/OD service magazine.

For security, access into the fenced SEDA ammunition area is restricted. Additionally, SEDA has erected a new fence further restricting unauthorized access to Munitions Response Area. Access into a work site exclusion zone will be limited to essential personnel specifically authorized to work on site.

Disposal/Venting/Demilitarization operations will be carried out weekly. Items which can be moved will be consolidated in accordance with "Procedures for Demolition of Multiple Rounds (Consolidated Shots) on Ordnance and Explosives (OE) Sites", dated August 1998 and approved by DDESB on 27 October 1998. Disposal will be carried out at the "Hill" on the OD Ground. MEC will be stored in the second magazine while awaiting demo operations. Items that cannot be moved will be blown-in-place daily, on an individual basis.

All munitions debris will be certified as explosive free and demilitarized prior to removal from the Seneca Army Depot.

All applicable OSHA USACE(385-1-1), DOD (6055.9-STD), Army (385-64) safety regulations will be followed at all times, without exception. Hazard analyses and daily safety briefings will be prepared and conducted as stated in the contractor's approved Site Safety and Health Plan (SSHP).

7.0 ALTERNATE TECHNIQUES.

An alternative barricade to the MOFD will be designed and submitted for approval. See Appendix B.

8.0 QUANTITY-DISTANCES.

The appropriate Quantity-Distances are shown on the SEDA Installation Explosives Q/D site map enclosed in Appendix A of this submission. For ease of review, the distances are repeated here.

The rationale for the MPM and citation for the calculation method are presented in Section 3.0 of this submission. In general, team separation distances will be determined by the greater of 200 feet or the K50 (0.9-psi overpressure) distance. The separation distance for all unrelated personnel for an accidental detonation from an OE area will be determined by the greatest of 200 feet, the K50 distance or the maximum fragment throw distance. The separation distance for all personnel (related and unrelated) for intentional detonations will be determined by the maximum of 200 feet, the K328 distance or the maximum fragment throw distance. Applying the above principles, the following distances apply:

OE Areas: Minimum of 1,233 feet (this is the maximum fragment range for the 81mm M374 Mortar).

OD Grounds Magazines: Minimum of 500 feet (Front) and 250 feet (Rear and Sides), IAW Table 9-1 of DoD 6055.9-STD. The back and sides of the existing magazines face the removal site. Therefore, 250 feet will govern for the vast majority of the proposed removal. Note that these distances are for 1.1 explosives; therefore, they exceed the distance requirements for the 1.4 demolition materials to be stored in one of the magazines. UXO (Class 1.1) will be stored in the second magazine. Other approved ammunition storage magazines are available on site if required.

Intentional Detonations: Minimum of 1,233 feet (via approved calculation).

During work, appropriate protection will be used for site personnel and the public during situations where an intentional detonation or Thermal Treatment is conducted for MEC found.

9.0 OFF-SITE DISPOSAL.

Not applicable.

10.0 TECHNICAL SUPPORT.

No Chemical Warfare Materials (CWM) are suspected at this site. The contractor will positively identify all OE uncovered before items are removed or destroyed. If a suspect CWM is encountered, the Site Safety Officer will stop all operations on site and notify the on site CENAB OE Safety Specialist. The CENAB OE Safety Specialist will notify the appropriate Explosive Ordnance Disposal (EOD) Detachment (725th Ordnance Company (EOD) Fort Drum) and/or Technical Escort Unit.

11.0 LAND USE RESTRICTIONS.

There will be reuse restrictions required following this action. The site will be transferred for reuse as discussed in the INTRODUCTION, allowing public access for surface activities with excavation below 14 inches (or within the engineered cover area) prohibited.

12.0 PUBLIC INVOLVEMENT.

This removal is being performed under the CERCLA umbrella since Seneca is a BRAC federal facility on the National Priorities List. Consequently, the required public involvement process is already in place (BCT, RAB, and general public involvement) with the SEDA BEC taking the lead.

13.0 AFTER ACTION REPORT.

Following the OE Removal Project at the Open Detonation Grounds, a copy of the Final Removal Report will be provided, to all whom reviewed this ESS, for information purposes.

13.0 AMENDMENTS AND CORRECTIONS.

An amendment or correction discussing any changes in the procedures to be used or the conditions encountered during this removal will be provided for review and approval as warranted.

14.0 REFERENCES.

General

a. AR 385-64, Ammunition and Explosives Safety Standards, dtd 22 May 1987

b. AR 385-64 (Draft), US Army Explosives Safety Program

c. Department of Defense Explosives Safety Board, Interim Guidance on Land Clearance Planning and Removal Depth for Ammunition and Explosives. 1993.

d. DDESB, Guidance for Clearance Plans, 27 January 1998.

e. Interim Final, "Guidance for Conducting Remedial Investigations/Feasibility Studies Under CERCLA", U.S. EPA, Office of Solid Waste and Emergency Response, October 1988.

f. "U.S. Corps of Engineers Safety and Health Requirements Manual," U.S. Army Engineering Manual No. EM-385-1-1, 3 September 1996.

g. "Safety Concepts and Basic Considerations for Unexploded Ordnance (UXO) Operations", U. S. Army Engineering and Support Center, Huntsville, Revised 16 February 1996.

h. "Interim Guidance Documents": http://www.hnd.usace.army.mil/oew/intguidocs.asp

i. "Regulations, Pamphlets, Manuals": http://www.hnd.usace.army.mil/oew/erepems.asp

Specific

a. "Federal Facility Agreement under CERCLA Section 120 in the matter of Seneca Army Depot, Romulus, New York," Docket No. II-CERCLA-FFA-00202, USEPA, U.S. Department of the Army, and the New York State Department of Environmental Conservation, November 1990.

b. "Work Plan Architectural-Engineering Services For Performing A Remedial Investigation/Feasibility Study (RI/FS) At The Open Burning (OB) Grounds, Seneca Army Depot, Romulus, New York," Chas. T. Main, Inc., 1991.

c. "Preliminary Site Characterization Report at the Open Burning (OB) Grounds," Chas. T. Main, Inc., 1992.

d. Final, "Remedial Investigation Report at the Open Burning (OB) Grounds", Parsons Engineering Science, Inc., September 1994.

e. Final, "Feasibility Study at the Open Burning (OB) Grounds", Parsons Engineering Science, Inc., June 1996.

f. Draft-Final, "Superfund Proposed Plan, the Open Burning (OB) Grounds at the Seneca Army Depot Activity (SEDA), Romulus, New York.", Parsons Engineering Science, Inc., January 1997.

g. Preliminary-Draft, "Record of Decision, Former Open Burning (OB) Grounds Site, Seneca Army Depot Activity,

Romulus, New York.", Parsons Engineering Science, Inc., March 1997.

h. Draft Final Ordnance and Explosives Engineering Evaluation/Cost Analysis, Seneca Army Depot, September 2001. OD Grounds (SEAD 45)

APPENDIX A

MAPS

APPENDIX B

Alternate Plexi-Glass Open front Barricade

APPENDIX C

Anomaly Investigation Results: SEAD 45 Excerpts from EE/CA

File
SEAD 45/155
OD Grds

DEPARTMENT OF DEFENSE EXPLOSIVES SAFETY BOARD
2461 EISENHOWER AVENUE
ALEXANDRIA, VIRGINIA 22331-0600

DDESB-PE

JUN 05 2009

MEMORANDUM FOR DIRECTOR, DEFENSE AMMUNITION CENTER
ATTENTION: SJMAC-ESM

SUBJECT: DDESB Approval of Amendment 1 to the Explosives Safety Submission (ESS) for Ordnance and Explosives Removal at the Open Detonation Grounds SEAD 45/155, Seneca Army Depot Activity, Romulus, NY

References: (a) DAC SJMAC-ESM Memorandum of 12 May 2009, Subject: Amendment 1 to the Explosives Safety Submission (ESS) for Ordnance and Explosives Removal at the Open Detonation Grounds SEAD 45/155, Seneca Army Depot Activity, Romulus, NY

(b) Email from Mr. Cliff Doyle (USATCES) to Mr. Tony Dunay (DDESB), dated 29 May 2009, Subject: RE: Seneca ESS Amend 1

(c) DoD 6055.09-STD, DoD Ammunition and Explosives Safety Standards, 29 February 2008, Incorporating Change 1, 24 March 2009

(d) DDESB TP-15, Approved Protective Construction, Version 2.0, June 2004

(e) DDESB TP-16, Methodologies for Calculating Primary Fragment Characteristics, Revision 3, 1 April 2009

The Department of Defense Explosives Safety Board (DDESB) Staff has reviewed the subject explosives safety submission (ESS) forwarded by reference (a), as modified by reference (b), against the requirements of reference (c). Based on the information provided, approval is granted for Amendment 1 to the ESS for removal and treatment of material potentially presenting an explosive hazard (MPPEH) at Open Detonation Grounds SEAD 45/155, Seneca Army Depot Activity, Romulus, NY. This approval is based on the following:

a. The inner radius of the donut ring is increased from 1,200 to 1,500 feet (ft) from OD Hill; the heavily wooded areas in the donut ring (i.e., 1,500 ft to 2,500 ft from OD Hill) will be sampled using transects and if material documented as an explosive hazard (MDEH) is found the sampled area will be cleared using mag, flag and dig techniques; clearances supported by electromagnetic detection (EM) may use anomaly discrimination (i.e., past on-site removals using particular EM equipment indicates that removal of anomalies with signatures $\geq$ 50 millivolts will remove most MPPEH); and adds intrusive remedial investigation/feasibility study of the donut hole area (i.e., OD Hill out to 1,500 ft).

b. All mechanized operations are classified as low input processing operations, thereby permitting the minimum separation distance (MSD) for unintentional detonations for nonessential personnel to be based on the hazardous fragment distance (HFD) vice the maximum fragment distance (MFD) of the munition with the greatest fragmentation distance (MGFD).

c. The MGFD remains the 81mm HE M374 Mortar; the MSD for teams for manual operations is 58 ft and for mechanized operations is 234 ft, based respectively on K40 of the MGFD and the HFD of the MGFD; the MSD for unintentional detonations for nonessential personnel from manual and mechanized operations is 234 ft based on the HFD of the MGFD; the MSD for intentional detonations for nonessential personnel is 1,233 ft based on the MFD of the MGFD; and consolidated in-grid detonations are authorized for a net explosive weight of 53 pounds hazard division 1.1 and with items having an MFD $\leq$ 1,233 ft.

d. Operators of mechanized equipment will be shielded from hazardous fragments based on unintentional detonation from mechanized operations involving the MGFD. The use of barricades/shields are authorized as engineering controls to prevent fragment penetration provided the Army ensures usage per reference (d). Additionally, these personnel will be provided blast over pressure protection of 35 ft based on K24 of the MGFD.

e. The use of hearing protection is authorized as an engineering control for unintentional detonation operations to provide equivalent K24 blast overpressure protection for essential personnel at K18 separation of 26 ft. The Army shall ensure hearing protection provides $\geq$ 9 decibel (dB) protection.

f. The use of the Miniature Open Front Barricade is authorized as an engineering control for unintentional detonations operations involving the items identified in reference (a) provided the Army ensures usage per reference (e), paragraph C6.2.4.8.

g. The use of sandbags and water mitigation systems are authorized as engineering controls for intentional detonation operations involving the items identified in reference (a) provided the Army ensures usage per reference (e), paragraph C6.2.4.8.

h. Recovered MPPEH, to include demolition debris, will be inspected and classified as material documented as safe prior to release.

i. All other stipulations and requirements established via the original ESS remain in effect.

The point of contact for this action is Mr. Tony Dunay, (703) 325-3513, DSN 221-3513, E-mail address: tony.dunay@ddesb.osd.mil.

E. Albert Olhoe

CURTIS M. BOWLING
Chairman
DDESB

File
SEAD 45/115
006-R-01

DEPARTMENT OF THE ARMY
US ARMY DEFENSE AMMUNTION CENTER
1 C TREE ROAD
MCALESTER, OK 74501-9053

REPLY TO ATTENTION OF

SJMAC-ESM

12 May 2009

MEMORANDUM FOR Department of Defense Explosives Safety Board (DDESB-PE/Mr. Alchowiak), 2461 Eisenhower Avenue, Alexandria, VA 22331-0600

SUBJECT: Amendment 1 to the Explosives Safety Submission (ESS) for Ordnance and Explosives Removal at the Open Detonation Grounds SEAD 45/155, Seneca Army Depot Activity, Romulus, NY

1. References:

a. Memorandum, Seneca Army Depot Activity (SEAD), DAIM-ODB-Se, 06 May 09, SAB.

b. DOD 6055.9-STD, Ammunition and Explosives Safety Standards, 29 February 2008 with Change 1 24 March 2009.

2. Reference 1.a with enclosed Amendment 1 is provided for your approval IAW with chapter 12 of reference 1.b. For your convenience, Amendment 1 includes the original submission as an Appendix.

3. The POC is Cliff Doyle, SJMAC-ESM, DSN 956-8741, COMML (918) 420-8741, email Clifford.doyle@us.army.mil.

FOR THE DIRECTOR:

DOYLE.CLIFFORD.H.1230381662

Digitally signed by DOYLE.CLIFFORD.H.1230381662
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=DOYLE.CLIFFORD.H.1230381662
Date: 2009.05.12 13:26:34 -05'00'

1 Encl
as

CLIFFORD H. DOYLE
MEC Team Leader
Explosives Safety Knowledge, OE and Chemical Division
US Army Technical Center for Explosives Safety

SJMAC-ESM
SUBJECT: Amendment 1 to the Explosives Safety Submission (ESS) for Ordnance and Explosives Removal at the Open Detonation Grounds SEAD 45/155, Seneca Army Depot Activity, Romulus, NY

CF: (w/encl)
Office of the Director of Army Safety, (DACS-SF/Mr. Patton), 223 23rd Street, Crystal Plaza 5, Suite 980, Arlington, VA 22202
Office of the Deputy Assistant Secretary of the Army for Environment, Safety, and Occupational Health, Special Assistant for Munitions, (DASA-DESOH/Mr. King), 110 Army Pentagon, Washington, DC 20310-0110
Office of the Assistant Chief of Staff for Installation Management, Base Realignment and Closure Office (DAIM-BD/Mr. Haughs), 600 Army Pentagon, Washington, DC 20310-0600
Seneca Army Depot BRAC Office (Steve Absolom)
Corps of Engineers, New York District (Tom Battaglia)

DEPARTMENT OF THE ARMY
SENECA ARMY DEPOT ACTIVITY
5786 STATE RTE 96, P.O. BOX 9
ROMULUS NY 14541-0009

REPLY TO
ATTENTION OF
DAIM-ODB-SE

06 May 2009

Memorandum For: Director, Defense Ammunition Center, ATTN SIOAC-ESL
(Mr. Clifford Doyle), Building 35, IC Tree Road,
McAlester, Ok 74501-9053

SUBJECT: Amendment 1 of the Explosive Safety Submission for Ordnance and Explosives Removal at the Open Detonation Grounds SEAD 45/115, Seneca Army Depot Activity, Romulus NY

1. The enclosed safety submission amendment #1 was prepared for Seneca Army Depot Activity to document changes required from the original Explosive Safety Submission that are required or were not included in the original ESS but are now included as part of this amendment.

2. The Amendment is being forwarded for your review.

3. Should you have any question, please contact me at (607) 869-1309 or email at stephen.m.absolom@us.army.mil.

Enclosure

Stephen M. Absolom
Installation Manager

Amendment 1 to the

Explosives Safety Submission (ESS)

for Ordnance and Explosives Removal

at the Open Detonation (OD) Grounds SEAD 45/155

Seneca Army Depot Activity,

Romulus, New York
14541-0009

Prepared by
Seneca Army Depot
and
U.S. ARMY TECHNICAL CENTER FOR EXPLOSIVES SAFETY
May 2009

1. This amendment applies to the Explosive Safety Submission, Ordnance and Explosives Removal at the Open Detonation (OD) Grounds (SEAD-45/115), April 2003, Seneca Army Depot Activity (SEDA), Romulus, NY, as approved by DDESB on 02 April 2003. Appendix A of this amendment contains the original ESS and the DDESB approval memo for same.

2. Paragraph 3 of this amendment lists each thing DDESB approved in its approval memo, and for each thing, lists what changes (if any) this amendment is making. Paragraph 4 of this amendment lists things in the ESS that DDESB did not specifically approve in its approval memo, but are being changed by this amendment.

3. Subparagraphs 3.a. through 3.i. below list each thing DDESB approved in its approval memo, and for each thing, list what changes, if any, this amendment is making.

a. Areal extent of removal. The original ESS establishes a "doughnut ring" shaped MEC removal area around the demolition pits (the pits are called "OD Hill"). This doughnut ring shaped area is the outer kickout area. In the original ESS, the inner boundary of the doughnut ring is 1200 feet from OD Hill. The outer boundary of the doughnut ring is 2500 ft from OD Hill. The original ESS does not address OD Hill and the acreage out to 1200 ft from OD hill (the inside of the doughnut ring).

(1) Original ESS: DDESB's approval memo states: "The response will address the kickout zone for the OD grounds, which includes about 330 acres located within the area bounded by the 1,200 ft and the 2,500 ft radii from 'OD Hill', as depicted on the map at Appendix A of the ESS."

(2) Amendment 1 does three things relative to the areal extent of removal: it reduces the acreage (i.e. the size) of the doughnut ring; it modifies the removal for heavily wooded/brushy areas in the doughnut ring; and it sites intrusive investigation activities for a new area – the area inside the doughnut ring (i.e., the hole in the doughnut). Each of these three changes is explained below. Please refer to the Appendix A, figure 1 as you read about these three changes.

1 Reduce the acreage (i.e., the size) of the doughnut ring. Amendment 1 reduces the size of the doughnut ring to an area bounded by 1,500 ft and 2,500 ft radii from OD Hill. Note that the change is to the size of radius for the inner diameter of the doughnut ring (1200 ft original radius is increased to 1500 ft). REASON: there is too much metallic clutter in the area between 1,200 ft and 1,500 ft to do geophysical mapping.

2 Modify the removal for heavily wooded/brushy areas in the doughnut ring. Some areas in the doughnut ring are very wooded and/or brushy. In order to geophysically map all the acreage in these areas to identify targets for removal, vegetation removal is required. Such vegetation removal is costly and environmentally objectionable. So instead, this amendment proposes that these wooded/brushy areas be sampled using transects. The transects will be removed of vegetation, geophysically mapped, and target anomalies removed. If MEC is found, a removal will be conducted in the effected area (see Appendix B, Figure 2 for a MSD map for sampling and removal in the wooded/brushy areas in the doughnut ring). The removal will be

done not by geophysical mapping and then digging, but rather by the "mag, flag and dig" method.

Note regarding paragraph 2 above: Removal is complete in the open areas in the doughnut ring. Transect sampling is almost complete in the wooded/brushy areas in the doughnut ring. Thus, this amendment is asking for "after the fact" approval for this completed work. This amendment is also asking for approval to finish the transect sampling in the wooded/brushy areas and to then conduct a removal in those wooded/brushy areas where transect sampling indicates MEC is present.

3 Conduct intrusive investigation in an area not included in the original ESS. The original ESS did not include the area inside the doughnut ring (OD Hill and acreage out to 1500 ft from OD Hill). This Amendment sites intrusive investigation in the area inside the doughnut ring. This area includes OD Hill and acreage out to 1500 ft from OD hill (see Appendix B, Figure 3 for an MSD map). Based on the results of this intrusive investigation, another ESS amendment will be submitted at a later date for MEC removal at OD Hill and in acreage out to 1500 ft from OD hill. Please see paragraph 4.a. for further details on MEC investigation inside the doughnut ring.

b. Future land use.

(1) Original ESS: DDESB's approval memo states "The intended use of the property addressed in this ESS is surface recreation/conservation with the potential to establish camping facilities in the future."

(2) Amendment 1: no change.

c. MGFD and associated MSD.

(1) Original ESS: DDESB's approval memo states "The most probable munition (MPM) is the 81mm M374 HE projectile, with a calculated minimum separation distance (MSD) of 1233 ft for both intentional and unintentional detonations. The MSD may be reduced to 200 ft when using DDESB-approved fragmentation mitigation methods, such as the sandbag barricades."

(2) Amendment 1:

(a) MGFD (called MPM in original ESS): No change. The 81mm M374 HE projectile remains the MGFD.

(b) MSD:

1 Unintentional detonations during manual and mechanized removal: HFD (234 ft) applies, vice the original ESS's MFD (1233 ft). REASON: current DOD 6055.9 STD, chapter 12, allows HFD for manual and mechanized removal. The MGFD is the 81mm HE M374 round. They are all kickouts and as such, have not experienced the launch environment (setback,

spin) necessary to arm the fuze. This renders the MEC relatively resistant to initiation during mechanized MEC operations such as excavation and sifting.

2 Intentional detonations: No change. MFD (1233 ft), for intentional detonations w/o engineering controls; 200 ft when using engineering controls (specifically, DDESB approved sandbag method).

d. Anomaly discrimination:

(1) The DDESB approval memo states all anomalies will be investigated.

(2) Amendment 1:

(a) The removal already done in the area from 1500 to 2500 feet from OD Hill recovered all anomalies with an electromagnetic signature above 50 millivolts.

REASON: anomalies with signatures of 50 millivolts or less consist mainly of clutter (small fragments and "hot rocks"). In addition, anomalies below 13 millivolts are meaningless, since 13 millivolts is the background reading. There is so much clutter below 50 millivolts that removing all of such would have greatly increased the cost of the project. Funds were and are not available for this additional work.

2 Some small MEC (20mm projectiles, small fuzes) many remain because some of these (depending on depth) may have signatures of 50 millivolts or less. Based on data collection and analysis done by the Army Corps of Engineers, it is estimated that 12 small MEC items may remain in the area from 1500 ft to 2500 ft from OD Hill. Remaining MEC will be subsurface.

e. Miniature Open Front Barricade (MOFB).

(1) Original ESS: DDESB's approval memo states "The DDESB-approved Miniature Open Front Barricade (MOFB) will be used whenever intrusive investigations need to be performed at a distance of less than the 1,233 ft MSD to the Army property line, inhabited buildings or public traffic routes. When the distance is less than 200 ft, traffic will be stopped and inhabited buildings will be evacuated until the intrusive operation is completed".

(2) Amendment 1 changes the above as follows: The DDESB-approved Miniature Open Front Barricade (MOFB) will be used whenever intrusive investigations need to be performed at a distance of less than the 234 ft MSD to the Army property line, inhabited buildings or public traffic routes. When the distance is less than 200 ft, traffic will be stopped and inhabited buildings will be evacuated until the intrusive operation is completed (Note that the change involves the distance that triggers use of the MOFB: it was 1233 ft; it is now 234 feet).

f. Protection for Essential Personnel from Mechanized MEC Operations.

(1) Original ESS - DDESB's approval memo states: "Earth moving and clearing equipment will be shielded with Lexan (minimum 4.26 in thick) or Plexi-glass (minimum 2.77 in thick) to protect equipment operators"

(2) Amendment 1 changes the above as follows: All mechanized equipment involving intentional contact with MEC shall provide shielding to its operators IAW DDESB's TP 16 Fragmentation Database. Per the database's Fragmentation Data Review Form (See Appendix C in this Amendment), shield thickness shall be as follows, at a minimum:

Shield Material	Shield Thickness, Minimum
4000 psi concrete	3.68 in
Mild steel	.66 in
Hard steel	.54 in
Aluminum	1.43 in
Lexan	4.36 in
Plexi-glass	2.77 in
Bullet-resistant glass	2.16 in

In addition, other essential personnel (other than equipment operators) shall be protected by the above shields or by separation from the mechanized MEC operation by HFD (234 ft).

g. Storage of demolition materials and MEC.

(1) Original ESS - DDESB's approval memo states:

"Each of the two earth covered magazines (ECMs) servicing the open burning/open detonation (OB/OD) grounds is approved to store a maximum net explosive weight (NEW) of 100 lbs hazard division (HD) 1.1 materials. One ECM will be used to store demolition explosives and the other will be used to store acceptable-to-move OE items pending disposal." *(Note: the remainder of DDESB's approval verbiage for storage of demolition materials and MEC is not reproduced here).*

(2) Amendment 1: no change from existing DDESB approval.

h. Locations and siting of intentional detonations.

(1) Original ESS - DDESB's approval memo states: "Acceptable-to-move OE items will be disposed of at the end of the workweek by intentional detonation at OD Hill. The applicable exclusion zone for OD Hill is 1,233 ft."

(2) Amendment 1: "Acceptable-to-move MEC items will be disposed of by intentional detonation at OD Hill. Unacceptable-to-move MEC items will be blown in place (BIP). The applicable exclusion zone for OD Hill and for BIP is 1,233 ft if engineering controls are not used, and 200 feet if the sandbag engineering control is used. The sandbag method is only good for individual round shots. At OD Hill, when engineering controls are not used, shots may be

consolidated provided the DDESB-approved Method for Consolidated Shots is used, and provided the NEW per shot (MEC and donor) does not exceed 53 lbs, which is the NEW commensurate with K328 and 1233 feet.

i. MPPEH.

(1) Original ESS - DDESB's approval memo states: "All OE scrap and range residue will be certified as explosive-free prior to removal from the work site".

(2) Amendment 1: Material Presenting a Potential Explosive Hazard (MPPEH) shall be inspected to determine status (MDEH or MDAS) (Material Documented as an Explosive Hazard or Material Documented as Safe). MDEH shall be destroyed by detonation at OD Hill. To qualify as MDAS, MPPEH must be subjected to two 100 percent independent inspections by UXO Technician Level II or above personnel, certified, verified, segregated, and placed in sealed containers for release for recycling or disposal.

4. Subparagraphs 4.a. through 4.c. of this amendment list things in the ESS that DDESB did not specifically approve in its approval memo, but are being changed or added by this amendment.

a. MEC sampling inside doughnut ring. This amendment adds MEC investigation inside the doughnut ring, as follows:

(1) In order to do a cost estimate for removing MEC inside the doughnut ring and then prepare an ESS for the removal action for inside the doughnut ring, sampling is required. Sampling will consist of test pit excavation to determine depth of MEC and metal contamination, depth to bedrock, volume estimates of soil, mass estimates of metal, environmental sampling, etc. To determine amount of MEC and metal, the media excavated from test pits will be sifted. Sifter operators will be shielded from fragments from the MGFD using shields per paragraph 3.f. Other essential personnel shall be protected by shields or be separated from sifting operations by HFD (234 ft). Nonessential personnel shall be separated from sifting operations by HFD (234 ft).

(2) Soil Excavation

(a) The test areas will be established and an initial surface sweep of the area will be conducted by UXO personnel. Any MEC encountered will be transported to the designated storage magazine for future demolition or destroyed (BIP) if unsafe to move.

(b) A test area will be excavated to a six (6) inch depth using a shielded excavator/grader which will stockpile the material in a windrow to remove moisture. The windrowed material will be loaded out with a shielded rubber tired loader and transported to the processing area. The operators of the grader, loader and trucks will operate behind shielding with thicknesses per paragraph 3.f. UXO observers will supervise all soil excavation and processing tasks protected by the shields per per paragraph 3.f.

(c) If the remaining soils above bedrock contain too many metal objects, an additional cut to a depth of one foot will be removed and transported to the processing area. The excavation cuts will continue until the anomaly count falls below 200 targets /acre or bedrock is encountered. From this excavation and target density data, the estimated volume of soil to be removed during the future removal action inside the doughnut ring will be calculated.

(3) Soil Processing. Stockpiled soils will be screened and sorted to remove MEC.

(a) The stockpiled material will be processed through a screening plant similar to a Trommel™ screen or shaker screen. The following equipment will be used:

- A grizzly sized at greater then 6"
- A de-lumper
- Vibrating 5/8" harp screen deck
- Cross belt magnet
- Magnetic head pulley
- Stack-out conveyors

(b) The material will be taken from the stockpile area by a shielded loader and placed into the 6" grizzly screen where all material greater than 6" will be retained. The material passing through the grizzly will continue to a low speed de-lumper for further size reduction.

(c) Once the material has been homogenized by the de-lumper, the material will than pass to a vibrating 5/8" Harp screen. The 5/8" screen size was selected because the smallest munitions found at the site was a 20 mm which has a least dimension of 0.78" which is larger than the 5/8" harp screen. The material retained by the 5/8" Harp screen will pass onto a sorting conveyor with an active cross belt magnet and a magnetic head pulley. The cross belt magnet will remove all ferrous items from the conveyor and drop them into a steel container. The out-feed material on the conveyor from the harp screen will be maintained at a maximum of five inches for efficient cross belt magnet operation. Any smaller ferrous material in the out-feed material not removed by the cross belt magnet will be retained by a magnetic head pulley. This unit has a strong electromagnet built into the final pulley on the conveyor. As the material leaves the out-feed conveyor, the ferrous material is attracted to the magnetic head pulley and dropped into a container below the head pulley. Both of the magnetic separators are self cleaning magnets that will remove the ferrous material from the oversize (greater than 5/8") output. The remaining non-ferrous soil and remaining munitions debris that pass the magnetic separation system will be conveyed to a stockpile by a stack out conveyor.

(d) The entire mechanical sorting operation will be observed by a shielded UXO Technician. The UXO observer will have a remote kill switch to stop the out-feed conveyors if a MEC is observed in the process. If a potential MEC item is observed in the process stream, the process equipment will be stopped with the kill switch and all personnel moved to a safe withdrawal distance. The MEC round will be removed and placed into a dedicated storage container. If the round is smoking it will be allowed to react unless it is deemed to be safe to remotely start up the conveyor and discharge the round into a bucket containing water to stop the reaction.

(e) The screening process will generate four separate material streams that will be treated as follows:

1 Material 6" and greater (gross oversize): This material will consist of large rocks, vegetation and metal scrap that do not pass through the "Grizzly" screen. This material will be sorted daily by the UXO technicians for possible MEC. The remaining oversize rocks and vegetation will be separated from the munitions debris and used as onsite backfill. Once the MEC is removed, the remaining munitions debris will be inspected, certified, and verified to allow disposal to a scrap dealer upon completion of the project.

2 Material >5/8" and <6": The secondary oversize stockpile will periodically be mechanically laid down in 6-inch to 12-inch lifts in a previously cleared area surrounded by silt fence. Once the material is laid out it will be swept for MEC by the UXO Technicians using a Fisher™ or similar all metal detector. All anomalies identified by the sweep team will be investigated by hand digging. Any MEC encountered that can be transported will be removed and placed into the onsite storage bunker for future disposal. Any item deemed unsafe to move will be BIP in the lay down area before the remainder of the area can be swept. All remaining munitions debris will be inspected, certified, and verified to allow disposal to a scrap dealer upon completion of the project

3 Material <5/8": The material that passes through the harp screen will be used as site backfill. At this point, the material that has passed through the 5/8-inch screen will be considered free of MPPEH and available for backfill as determined by the analytical results of the soil sampling effort.

4 Ferrous Material Removed by Magnet: This material will be laid down in a previously cleared area in a 6-inch lift where it will be visually inspected for MEC and munitions debris by UXO technicians. MEC will be removed and placed into storage in the onsite storage bunker for further disposal. Munitions debris will be inspected, certified, and verified to allow disposal to a scrap dealer upon completion of the project

(f) The contractor will take soil samples for environmental analysis and record volumes and quantities of materials produced from the soil processing plant. The types and amount of material and waste streams expected to be produced during the future removal action for inside the doughnut ring will be calculated.

b. Quality Assurance/Quality Control (QA/QC).

(1) The ESS stated a post-removal QA mapping of a minimum of 10% of the area (by grid method) would determine pass/fail. Grid areas failing would require re-work.

(2) Instead, all targets identified in the open area in the doughnut ring and chosen for investigation were subjected to a more rigorous process. The target's original GPS coordinates were relocated in the field and flagged by QC personnel. The UXO Teams were then sent to re-acquire 100% the targets again using the same mapping instrument as in Phase I. Provided the detector response (mV) was similar or the same as in Phase I, and the target was within a 48 in.

diameter around the flag, the UXO teams performed surface and sub-surface clearance until the object(s) were removed or a "no contact" was declared. Target information was then recorded on the Team Dig Sheets. If the detector response was not similar, or the target was not within a 48 in. diameter around the flag, then the grid failed and was remapped.

(3) Thus, positional accuracy and detector response were subjected to QC for all targets.

(4) The USACE buried 38 QA items in undisclosed locations. All were successfully identified and removed. Forty three "No contact" locations were inspected after removal action by the SUXOS. No metal objects were found. Fifteen of 169 transects surveyed and investigated were inspected by the SUXOS. All inspected transects passed.

c. Future removal action inside the doughnut ring (OD Hill and acreage out to 1500 feet from OD Hill).

(1) Original ESS: as stated earlier, the original ESS does not address OD Hill and acreage out to 1500 feet from OD Hill.

(2) Amendment 1 adds intrusive investigation in OD Hill and acreage out to 1500 feet from OD Hill. Data from this intrusive investigation will allow the Army to determine costs and scope of work for a future removal action (and a future ESS Amendment). However, the general removal approach is already known, as are the likely land use restrictions. Therefore, this Amendment requests approval of the below general removal approach and land use restrictions:

(a) At OD Hill, earth moving equipment will excavate soil to bedrock. All excavated soil will be sifted using the process similar to that described in paragraph 4.a.(3), which is the process to be used for initial soils/MEC investigation inside the doughnut ring.

(b) Elsewhere inside the doughnut ring, earth moving equipment will excavate to the depth required to remove heavily metallic-cluttered soil. Removal of heavily metallic-cluttered soil will allow efficient manual or geophysical mapping and identification of individual metallic anomalies lying below the heavily cluttered strata. The excavation will continue until bedrock is reached or the remaining anomalies can be investigated and removed using manual methods. All excavated soil will be will be sifted using the process similar to that described in paragraph 4.a.(3), which is the process to be used for initial soils/MEC investigation inside the doughnut ring. EXCEPTION: woody/brushy areas inside the doughnut ring will cleared using strictly manual clearance techniques (mag, flag and dig).

(3) Processed and inspected soils will be left on site or disposed off site depending upon environmental sampling results.

(4) The use of the property after transfer from the Army will require restriction. Public access for surface activities should be allowed with a prohibition on excavation within the 1500 foot radius of OD Hill. A deed notice referencing previous MR actions and advice concerning MPPEH is sufficient to protect human health.

Appendix A

DDESB Approval of Basic ESS
and
Basic ESS

DEPARTMENT OF DEFENSE EXPLOSIVES SAFETY BOARD
2461 EISENHOWER AVENUE
ALEXANDRIA VIRGINIA A 22331-0600

DDESB-KO

8 APR 2003

MEMORANDUM FOR DIRECTOR, DEFENSE AMMUNITION CENTER,
ATTENTION: SJMAC-ESL

SUBJECT: Explosives Safety Submission (ESS) for Ordnance and Explosives Removal at the Open Detonation Grounds SEAD-45/115, Seneca Army Depot Activity, Romulus, NY 14541-0009

References: (a) SJMAC-ESL Memorandum, Subject as Above, 11 Feb 2003, with Enclosure

(b) DoD 6055.9-STD, Ammunition and Explosives Safety Standards, Jul 1999, As Amended

(c) Electronic Mail Message from Mr. Cliff Doyle, SJMAC-ESL, to Ms. Lydia Sanchez, DDESB-KO, Subject: Seneca ESS for OD Ground, 8 Apr 2003

The DDESB Secretariat reviewed the subject ESS, submitted via reference (a), against the explosives safety criteria at reference (b), as amended. Based on this review and additional information provided via reference (c), we approve the ordnance and explosives (OE) removal action within the peripheral acreage (kick-out zone) of the open detonation (OD) grounds (SEAD-45/115) at Seneca Army Depot Activity. This approval is as follows:

- The response will address the kick-out zone for the OD grounds, which includes about 330 acres located within the area bounded by the 1,200 ft and the 2,500 ft radii from "OD Hill," as depicted on the map at Appendix A of the ESS.

- The intended use of the property addressed in this ESS is surface recreation/ conservation with potential to establish camping facilities in the future.

- The most probable munition (MPM) is the 81mm M374 HE projectile, with a calculated minimum separation distance (MSD) of 1,233 ft for both, intentional and unintentional detonations. The MSD may be reduced to 200 ft when using DDESB-approved fragment mitigation methods, such as the sandbag barricades.

- Based on the intended use and the MPM, all anomalies will be investigated intrusively and removed to a depth of four feet, which exceeds the expected depth of the MPM. Anomalies identified as OE or potential OE will be cleared-to-depth.

- The DDESB-approved miniature open front barricade (MOFB) will be used whenever intrusive investigations need to be performed at a distance of less than the 1,233 ft MSD to the Army property line, inhabited buildings or public traffic routes. When the distance is less than 200 ft, traffic will be stopped and inhabited buildings will be evacuated until the intrusive operation is completed.

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- Earth moving and clearing equipment will be shielded with Lexan (minimum 4.26 in thick) or Plexi-Glass (minimum 2.77 in thick) to protect equipment operators.

- Each of the two earth-covered magazines (ECMs) servicing the open burning/open detonation (OB/OD) grounds is approved to store a maximum net explosive weight (NEW) of 100 lbs hazard division (HD) 1.1 materials. One ECM will be used to store demolition explosives and the other will be used to store acceptable-to-move recovered OE items pending disposal.

  -- Per paragraph C2.5.2.3.1.1.3 of reference (b), the applicable minimum inhabited building separation distance (IBD) for each magazine, based on 100 lbs HD 1.1 explosives, is 658 ft to the front of the magazine and 250 ft to the sides and rear.

  -- ECM A0705, which is site-approved for up to 250,000 lbs HD 1.1 explosives, will be used to stored any recovered OE that exceeds the 100 lbs limit for the OE service magazine. The applicable IBD for this ECM is 3,150 ft.

- Acceptable-to-move OE items will be disposed of at the end of the workweek by intentional detonation at OD Hill. The applicable IBD (exclusion zone) for OD Hill is 1,233 ft.

- All OE scrap and range residue will be certified as explosive-free prior to removal from the work site.

Your request for approval of a modified MOFB design to use Plexi-Glass construction cannot be approved at this time due to insufficient information to support protection equivalent to that of the approved aluminum MOFB. We recommend you submit a revised MOFB design data package for our review and approval, including the appropriate information for construction materials considered as alternatives to aluminum. The data package should include sufficient analysis and, when available, tests data to support the alternate construction material and design.

If necessary to make changes to this approved ESS that could increase the level of risk associated with OE at the site, an amendment or updated ESS must be submitted to this office for further review and approval.

The point of contact for this action is Ms. Lydia E. Sanchez, (703) 325-1373, DSN 221-1373, E-mail address Lydia.Sanchez@hqda.army.mil.

William E Wright

WILLIAM E. WRIGHT
Captain, USN
Chairman

cc:
DACS-SF
DASA(ESOH) (ATTN: Mr. King)

DEPARTMENT OF THE ARMY
US ARMY DEFENSE AMMUNITION CENTER
1 C TREE ROAD
MCALESTER OK 74501-9053

REPLY TO
ATTENTION OF

SJMAC-ESL

11 FEB 2003

MEMORANDUM FOR Department of Defense Explosive Safety Board (DDESB-KO), 2461 Eisenhower Avenue, Alexandria, VA 22331-0600

SUBJECT: Explosive Safety Submission (ESS) for Ordnance and Explosives Removal at the Open Detonation Grounds SEAD-45/115, Seneca Army Depot Activity, Romulus, NY 14541-0009

1. References:

a. Memorandum, Department Of The Army, Seneca Army Depot Activity, DAIM-BO-N-SE, 17 January 2003, Subject: Explosive Safety Submission (ESS) for Ordnance and Explosives Removal at the Open Detonation Grounds SEAD-45/115, Seneca Army Depot Activity, Romulus, NY

b. DOD 6055.9-STD, July 1999, Ammunition and Explosives Safety Standards.

c. AR 385-64, 28 November 1997, w/change 1, 1 February 2000, U.S. Army Explosives Safety Program.

2. We have reviewed the subject Explosive Safety Submission (ESS) in accordance with the criteria of DOD 6055.9-STD as implemented by AR 385-64, and have granted Army approval under the conditions imposed by paragraph 10 of this memorandum. It is provided for Department of Defense Explosive Safety Board (DDESB) review with our recommendation for approval.

3. The subject submission, reference 1a, requests review and approval of the explosives safety aspects of the Ordnance and Explosive (OE) Removal Action (RA) for the peripheral acreage ("kick out" zone) of the Open Detonation (OD) Grounds (SEAD-45). This area covers approximately 330 acres located between 1200 ft and 2500 ft radius of the "OD Hill" (see appendix A). A separate ESS will be submitted for the inner 1200 ft radius.

4. OE remediation will be conducted in two phases. Phase I consists of brush removal and geophysical mapping. During this phase no intrusive work will be conducted. All anomalies will be mapped during Phase I. Only OE found on the surface will be disposed of. Phase II consists of investigating all anomalies intrusively and removal of all surface and subsurface OE to a clearance depth designated at four feet. Any OE detected below the clearance depth of four feet will also be removed.

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SJMAC-ESL
SUBJECT: Explosive Safety Submission (ESS) for Ordnance and Explosives Removal at the Open Detonation Grounds SEAD-45/115, Seneca Army Depot Activity, Romulus, NY 14541-0009

5. The Seneca County Industrial Development Agency (IDA) has designated the current OD grounds to be used for Conservation/Recreation. There are currently no plans to establish camping facilities. However the IDA does not wish to restrict such a possibility in the future. Therefore a clearance depth of four feet has been established based upon possible future use.

6. The Most Probable Munition (MPM), paragraph 3.0 of the ESS, is based on items encountered during the Engineering Evaluation/Cost Analysis (EE/CA) investigation. Appendix C is a listing of all anomalies found during the EE/CA; however, the contractor did not distinguish between OE, Ordnance Related Scrap (ORS) and other range residue. Thus this listing gives the erroneous impression that live munitions larger then the MPM were found. The largest live round found was the 81mm M374 HE and therefore was chosen as the MPM. If other munitions are found, requiring a greater minimum separation distance, an amendment to the ESS will be submitted for approval.

7. The maximum fragmentation distance for intentional and unintentional detonation is set at 1233 feet based on the MPM. Calculation is based on HNC-ED-CS-S-98-1, Methods for Predicting Fragmentation Characteristics of Cased Explosives, dated January 1998 and approved by the DDESB on 6 April 1998.

8. A Professional Engineer Design, in Appendix B, is for use of Plexi Glass as a substitute for aluminum for use of the Miniature Open Front Barricade (MOFB). The MOFB was approved by DDESB memorandum, dated 25 February 1999, Subject: Miniature Open Front Barricade (MOFB) Submission. The required thickness of the proposed MOFB will be 2.77 inches for Plexi-Glass based on the MPM. The thickness calculation is based on calculations performed by Dr. Michele Crull, Huntsville Corps Of Engineer, using HNC-ED-CS-S-98-1, Methods for Predicting Fragmentation Characteristics of Cased Explosives, dated January 1998 and approved by the DDESB on 6 April 1998 and using equations for penetration in TM 5-1300, Structures To Resist the Effects Of Accidental Explosions, dated November 1990.

9. The following additional information is provided:

a. Intrusive work has not started. The anticipated start date is April 2003 instead of November 2002 as stated in paragraph 4.0 of reference 1.

b. A daily check will be conducted with the Magnetic Locator, over a test bed seeded with comparable items to the MPM at the maximum depth, to ensure operability. Instruments that are unable to locate the test items will not be used. A record of the test results will be maintained on site.

c. Clearance operations will be from 1200 ft to 2500 ft. This is based on the EE/CA recommendation. During the EE/CA no ordnance was found further than 2215 ft.

d. All Ordnance and Explosive (OE) scrap and Range Residue (RR) will be certified explosive free and consolidated in a lockable dumpster, located near the service magazines, prior to removal from within the work site.

e. If at any time the service magazines exceeds 100 lb NEW the overflow will be stored in Magazine A0705, sited as a non standard ECM for 250,000 lbs NEW. Magazine A0705 is located in the first igloo block east of the OB grounds, formally "A" Block. The magazine is on the 6th row from the north and is the 5th magazine from the west.

f. All magazines located in the former "A" Block, except Magazine A0705, are no longer in use. Empty magazines have been cleaned and secured to prevent use. There are no external PES exposing workers on this project site.

g. Buildings, located on the map, approximately 2,000 ft to 3,500 ft south, southwest of the service magazines and OB grounds are vacant and no longer used.

h. NYS Route 96A is a public traffic route with approximately 50 cars per hour.

i. The area, located on the map, west of NYS Route 96A, are private farms and farmhouses with associated farm buildings. These buildings are considered inhabited buildings.

j The entrance marked as "Troop Entrance" is no longer in use.

k. The area, located on the map, east of NYS Route 96A and near the road marked "Troop Entrance", are private farms and farmhouses with associated farm buildings. These buildings are considered inhabited buildings.

l. The Sewage Treatment Plant is active and is considered an inhabited building. The buildings, approximately 500 feet east of the plant are unoccupied.

m. The complete area northeast of the OE Removal Area marked private property "Kids Peace" is a residential center for troubled teenagers The horse shoe building is the dormitory. The complete area is considered as inhabited building.

SUBJECT: Explosive Safety Submission (ESS) for Ordnance and Explosives Removal at the Open Detonation Grounds SEAD-45/115, Seneca Army Depot Activity, Romulus, NY 14541-0009

10. The following additional requirements will be complied with:

a. During Phase I and II, a ten percent (10%) Quality Assurance (QA) check will be conducted on the entire geophysical mapping and OE removal effort. A grid will fail if one UXO/OE or UXO/OE look alike is found. Failure of a grid will require re-mapping and additional intrusive investigation.

b. During intrusive operations the MOFB will be used, at all times, if the operation is 1233 feet or less (the maximum fragmentation distance for intentional and unintentional detonation) from the nearest occupied building or public traffic route. . In addition, for items that are less then 200 feet from Public Traffic Route or inhabited buildings, the traffic will be stopped and inhabited buildings will be evacuated until intrusive operation has been completed.

c. All personnel entering the work area must receive a safety briefing. All non-essential personnel will be escorted at all times. When non-essential personnel are present work will stop until the personnel have left the work area exclusion zone.

d. All UXO/OE, that is safe to move as determined by the Senior UXO Specialist (SUXOS), will be consolidated in the on site service magazine for weekly disposal using the "OD Hill". The "OD Hill" is the original demolition pit area of the OD ground and is not drawn to scale on the accompanying map (Appendix A). UXO/OE that is unsafe to move will be blown in place (BIP) using approved DDESB barricades/sandbags, etc to reduce fragmentation. In addition, if BIP is required, for items that are less than 200 feet from Public Traffic Route or inhabited buildings the traffic will be stopped and inhabited buildings will be evacuated until BIP has been completed.

e. The two service magazines are "double igloo type" earth-covered magazines located approximately 750 feet east of "OD Hill" near Reeder Creek. Explosive storage will be limited to 100 lbs of Net Explosive Weight (NEW) of 1.1 per magazine. One magazine will contain explosives, provided by the contractor, which will be used for intentional detonation. The second magazine will be used to store UXO awaiting the weekly demolition operation. The two magazines are treated as one for QD purposes. Based on table C9.T1 of DOD 6055.9 STD dated July 1999, the Inhabited building distance is set to 500 feet from the front of the magazine and 250 feet from the side and rear. To allow the service magazine to be sited as an ECM, the earth cover will be maintained at 2 feet as required by paragraph 8-30d(2) of DA Pam 385-64.

f. The sandbag barricade separating the contractor's detonating cord, perforators and time fuze from the initiators will meet the requirements of table 4-3, note 9 of DA Pam 385-64.

SJMAC-ESL
SUBJECT: Explosive Safety Submission (ESS) for Ordnance and Explosives Removal at the Open Detonation Grounds SEAD-45/115, Seneca Army Depot Activity, Romulus, NY 14541-0009

11. The POC is Mr. Alfred Voelkelt, SOSAC-ESL, DSN 956-8122, email address Alfred.Voelkelt@dac.army.mil.

FOR THE DIRECTOR:

JAMES R. GRAY
Chief, Ordnance Explosives
Environmental Division

Encl
As

CF (wo/encl):
Office of the Director of Army Safety (DACS-SF), Chief of Staff, 2211 South Clark Street, Room 980, Arlington, VA 22202
U.S. Army Engineering and Support Center, Huntsville (CEHNC-OE), P.O. Box 1600, Huntsville, AL 35807-4301
Office of the Assistant Secretary of the Army (Installations and Environment), ATTN: DESOH (Asst. for Munitions) 110 Army Pentagon, Washington, DC 20310-0110

DEPARTMENT OF THE ARMY
SENECA ARMY DEPOT ACTIVITY
5786 STATE RTE 96, P.O. BOX 9
ROMULUS, NEW YORK 14541-0009

REPLY TO ATTENTION OF
DAIM-BO-N-SE

7 January 2003

MEMORANDUM FOR Director, Defense Ammunition Center, ATTN: SIOAC-ESL (Ms. Jean Gallagher), Building 35, 1C Tree Road, McAlester, OK 74501-9053

[redacted]

SUBJECT: Explosive Safety Submission for Ordnance and Explosives Removal at the Open Detonation Grounds SEAD-45/115, Seneca Army Depot Activity, Romulus, NY

1. The enclosed safety submission was prepared for Seneca Army Depot Activity and outlines the safety criteria for the protection of site personnel and the public during the explosives operations scheduled at the subject Demolition Grounds.

2. The explosives safety submission is being forwarded for your review. Members of the USACE OE-CX are concurrently reviewing the document for information and comment.

2. Should you have any questions, you may contact me at 607/ 869-1309.

Encl (3 copies)

STEPHEN M. ABSOLOM
Commander's Representative

CF:
Bob Nore, Hunstville Center, COE
Tim Matthews (w/o encl)
Chris Boes. AEC

Explosives Safety Submission

Ordnance and Explosives Removal at the Open Detonation (OD) Grounds, Seneca Army Depot Activity, Romulus, New York

September, 2002

Prepared by

US ARMY CORPS OF ENGINEERS

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INTRODUCTION

This Explosive Safety Submission is for the removal of Ordnance and Explosives (OE) from the peripheral acreage ("kick out" zone) of the Open Detonation (OD) Grounds (SEAD-45), Seneca Army Depot Activity (SEDA), New York. It outlines the safety aspects of the plan for cleanup of Unexploded Ordnance (UXO) and OE on property that is owned by the Department Of Defense (DoD).

SEDA is a US Army facility located in Seneca County, New York. SEDA occupies approximately 10,600 acres (Appendix A). It is bounded on the west by State Route 96A and on the east by State Route 96. The cities of Geneva and Rochester are located to the northwest (14 and 50 miles, respectively); Syracuse is 53 miles to the northeast and Ithaca is 31 miles to the south. The surrounding area is generally used for farming.

SEDA was included on the Federal Facilities National Priorities List on 13 July 1989. Consequently, all work to be performed under this contract will be performed according to Comprehensive Environmental Response Compensation and Liability Act (CERCLA) and the "Federal Facility Agreement under CERCLA Section 120 in the matter of Seneca Army Depot, Romulus, New York,".

SEDA was included on the 1995 Base Realignment and Closure List and has been closed. The Seneca County Industrial Development Agency (IDA) has prepared a reuse report entitled "Seneca Army Depot Reuse Plan and Implementation Strategy". The majority of the installation will be used for housing developments, industrial development, institutional and conservation/recreation uses upon transfer. The current OD Grounds site will fall within the area designated for "Conservation/Recreation". The intended uses, which fall within the definition of "Conservation/Recreation", are wildlife habitation, wildlife viewing, hiking/walking and picnicking. Although there is currently no plan for establishing camping facilities, the IDA does not wish to restrict such a possibility in the future. Therefore, this ESS is based upon the assumption that the clearance depth (4 ft).to be used will be based upon the Public Access scenario (e.g. surface recreation).

1.0 REASON FOR OE.

Open detonation/open burning operations have been conducted for more than 50 years in the munitions destruction area or Demolition Grounds (100 acres) in the northwest portion of the installation. The area was administratively subdivided into the Open Burning and Open Detonation Grounds in the 1970's for environmental permit applications.

The Open Detonation (OD) Area consists of approximately 65 acres of the northern portion of this site immediately adjacent to the Open Burning (OB) Grounds (35 acres). The OB Grounds OE removal was successfully completed in September 2002 under a separate ESS. This site was cleared to a depth of two feet after one foot of earth was removed and separately processed for OE.

An OE Engineering Evaluation/Cost Analysis (EE/CA) for the OD area was completed in 2002. This study confirmed the existence of surface OE in an area out to 1,800' radius from the OD "Hill" possibly due to "kick-outs" or the annual clearance of surface vegetation (fire breaks) conducted with earth moving equipment. The EE/CA recommended OE clearance out to a 2,500 foot radius from the "Hill".

The perimeter OD Grounds OE removal is the subject of this Explosives Safety Submission. This ESS covers the surface and subsurface OE removal for the 330 acres located between 1200ft and 2500 ft radius of the "Hill". The entire OD Grounds Project will be conducted in phases. A separate ESS will be submitted for the inner 1200 ft radius (approx. 65 acres).

2.0 MAPS.

Maps detailing the location and extent of the area of concern and presenting the relevant Public Withdrawal Distances, Q-D Distances, etc., are presented in Appendix A to this submission.

3.0 AMOUNT AND TYPE OF OE.

As part of an installation-wide OE Engineering Evaluation/Cost Analysis (EE/CA), OE presence and density at the OD Grounds site was characterized. Fifty-seven 100' by 100' grids were surveyed using a Magnetometer and EM-61. Additionally, six grids in heavily wooded areas were investigated by the "mag and flag" method using handheld instruments. A total of 24.2% of the OD area (65 acres proper) was characterized. A summation of the effort follows:

- In the majority of EM-61 grids, so much buried metal was present that data was difficult to interpret and individual anomalies were very difficult to discern. In these cases, the contouring range was increased and the 20 highest amplitude anomalies were picked for investigation.
- Of the 1,337 anomalies identified in the EM-61 surveyed grids, 86% was intrusively investigated. Eight were false positives since no discernable metal debris was located. OE was recovered from 1,075 of the anomalies investigated.
- OE recovery depths ranged from surface to a depth of four feet.

In addition to the 65-acre area (OD Grounds proper) investigation, meandering path data was collected in the peripheral acreage using an EM-61. Approximately 3.5 acres of data were taken. A summation of the effort follows:

- Of 970 anomalies selected from the data, roughly 698 (72%) were investigated. Of these 19 (2.7%) were false positives.
- OE-related items were recovered from 667 (95%) of the anomalies investigated. Twenty-one of these were UXO.
- OE recovery depths ranged from surface to a depth of 36 inches.

UXO and OE located at the site are listed in Appendix C, pages C-9 through C-23. In addition, the OE and UXO encountered during the OB Grounds OE Removal Project confirmed this expectation.

Based upon the results of the EE/CA characterization, two Most Probable Munitions (MPM) were chosen for this site. One was chosen for determination of the required Public Withdrawal Distance and barricade thickness. This is the M374, 81mm Mortar. The Net Explosive Weight (NEW) is 2.09 lbs. of Composition B. The Public Withdrawal Distance (PWD) for this MPM is 1233 feet, which was computed using HNC-ED-CS-S-98-1 (approved by DDESB on 6 April 1998) by Ms.Sherene Rizvi, USAESC, Huntsville, Engineering Division, Structures Branch, November 2001.

Miniature Open Front Barricade (MOFB) thickness is 1.43 inches of Aluminum. Sand bag enclosure for intentional detonations is 20 inches thick with 6 inch standoff between munition and sand bags. Sand Bag throw distance=125 ft. Minimum Separation Distances for both the MOFB and Sand Bag enclosure = 200 ft. A professional engineer design of an alternative plexi-glass barricade is included for approval, in Appendix B.

The choice of the 81mm Mortar was made despite the references (Appendix C) to larger and "live", "UXO" items. The Contractor referred to all items with HE filler as "UXO" and "live" regardless of whether the item was fuzed. Consequently, the largest, full-up and fuzed round found during the characterization was the 81mm Mortar. If however, a larger, live or suspected live OE item is encountered, its withdrawal distances will be determined in accordance with the procedures defined in 98-01 and adjustments will be made accordingly. Until the appropriate distances are determined by 98-01, the default distances in DoD 6055.9-STD (Chapter 5, Paragraph E.4.a) will be used.

The second MPM was chosen for the purpose of determining the effectiveness of geophysical investigation equipment with respect to the smallest, HE-filled, items found. This is the 20mm projectile. This class of projectile was the most frequent OE item found during the OB Grounds OE Removal Project.

4.0 START DATE.

Work will be phased depending on funding. It is anticipated that Phase I (Brush clearing and Geophysical mapping of the outer periphery 1,200' to 2,500' radius from the OD Hill) will begin in ***October 2002*** beginning with survey work and progressing to intrusive investigation work. Intrusive work should begin by ***November 2002.***

5.0 FROST LINE DEPTH.

The design frost depth for this site is 40 inches.

6.0 CLEARANCE TECHNIQUES.

This section presents information concerning the techniques to be used during the removal of OE at this site.

General Progression. OE remediation at the SEDA OD Grounds will take place in the following phases:

o **Phase I.** The OD grounds were operated under RCRA Interim Status until its closure. As such, the OD Grounds must be closed in a manner that meets RCRA closure requirements. The first step toward meeting RCRA requirements will be the brush removal and geophysical mapping of the area from 1,200' to 2,500' radius from the center of the OD Hill (approximately 330 acres). No ESS is required for this Phase.

The geophysical mapping Statement of Work (SOW) will be developed. This specification will include the requirements for a Test Plot sufficient to calibrate the instruments and validate the capability of detecting a 20 mm, 75mm, 90mm, 105mm, and 155mm projectile target to their maximum detection depth.

EM-61 and Magnetometers will be towed in multiple instrument arrays in the open and cleared areas and the survey teams will be provided with UXO avoidance support. The contractor will perform periodic QC during the mapping of all grids in accordance with Quality Control for OE Digital Geophysical Mapping, USAESC, Huntsville. QA sampling of the completed grids will be specified in the SOW and completed prior to USACE acceptance and the start of intrusive investigations.

Some areas will require manual surface and subsurface clearance. UXO personnel will locate and record the position of anomalies in the heavy brush/forest acreage using approved handheld detection equipment and Trimble GPS. The SUXOS or UXO QC Manager will perform QC on 10% of the areas mapped in this manner. The USACE OE Safety Specialist will perform QA on an additional and distinct 10 % of these areas, for a total of 20%.

Any OE found on the surface will be disposed of weekly unless it requires Blow in Place (BIP).

Phase II

Upon completion of the geophysical mapping and anomaly identification obtained in Phase I, the contractor will investigate all anomalies intrusively, and remove all surface and subsurface OE to a depth of four (4) feet. Any OE encountered below this depth shall also be removed. OE will be destroyed or certified as inert ORS on a weekly basis unless BIP is required.

Intrusive investigation of anomalies will utilize the MOFD engineering control in areas adjacent (within 200 feet) of private property boundaries. The Plexi-Glass Open Front Barricade will also be used, if approved. The contractor's SUXOS or UXO QC Manager will perform internal QC during all anomaly removal efforts.

Upon completion of the anomaly investigations, the contractor will perform QA on the entire geophysical mapping and OE removal effort. Ten percent (10%) of the area will be mapped again using the EM-

gazine. In the second of the magazines, UXO

61/Magnetometer. Any anomalies detected will be intrusively investigated and removed. A grid will fail if one UXO/OE is found. Failure of a grid will require re-mapping and additional intrusive investigation.

All of the data gathered from the mapping and anomaly investigation will be compiled to draw conclusions on the existence or non-existence of OE contamination at depth. A conclusion will be drawn regarding the existence of OE-contamination remaining at this site. For instance, because all OE is removed to depth outside the inner 65 acres of the actual OD area, release of this portion of the site for restricted use will be sought. This request will be based upon the following:

(1) Outside the 65-acre site proper, mapping, anomaly investigation and removal to depth will have been done and OE will have been removed to depth.

(2) Inside the 65 acre OD area including the OD Hill, OE/UXO will remain until such time that the BRAC Office decides what remedial action will occur. Any chosen alternative (considered **Phase III**) will require an additional, separate ESS.

Discussion of Project-Specific Procedures.

All geophysical surveying and brush clearing activities will be conducted utilizing a UXO Tech II escort who will provide OE avoidance services so that grid stakes/flags/markers can be placed in the ground. Surveying activities will consist of the location of soil excavation points, site grids, control points and verification of payment quantities. For surface clearance, each grid will be walked and visually checked for the presence of ordnance. Instrument assistance may be used as required. For subsurface clearance performed using digital geophysics, each grid will be divided into 2, 2.5 or 3-foot lanes depending upon which spacing provides the best detection capability as demonstrated in the geophysical prove-out. For subsurface clearance performed using analog, handheld instruments, each grid will be divided into 5 foot transects or lanes. For both types of instruments, operators will walk each lane with the chosen geophysical instrument. The chosen instrument(s) will be capable of detecting the Most Probable Munitions to the proposed depths. A test grid will be established in a clean area, in terrain that closely approximates the characteristics of the project site, with inert items representing the likeness of the chosen MPM, at varying depths down to the clearance depth of 4' ft, for daily calibration of detection equipment to verify operability and detection.

All anomalies will be dug to depth to determine the identity thereof. Earth moving equipment will be utilized to excavate soils one foot on each side of the marker flag. UXO techs will remove the remaining soil using hand tools. The MOFB will be utilized whenever there is less than 1233 ft. distance to the Army property line or an inhabited building.

During all OE operations, Lexan or Plexiglass shields will protect earthmoving and clearing equipment operators. Shield thickness has been calculated to be a minimum of 2.77 inches of Plexiglas or 4.26 inches of Lexan (by Ms. Sherene Rizvi, Structures Branch, USAESC, Huntsville, using THOR equations for fragment penetration from TM 5-1300) using the 81mm M374 Mortar on 29 November 2002 and verified by Dr. Michelle Crull, USAEC, Huntsville, on 10 September 2002.

With respect to OE destruction, of specific concern are the location of explosives storage facilities and detonation operations with respect to facilities and people and any effects thereon. The contractor will provide explosives for destruction operations. It is anticipated that demolition materials and shaped charges, as appropriate, will be used. These are considered Class 1.1 and 1.4 explosives.

Explosives will be stored in the SEDA OB/OD area double igloo type, earthen-covered magazine. The existing magazine is constructed to DDESB and Army standards and is complete with the required lightning protection and current ground testing certification.. The contractor will store detonating cord, perforators and time fuse in one half of one of the magazines. In the other half of the first magazine, the contractor will store initiators. A sandbag wall (minimum two feet wide and at least as high as materials stacked on either side) will separate the two halves of this magazine. In the second of the magazines, UXO

(which was located and is awaiting the weekly demolition operation) will be stored. Each of the two magazines is designed for storage of a maximum NEW not to exceed 450 pounds. At no time will the contractor store more than 100 pounds NEW in either magazine. As for security, access into the SEDA ammunition area is itself, extremely restricted. The OD Grounds is remotely located within the ammunition area. Additionally, the contractor will establish and enforce strict area and site access at the OD site proper. Access into a work site exclusion zone will be limited to contractor personnel specifically authorized to work on site, Army Corps of Engineers safety personnel and the Corps of Engineers Contracting Officer and Contracting Officer's Representative. All other personnel will be restricted from entering the exclusion zone or be escorted by contractor or Corps personnel.

Disposal/Venting/Demilitarization operations will be carried out weekly. Items which can be moved will be consolidated in accordance with "Procedures for Demolition of Multiple Rounds (Consolidated Shots) on Ordnance and Explosives (OE) Sites", dated August 1998 and approved by DDESB on 27 October 1998. Disposal will be carried out at the "Hill" on the OD Ground. UXO will be stored in the second magazine while awaiting demo operations. Items that cannot be moved, will be blown-in-place daily, on an individual basis.

7.0 ALTERNATE TECHNIQUES.

An alternative barricade to the MOFD will be designed and submitted for approval. See Appendix B.

8.0 QUANTITY-DISTANCES.

The appropriate Quantity-Distances are shown on the SEDA Installation Explosives Q/D site map enclosed in Appendix A of this submission. For ease of review, the distances are repeated here.

The rationale for the MPM and citation for the calculation method are presented in Section 3.0 of this submission. In general, team separation distances will be determined by the greater of 200 feet or the K50 (0.9-psi overpressure) distance. The separation distance for all unrelated personnel for an accidental detonation from an OE area will be determined by the greatest of 200 feet, the K50 distance or the maximum fragment throw distance. The separation distance for all personnel (related and unrelated) for intentional detonations will be determined by the maximum of 200 feet, the K328 distance or the maximum fragment throw distance. Applying the above principles, the following distances apply:

OE Areas: Minimum of 1,233 feet (this is the maximum fragment range for the 81mm M374 Mortar).

OD Grounds Magazines: Minimum of 500 feet (Front) and 250 feet (Rear and Sides), IAW Table 9-1 of DoD 6055.9-STD. The back and sides of the existing magazines face the removal site. Therefore, 250 feet will govern for the vast majority of the proposed removal. Note that these distances are for 1.1 explosives; therefore, they exceed the distance requirements for the 1.4 demolition materials to be stored in one of the magazines. UXO (Class 1.1) will be stored in the second magazine. Other approved ammunition storage magazines are available on site if required.

Intentional Detonations: Minimum of 1,233 feet (via approved calculation).

During Phase I, appropriate protection will be used for site personnel and the public during situations where an intentional detonation is planned for ordnance found on the surface during Phase I operations. Most OE will be moved to the OD "Hill" for detonation or Thermal Treatment/Certification as ORS.

During Phase II operations, a Miniature Open Front Barricade (MOFB) or approved alternate, constructed in accordance with USAESC Huntsville Engineering Drawings, and approved by Dr. Michelle Crull, USAESC, is planned for use during intrusive activities for protection against unintentional detonations.

9.0 OFF-SITE DISPOSAL.

Not applicable.

10.0 TECHNICAL SUPPORT.

No Chemical Warfare Materials (CWM) are suspected at this site. The contractor will positively identify all OE uncovered before items are removed or destroyed. If a suspect CWM is encountered, the Site Safety Officer will stop all operations on site and notify the on site CENAB OE Safety Specialist. The CENAB OE Safety Specialist will notify the appropriate Explosive Ordnance Disposal (EOD) Detachment (725th Ordnance Company (EOD) Fort Drum) and/or Technical Escort Unit.

11.0 LAND USE RESTRICTIONS.

There will be reuse restrictions required following this action. The site will be transferred (sometime during the closure process) for use as discussed in the INTRODUCTION, above.

12.0 PUBLIC INVOLVEMENT.

This removal is being performed under the CERCLA umbrella since Seneca is a BRAC federal facility on the National Priorities List. Consequently, the required public involvement process is already in place (BCT, RAB, and general public involvement) with the SEDA BEC taking the lead.

13.0 AFTER ACTION REPORT.

Following the OE Removal Project at the Open Detonation Grounds, a copy of the Final Removal Report will be provided, to all whom reviewed this ESS, for information purposes.

13.0 AMENDMENTS AND CORRECTIONS.

An amendment or correction discussing any changes in the procedures to be used or the conditions encountered during this removal will be provided for review and approval as warranted.

14.0 REFERENCES.

General

a. AR 385-64, Ammunition and Explosives Safety Standards, dtd 22 May 1987

b. AR 385-64 (Draft), US Army Explosives Safety Program

c. Department of Defense Explosives Safety Board, Interim Guidance on Land Clearance Planning and Removal Depth for Ammunition and Explosives. 1993.

d. DDESB, Guidance for Clearance Plans, 27 January 1998.

e. Interim Final, "Guidance for Conducting Remedial Investigations/Feasibility Studies Under CERCLA", U.S. EPA, Office of Solid Waste and Emergency Response, October 1988.

f. "U.S. Corps of Engineers Safety and Health Requirements Manual," U.S. Army Engineering Manual No. EM-385-1-1, 3 September 1996.

g. "Safety Concepts and Basic Considerations for Unexploded Ordnance (UXO) Operations", U. S. Army Engineering and Support Center, Huntsville, Revised 16 February 1996.

h. "Interim Guidance Documents": http://www.hnd.usace.army.mil/oew/intguidocs.asp

i. "Regulations, Pamphlets, Manuals": http://www.hnd.usace.army.mil/oew/erepems.asp

Specific

a. "Federal Facility Agreement under CERCLA Section 120 in the matter of Seneca Army Depot, Romulus, New York," Docket No. II-CERCLA-FFA-00202, USEPA, U.S. Department of the Army, and the New York State Department of Environmental Conservation, November 1990.

b. "Work Plan Architectural-Engineering Services For Performing A Remedial Investigation/Feasibility Study (RI/FS) At The Open Burning (OB) Grounds, Seneca Army Depot, Romulus, New York," Chas. T. Main, Inc., 1991

c. 'Preliminary Site Characterization Report at the Open Burning (OB) Grounds," Chas. T. Main, Inc., 1992.

d. Final, "Remedial Investigation Report at the Open Burning (OB) Grounds", Parsons Engineering Science, Inc., September 1994.

e. Final, "Feasibility Study at the Open Burning (OB) Grounds", Parsons Engineering Science, Inc., June 1996.

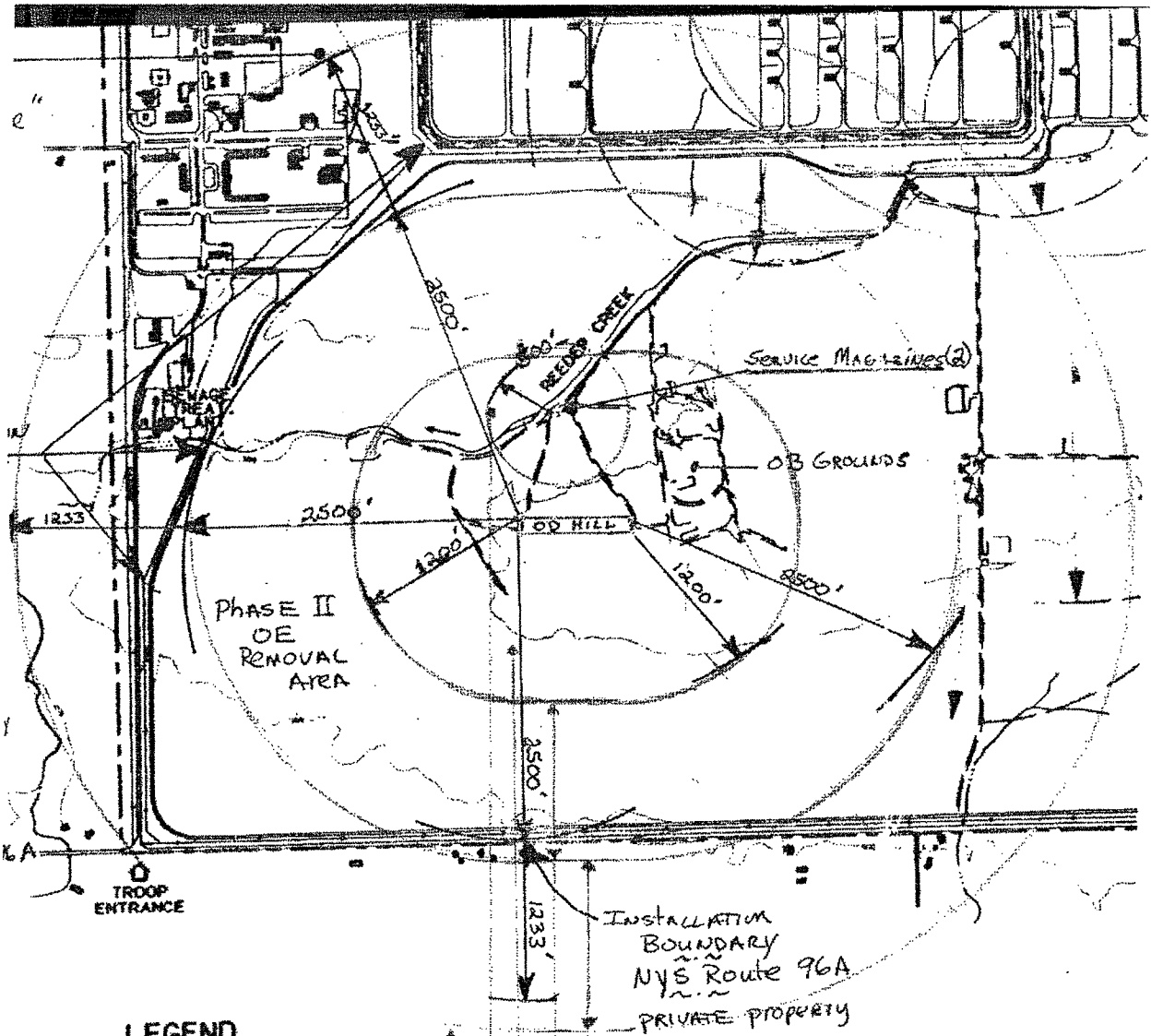
f. Draft-Final, "Superfund Proposed Plan, the Open Burning (OB) Grounds at the Seneca Army Depot Activity (SEDA), Romulus, New York.", Parsons Engineering Science, Inc., January 1997.

g. Preliminary-Draft, "Record of Decision, Former Open Burning (OB) Grounds Site, Seneca Army Depot Activity, Romulus, New York.", Parsons Engineering Science, Inc., March 1997.

h. Draft Final Ordnance and Explosives Engineering Evaluation/Cost Analysis, Seneca Army Depot, September 2001. OD Grounds (SEAD 45)

APPENDIX A

MAPS



LEGEND

EXISTING

- BUILDING, PERMANENT
- BUILDING, SEMI-PERMANENT
- BUILDING, TEMPORARY
- ROADS AND PARKING
- TRAIL OR EARTH ROAD
- RAILROAD
- FENCE

- RESERVATION BOUNDARY
- RIGHT-OF-WAY OR EASEMENT
- DRAINAGE DITCH
- 250 INDEX CONTOUR
- EXPLOSIVE SAFETY QUANTITY-DI
- AIRFIELD/HELIPAD SAFETY ZONE
- SENSITIVE NATURAL AREAS

EXCLUSION ZONE

WORK AREA COVERED BY THIS ESS

A SEPARATE ESS WILL BE SUBMITTED FOR THIS AREA

HD FOR SERVICE MAGAZINES

MEASUREMENT IS FROM THE NORTHWEST CORNER OF THE OD H

Appendix B

Figures 1 through 4

LEGEND:

Wooded/Brushy Area

N
W E
S

0 485 970 1,940 Feet

PARSONS

Seneca Army Depot
OD Ground

Removal & Investigation Activities
Covered by Amendment 1 to ESS

Figure 1

LEGEND:

Wooded/Brushy Area

N
W E
S

0 700 1,400 2,800 Feet

PARSONS

Seneca Army Depot
OD Ground

MSD for removal action in wooded/ brushy areas in the doughnut ring

Figure 2

LEGEND:

Wooded/Brushy Area

N
W E
S

0 550 1,100 2,200 Feet

PARSONS

Seneca Army Depot
OD Ground

MSD for intrusive MEC sampling inside the doughnut ring using mechanical MEC excavation and sifting

Figure 3

LEGEND:

Wooded/Brushy Area

N
W E
S

0 500 1,000 2,000 Feet

PARSONS

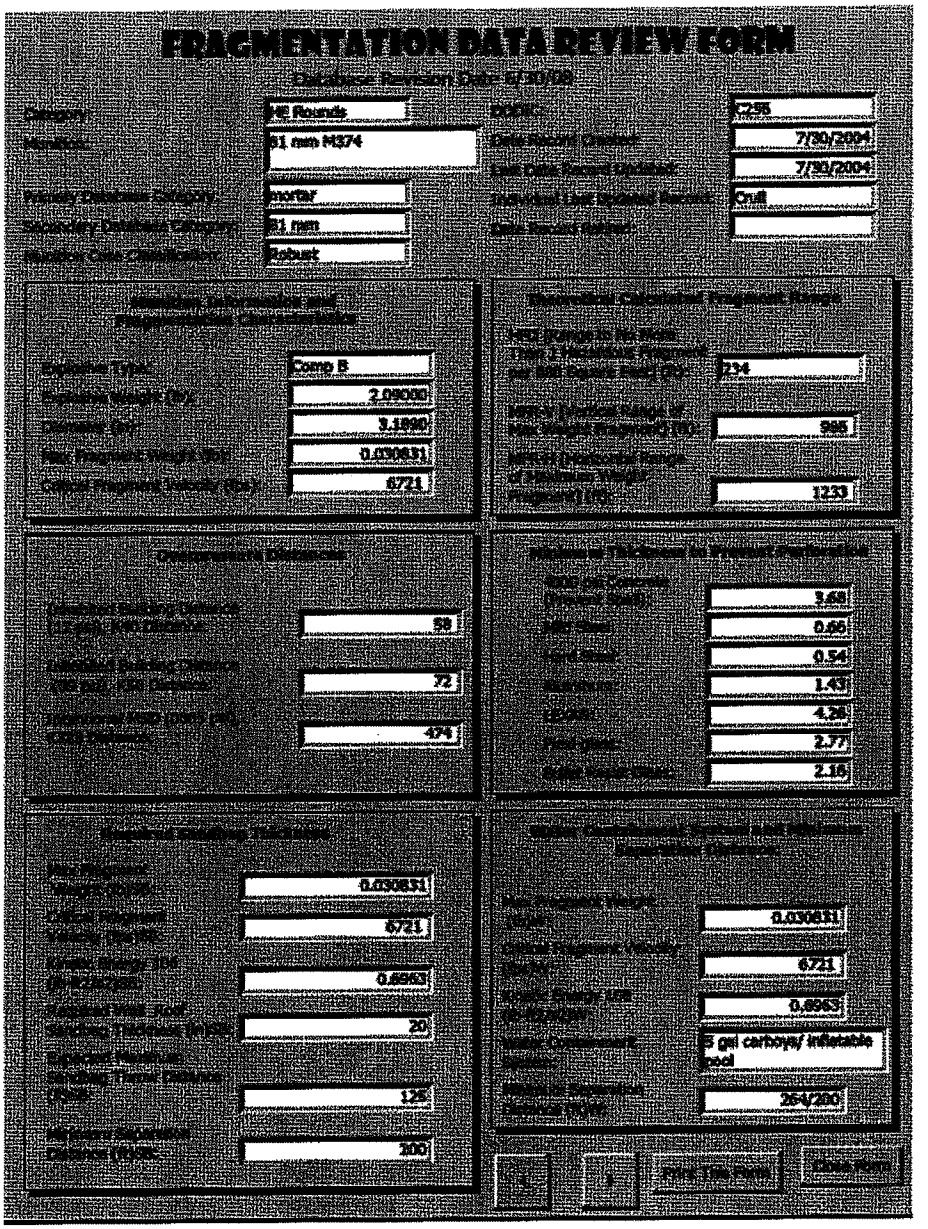
Seneca Army Depot
OD Ground

MSD for intentional detonation of MEC at OD Hill

Figure 4

Appendix C

Fragmentation Data Review Form


FRAGMENTATION DATA REVIEW FORM
Database Revision Date: 9/23/10
Category
HE Rounds
Munition
81 mm M374
Primary Database Category
mortar
Secondary Database Category
81 mm
Munition Case Classification
Robust
Comp B
2.09000
3.1890
0.030631
6721
734
985
1233
99
72
474
3.68
0.66
0.54
1.43
4.28
2.77
2.16
0.030631
6721
0.8963
20
125
100
0.030631
6721
0.8963
5 gal carboys/ inflatable pool
264/280
Print This Page
Close Form

Appendix H

Contractor Personnel Qualifications Certification Letter

(This Appendix is a placeholder for the draft final work plan. An updated appendix will be provided for the final work plan)

Appendix I

TPP Work Sheets

(Not Required)