UNIFORM FEDERAL POLICY
QUALITY ASSURANCE PROJECT PLAN
FINAL

Long-Term Monitoring/Land Use Control Management
Former Seneca Army Depot, Romulus, New York

PREPARED FOR:

U.S. ARMY CORPS OF ENGINEERS,
ENGINEERING AND SUPPORT CENTER,
HUNTSVILLE
5021 Bradford Drive East
Huntsville, Alabama 35805

U.S. ARMY CORPS OF ENGINEERS,
NEW YORK DISTRICT
26 Federal Plaza
New York, New York 10278

CONTRACT NO. W912DY22D0131
TASK ORDER NO. W912DY22F0374

June 2023

Uniform Federal Policy Quality Assurance Project Plan for Long-Term Monitoring/Land Use Control Management

Former Seneca Army Depot, Romulus, New York

Contract No. W912DY22D0131
Task Order No. W912DY22F0374

Prepared for

U.S. Army Corps of Engineers
Engineering and Support Center
Huntsville
5021 Bradford Drive East
Huntsville, Alabama 35805

U.S. Army Corps of Engineers
New York District
26 Federal Plaza
New York, New York 10278

Prepared by

EA Engineering, P.C. and Its Affiliate EA Science and Technology
225 Schilling Circle, Suite 400
Hunt Valley, Maryland 21031

June 2023

This page intentionally left blank

TABLE OF CONTENTS

LIST OF TABLES

LIST OF TABLES (continued)

LIST OF FIGURES

LIST OF APPENDIXES

LIST OF ACRONYMS AND ABBREVIATIONS

°C	Degrees Celsius
µg/L	Microgram(s) per liter
%	Percent
%D	Percent difference
%R	Percent recovery
%RSD	Percent relative standard deviation
AHA	Activity Hazard Analysis
AOC	Area of Concern
APP	Accident Prevention Plan
ASP	Associate Safety Professional
ASTM	American Society for Testing and Materials
AWQS	Ambient Water Quality Standard
B.A.	Bachelor of Arts
BFB	Bromofluorobenzene
bgs	Below ground surface
BRAC	Base Realignment and Closure
B.S.	Bachelor of Science
BS	Blank spike
BSD	Blank spike duplicate
BTEX	Benzene, Toluene, Ethylbenzene, and Xylene
CAS	Chemical Abstract Service
CCB	Continuing calibration blank
CCV	Continuing calibration verification
CEHNC	U.S. Army Corps of Engineers, Engineering and Support Center, Huntsville
CENAN	U.S. Army Corps of Engineers–New York District
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERFA	Community Environmental Response Facilitation Act
CMQ/OE	Certified Manager of Quality/Organizational Excellence
CoC	Chain-of-custody
COC	Contaminant of concern
COR	Contracting Officer’s Representative
CPR	Cardiopulmonary resuscitation
CQA	Certified Quality Auditor
CQM	Contract Quality Management
CSM	Conceptual site model
CSP	Certified Safety Professional
DA	Department of the Army
DL	Detection limit
DO	Dissolved oxygen

LIST OF ACRONYMS AND ABBREVIATIONS (CONTINUED)

DoD	Department of Defense
DQO	Data quality objective
DRMO	Defense Reutilization and Marketing Office
EA	EA Engineering, Science, and Technology, Inc., PBC
EBS	Environmental Base Survey
EDD	Electronic data deliverable
ELAP	Environmental Laboratory Accreditation Program
EM	Engineer Manual
EOD	Explosive Ordnance Disposal
EPA	U.S. Environmental Protection Agency
ERIS	Environmental Restoration Information System
FFA	Federal Facility Agreement
FS	Feasibility Study
ft	Foot (feet)
FUDS	Formerly Used Defense Site
GC/FID	Gas chromatograph/flame ionization detector
GC/MS	Gas chromatograph/mass spectrometer
GIS	Geographic information system
GISP	Geographic Information Systems Professional
GPS	Global Positioning System
H&S	Health and safety
HAZWOPER	Hazardous Waste Operations and Emergency Response
HCl	Hydrochloric acid
HNO_3	Nitric acid
HTRW	Hazardous, toxic, and radioactive waste
IC	Ion chromatography
ICAL	Initial calibration
ICB	Initial calibration blank
ICP	Inductively coupled plasma
ICS	Inference check standards
ICV	Initial calibration verification
ID	Identification
IDW	Investigation-derived waste
IRFNA	Inhibited Red Fuming Nitric Acid
IS	Internal standard
KO	Contracting Officer
L	Liter

LIST OF ACRONYMS AND ABBREVIATIONS (CONTINUED)

LCS	Laboratory control sample
LCSD	Laboratory control sample duplicate
LOD	Limit of detection
LOQ	Limit of quantitation
LTM	Long-Term Monitoring
LUC	Land use control
M	Million
MB	Method blank
MEC	Munitions and Explosives of Concern
MEGA	Multiple Environmental Government Acquisition
mg/L	Milligram(s) per liter
mL	Milliliter(s)
MMRP	Military Munitions Response Program
M.S.	Master of Science
MS	Matrix spike
MSD	Matrix spike duplicate
N	Represents total data set
NA	Not applicable
NAVSEA	Naval Sea Systems Command
ND	Non-detect
NDL	National Priorities List
No.	Number
NO_3	Nitrate
NSL	No Screening Level
NTU	Nephelometric turbidity unit(s)
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
O&M	Operations and maintenance
OSHA	Occupational Safety and Health Administration
ORP	Oxidation-reduction potential
OU	Operable unit
PAH	Polycyclic aromatic hydrocarbon
PAL	Project action limit
PDF	Portable document format
PE	Professional Engineer
PG	Professional Geologist
PhD	Doctor of Philosophy
PID	Planned Industrial Development
PM	Project Manager
PMP	Project Management Professional

LIST OF ACRONYMS AND ABBREVIATIONS (CONTINUED)

POC	Point-of-contact
POD	Pacific Ocean Division
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
QCM	Quality Control Manager
QL	Quantitation limit
QSM	Quality Systems Manual
RCRA	Resource Conservation and Recovery Act
RF	Response factor
RI	Remedial Investigation
ROD	Record of Decision
RPD	Relative percent difference
RRT	Relative retention time
RSD	Relative standard deviation
RT	Retention time
SDG	Sample delivery group
SEAD	Former Seneca Army Depot
SMWU	Solid Waste Management Unit
SOP	Standard Operating Procedure
SSHO	Site Safety and Health Officer
SSHP	Site Safety and Health Plan
STR	Senior Technical Review(er)
SUNY	State University of New York
SVI	Soil vapor intrusion
TBD	To be determined
TO	Task Order
TOC	Total organic carbon
UFP	Uniform Federal Policy
USACE	U.S. Army Corps of Engineers
UXO	Unexploded ordnance
UXOQCS	Unexploded Ordnance Quality Control Specialist
VOC	Volatile organic compound
VP	Vice President
XRF	X-ray fluorescence

This page intentionally left blank

1. INTRODUCTION

1.1 This Uniform Federal Policy (UFP) Quality Assurance Project Plan (QAPP) has been prepared to describe the methodology, data quality objectives (DQOs), quality assurance (QA), and quality control (QC) procedures for the long-term management to be performed at the Former Seneca Army Depot (SEAD) site, Romulus, New York (**Figure 1-1**), herein referenced as the "site." This UFP-QAPP is submitted to meet the requirements of the Performance Work Statement for Contract Number (No.) W912DY22D0131, Task Order (TO) No. W912DY22F0374. The project activities will be conducted under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Activities involving work in areas potentially containing explosive hazards shall be conducted in full compliance with the U.S. Army Corps of Engineers (USACE), Department of the Army (DA), and Department of Defense (DoD) regulations, guidance, standards, and manuals.

1.2 SEAD is a 10,587-acre former military facility located in Seneca County in the towns of Varick and Romulus, New York, and was owned by the United States Government and operated by the DA between 1941 and 2000. SEAD was a munitions storage and disposal facility utilized by the United States Army from 1941 until the 1990s. In 1995 SEAD was listed in the Base Realignment and Closure (BRAC) Commission. In 1999, SEAD's military mission was terminated, and the installation was closed in 2000 under DoD's BRAC process. Since 2000, the Army has assumed a caretaker role at SEAD, pending the close-out of environmental investigations, studies, and remedial activities that are required at the former facility. Environmental concerns at SEAD are being addressed through a Federal Facility Agreement (FFA) between the U.S. Army, U.S. Environmental Protection Agency (EPA) (EPA Site Identification [ID] NY0213820830), and the State of New York (Site ID 850006).

1.3 As part of SEAD close-out activities, more than 9,250 acres of land within the former Depot was transferred to new owners for reuse.

1.4 This TO covers 42 sites at SEAD, including: SEAD-1, 2, 5, 12, 13, 16, 17, 23, 25, 26, 27, 39, 40, 41, 43, 44A, 44B, 46, 52, 56, 59, 62, 64A, 64B, 64C, 64D, 66, 67, 69, 71, 121C, 121I, 122B, 122E, 002-R-01, 003-R-01, 007-R-01, and the Ash Landfill Operable Unit (OU) (SEADs 3, 6, 8, 14, and 15) (**Figure 1-2**). These sites have existing Records of Decision (RODs) and are in long-term monitoring (LTM), have land use controls (LUCs) in place, or both (**Table 1-1**).

1.5 This UFP-QAPP functions as the work plan for continued LTM/LUC activities, including the following:

- LTM of groundwater to maintain ROD compliance at SEAD-16, SEAD-25, and the Ash Landfill (SEADs 3, 6, 8, 14, and 15)
- Annual inspections of LUCs at each of the 42 SEADs.

1.6 This UFP-QAPP documents the project organization, roles, and responsibilities; specific procedures for the execution of technical field activities; data collection activities; laboratory analytical and reporting procedures; QA/QC; and the assessment of oversight planning that will help ensure the quality of the investigation. The purpose of this UFP-QAPP is to provide instruction and guidance associated with the collection, analysis, and reporting of data to ensure that data are scientifically valid, legally defensible, and meet the established QA/QC objectives. This document has been developed to address the data acquisition, management, sampling locations, sample analysis, installation information, and DQOs.

1.7 This UFP-QAPP was prepared in compliance with 40 Code of Federal Regulations Part 300.415 (b)(4)(ii) and meets the requirements set forth in the Intergovernmental Data Quality Task Force UFP for QAPPs (EPA 2005) using the "optimized" version introduced in 2012 (EPA 2012). As such, this UFP-QAPP contains the elements of a QAPP as specified in EPA's Requirements for QAPPs EPA QA/R-5 (EPA 2001, reissued 2006). The UFP-QAPP format includes project-specific data acquisition operations and specifies the requirements to be fulfilled to achieve the data usability requirements to support the decision-making process. The UFP-QAPP format outlines the DQOs and provides a plan for data collection and evaluation. This UFP-QAPP will be used in conjunction with the included Accident Prevention Plan (APP), which lists site-specific hazards and the hazard controls to be used to ensure worker safety.

1.8 This UFP-QAPP is organized with the original 37 worksheets consolidated into optimized UFP-QAPP worksheets (Intergovernmental Data Quality Task Force 2012a). The table of contents of this document presents a listing of all the UFP-QAPP worksheets. References used in preparation of the UFP-QAPP worksheets are presented in Worksheet #13 and in the References section of this UFP-QAPP. Appendixes to this UFP-QAPP, provided as separate tabs, are as follows:

- Appendix A: Laboratory Certifications
- Appendix B: Field Forms
- Appendix C: Laboratory Standard Operating Procedures
- Appendix D: Field Standard Operating Procedures
- Appendix E: Accident Prevention Plan
- Appendix F: Quality Assurance Surveillance Plan
- Appendix G: Land Use Controls Site Locations

Table 1-1. Summary of Areas of Concern and LTM/LUC Requirements

Site No.	Site Name	LTM	LUC
Planned Industrial Development (PID)Warehouse Area			
SEAD-1	Hazardous Waste Container Storage Facility (Building 307)		X
SEAD-2	PCB Transformer Storage Facility (Building 301)		X
SEAD-5	Sewage Sludge Piles		X
SEAD-16	Building S311, (former) Abandoned Deactivation Furnace	X	X
SEAD-17	Building 367, (former) Active Deactivation Furnace		X
SEAD-25	Fire Training and Demonstration Pad	X	X
SEAD-26	Fire Training Pit		X
SEAD-27	Building 360 Steam Cleaning Waste Tank		X
SEAD-39	Building 121 Boiler Plan Blowdown Leach Pit		X
SEAD-40	Building 319 Boiler Plant Blowdown Leach Pit		X
SEAD-59	Fill Area West of Building 135		X
SEAD-64A	Garbage Disposal Area, Debris Landfill south of Storage Pad		X
SEAD-66	Pesticide Storage Area near Buildings 5 and 6		X
SEAD-67	Dump Site east of Sewage Treatment Plant No. 4		X
SEAD-71	Alleged Paint Disposal Area		X
SEAD-121C	Defense Reutilization and Marketing Office (DRMO) Yard		X
SEAD-121I	Rumored Cosmoline Disposal Area		X
Prison Area			
SEAD-43	SEAD-43 Old Missile Propellant Test Lab		X
SEAD-44A	SEAD-44A Quality Assurance Test Laboratory		X
SEAD-44B	SEAD-44B Quality Assurance Test Laboratory		X
SEAD-52	SEAD-52 Buildings 608 and 612 – Ammunition Breakdown Are		X
SEAD-56	SEAD-56 Herbicide and Pesticide Storage		X
SEAD-62	SEAD-62 Nicotine Sulfate Disposal Area near Buildings 606 and 612		X
SEAD-64C	SEAD-64C Garbage Disposal Area		X
SEAD-69	SEAD-69 Building 606 Disposal Area		X
Other SEADs with LUC Requirements			
SEAD-12	Radioactive Waste Burial Sites		X
SEAD-13	Inhibited Red Fuming Nitric Acid (IRFNA) Disposal Site		X
SEAD-23	Open Burning Ground		X
SEAD-64B	Garbage Disposal Area, Disposal Area South of Classification Area		X
SEAD-64D	Garbage Disposal Area West of Building 2203		X
North End Barracks Area			
SEAD-41	Building 718 Boiler Plant Blowdown Leach Pit		X
Airfield Parcel			
SEAD-122B	Small Arms Range, Airfield		X
SEAD-122E	Plane Deicing Areas		X
Ash Landfill Operable Unit			
SEAD 3	Incinerator Cooling Water Pond	X	X
SEAD-6	Abandoned Ash Landfill	X	X
SEAD-8	Non-Combustible Landfill	X	X
SEAD-14	Refuse Burning Pits	X	X
SEAD-15	Building 2207 – Abandoned Solid Waste Incinerator	X	X
Former Munitions Response Sites (MRSs)			
SEAD-46	Small Arms Range (i.e., 3.5-inch Rocket Range)		X
SEAD 003-R-01	Explosive Ordnance Disposal Area (#1) (SEAD-57)		X
SEAD 007-R-01	Grenade Range		X
SEAD 002-R-01	Explosive Ordnance Disposal Areas #2 and #3		X

This page intentionally left blank

Legend

🟩 Former Depot Boundary

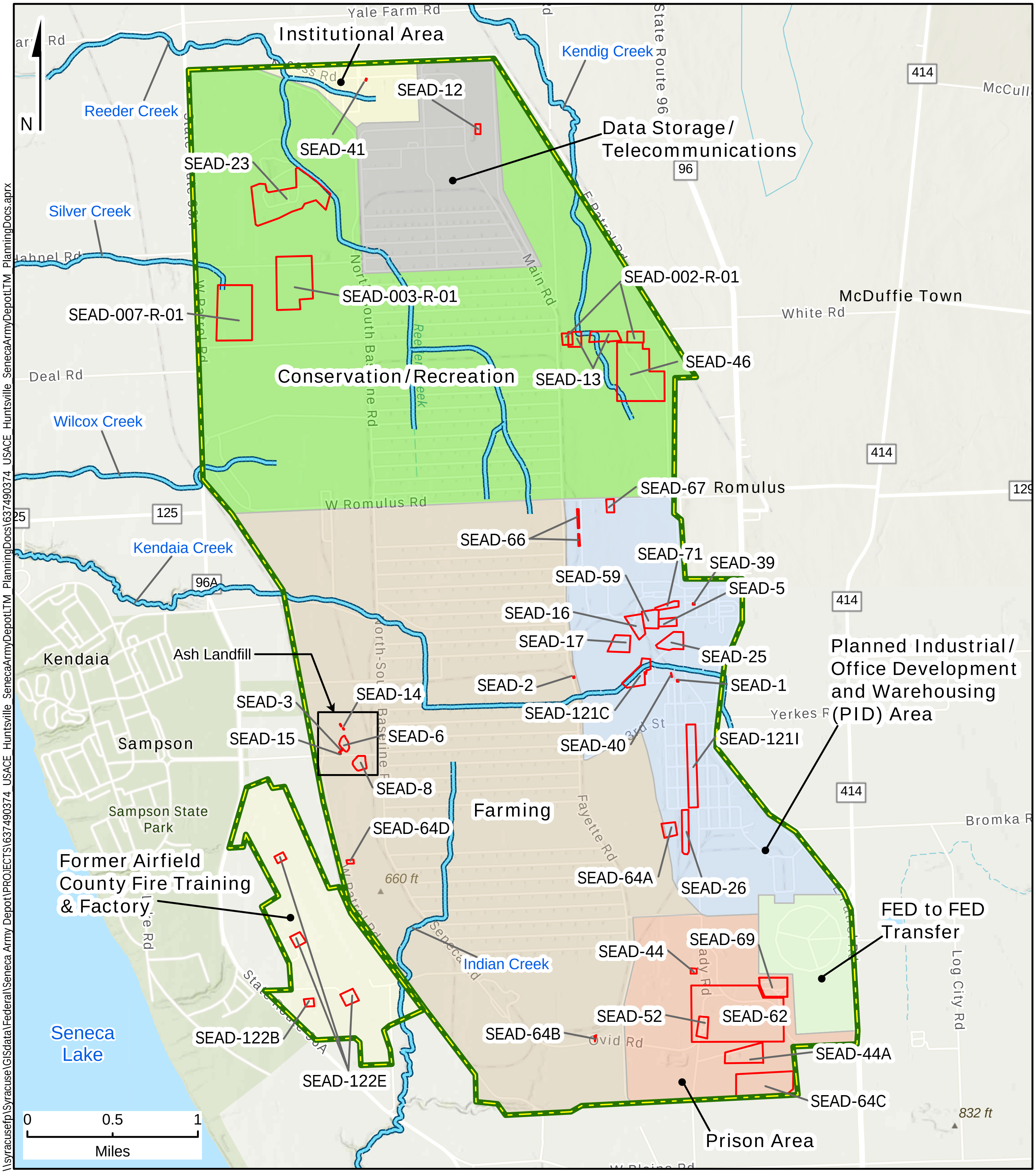
Figure 1-1

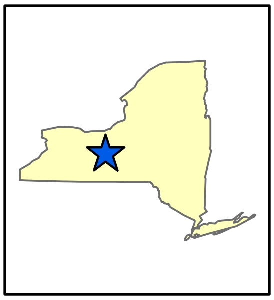
Site Location
Former Seneca Army Depot
Romulus, New York

Map Date:1/4/2023 9:21 AM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

\\eafs\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01 Seneca O&M and LUCs\05 GIS\PROJECTS\637490374 USACE Huntsville SenecaArmyDepotLTM PlanningDocs\637490374 USACE Huntsville SenecaArmyDepotLTM PlanningDocs.aprx





Legend

🟩 Former Depot Boundary

🟥 SEAD Sites

〜 Drainage

Figure 1-2
Site Features
Seneca Army Depot (SEAD)
Romulus, Seneca County, New York

Map Date:3/17/2023 1:46 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

Worksheet #1 and #2 Title and Approval Page

Site Name/Project Name:	Former Seneca Army Depot/Long-Term Monitoring (LTM) and Land Use Control (LUC) Management and LTM/LUC Optimization	
Site Location:	Romulus, New York	
Contract/Work Assignment	Contract No. W912DY22D0131 TO No. W912DY22F0374	
Document Title:	Uniform Federal Policy-Quality Assurance Project Plan Long-Term Monitoring/Land Use Control Management	
Lead Organization Project Manager (PM)	Charles H. Heaton, PE, USACE, Huntsville (CEHNC)	
Signature:	HEATON.CHARLES.HUDDLESTON.JR.1144858758 Digitally signed by HEATON.CHARLES.HUDDLESTON.JR.1144858758 Date: 2023.06.12 16:21:52 -05'00'	**Date:** 12 June 2023
Organization PM	Chris Gallo, USACE, New York District (CENAN)	
Signature:	Digitally signed by GALLO.CHRISTOPHER.T.1604778820 Date: 2023.06.12 17:28:47 -04'00'	**Date:**
Corporate Director of Quality Control	Frank Barranco, PhD, PE, PG, CMQ/OE, EA Engineering, Science, and Technology, Inc., PBC (EA)	
Signature:	F. D Barranco, Jr.	**Date:** 12 June 2023
Site Project Manager	Timothy Reese, PE, EA	
Signature:		**Date:** 12 June 2023
USEPA Region 2	Bob Morse Remedial Project Manager	
Signature:	ROBERT MORSE Digitally signed by ROBERT MORSE Date: 2023.06.13 09:44:48 -04'00'	**Date:**
USEPA Region 2	Lynn Arabia, CHMM Quality Assurance Officer	
Signature:	Lynn E Arabia Digitally signed by Arabia, Lynn Date: 2023.06.13 14:21:09 -04'00'	**Date:**

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Division of Environmental Remediation, Remedial Bureau A
625 Broadway, 12th Floor, Albany, NY 12233-7015
P: (518) 402-9625 I F: (518) 402-9722
www.dec.ny.gov

June 9, 2023

Christopher Gallo
Environmental, InterAgency &
International Services Branch
US Army Corps of Engineers
New York District
26 Federal Plaza, Room 17-401
New York, NY 10278-0090
Christopher.T.Gallo@usace.army.mil

Re: Draft-Final UFP-QAPP for LTM/ LUC Management
Seneca Army Depot, NYSDEC Site No. 850006

Dear Chris Gallo:

The New York State Department of Environmental Conservation (NYSDEC) has reviewed the Draft-Final UFP-QAPP for LTM / LUC Management at the Former Seneca army Depot (SEAD), dated May 2023. Following our review of this document we have no further comments and accept the work plan.

If you have any questions or comments on this matter, please contact me at (518) 402-9614 or melissa.sweet@dec.ny.gov.

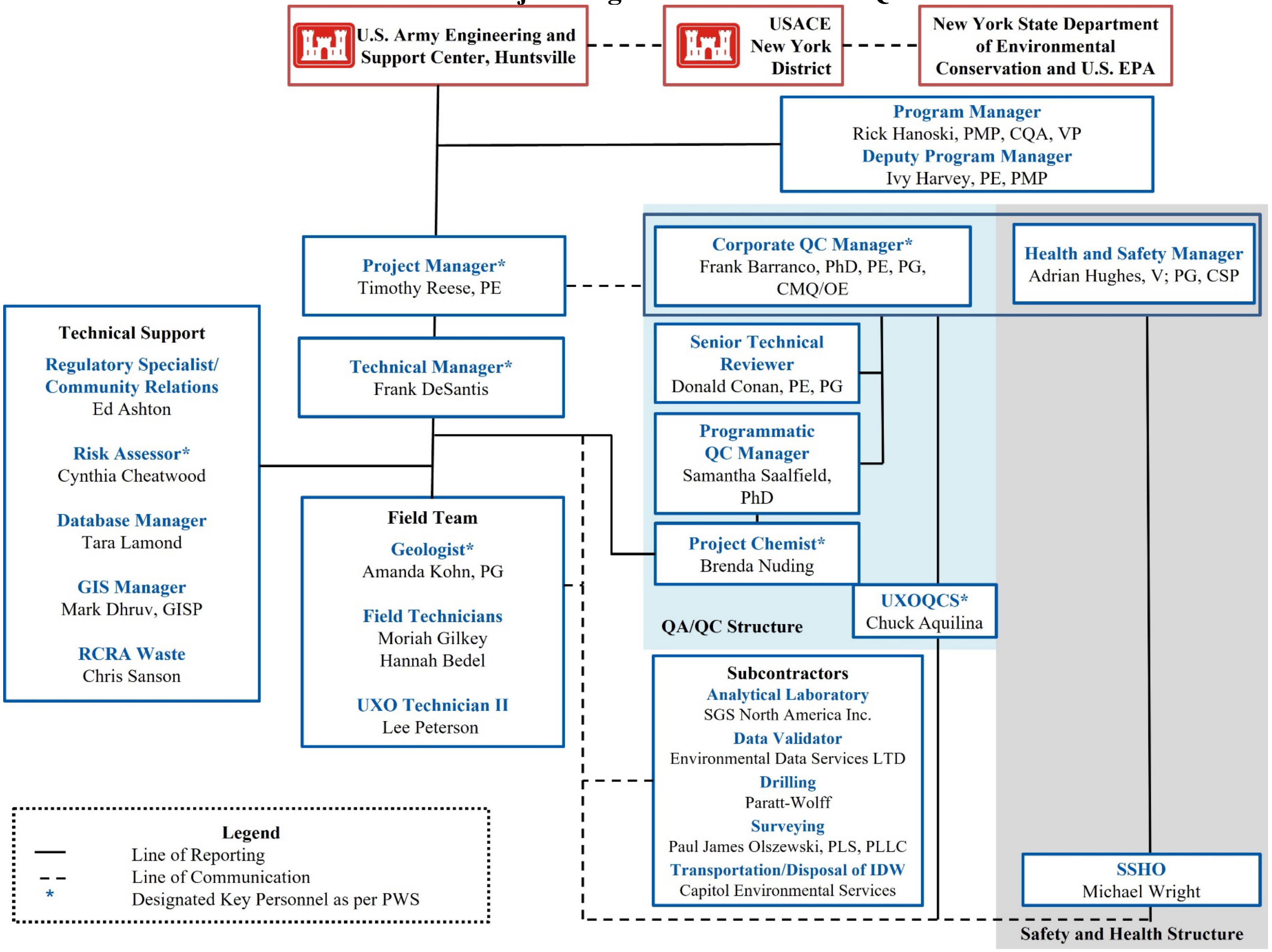
Sincerely,

Melissa L. Sweet

Melissa L. Sweet, PE
Project Manager

ec: J. Swartwout – NYSDEC
M. Sergott, J. Deming – NYSDOH
B. Morse – USEPA
J. Moore, C. Heaton, B. Hodges – USACE

Worksheet #3 and #5 Project Organization and UFP-QAPP Distribution



This page intentionally left blank

UFP-QAPP Worksheet #3 and #5 Distribution Key Personnel Contact List

Name	Position	Contact
USACE		
Todd Henderson	CEHNC, KO	Jeffrey.T.Henderson@usace.army.mil 256-895-3953
Hud Heaton, P.E.	CEHNC, COR/PM	Charles.H.Heaton@usace.army.mil 256-895-1657
Christy Tallant	CEHNC, Contract Specialist	Christy.N.Tallant@usace.army.mil 256-895-3953
Chris Gallo	CENAN, PM	Christopher.T.Gallo@usace.army.mil 917-790-8230
Barry Hodges	CEHNC, Technical Manager	Barry.A.Hodges@usace.army.mil 256-895-1894
Alexandria Chesnut	CEHNC, Chemist	Alexandria.R.Lambert@usace.army.mil 256-895-1392
Tony Isadore	CEHNC, OE Safety Specialist	Anthony.N.Isadore@usace.army.mil 256-895-8098
Chad Wood	CEHNC, Project Geophysicist	Chad.M.Wood@usace.army.mil 256-895-1399
Jim Moore	CENAN, Base Environmental Coordinator	James.T. Moore@usace.army.mil 347-271-0226
Regulators		
Bob Morse	EPA, Remedial PM	Morse.Bob@epa.gov 212-637-4331
Melissa Sweet	NYSDEC, Remedial PM	Melissa.Sweet@dec.ny.gov 518-402-9614
Contractor (EA) Personnel		
Key Project Personnel		
Timothy Reese, PE	PM	treese@eaest.com 410-329-5185
Brenda Nuding	Project Chemist	bnuding@eaest.com 808-256-8268
Frank DeSantis	Technical Manager	fdesantis@eaest.com 315-565-6554
Amanda Kohn, PG	Geologist	akohn@eaest.com 315-431-4610
Cynthia Cheatwood	Risk Assessor	ccheatwood@eaest.com 410-329-5154

UFP-QAPP Worksheet #3 and #5 Distribution Key Personnel Contact List

Name	Position	Contact
Chuck Aquilina	Unexploded Ordnance Quality Control Specialist (UXOQCS)	caquilina@eaest.com 520-909-9248
Frank Barranco, PhD, PE, PG, CMQ/OE	Corporate QA/QC Manager	fbarranco@eaest.com 410-329-5137
Additional Project Personnel		
Rick Hanoski, Project Management Professional (PMP), Vice President (VP)	Program Manager	rhanoski@eaest.com 410-584-7000
Ivy Harvey, PE, PMP	Deputy Program Manager	iharvey@eaest.com 410-527-2438
Samantha Saalfield, PhD	Programmatic Quality Control Manager (QCM)	ssaalfield@eaest.com 410-527-2491
Adrian Hughes, PG, Associate Safety Professional (ASP), Certified Safety Professional (CSP)	Corporate Health and Safety (H&S) Officer	ahughes@eaest.com 410-527-2059
Michael Wright	Site Safety and Health Officer (SSHO)	mwright@eaest.com. 315-565-6572
Ed Ashton	Regulatory Specialist/Community Relations	eashton@eaest.com 315-565-6560
Don Conan, PE, PG	Senior Technical Reviewer	dconan@eaest.com 315-565-6551
Tara Lamond	Database Manager	tlamond@eaest.com 410-329-5172
Mark Dhruv, Geographic Information Systems Professional (GISP)	Geographic Information System (GIS) Manager	mdhruv@eaest.com 410-329-5111
Chris Sanson	RCRA Waste Manifest Official	csanson@eaest.com 315-930-3762
Kevin Gibbons	Laboratory (SGS Orlando) Point-of-Contact (POC)	Kevin.Gibbons@sgs.com 732-406-1471
Svetlana Izosimova	Laboratory (SGS Orlando) QA Manager	Svetlana.Izosimova@sgs.com 407-425-6700 ext. 14928
Diane Waldschmidt	Data Validator (Environmental Data Services, Ltd.)	dwaldschmidt@eds-us.net 561-475-2000

Worksheet #4, #7, and #8 Personnel Qualifications and Sign-Off Sheet

4/7/8.1 The qualifications of USACE personnel are under the purview of the DoD and will not be outlined in this UFP-QAPP. The table in this worksheet summarizes the responsibilities and provides a space for the signatures of key personnel to the site covered in this UFP-QAPP. Signatures on the sign-off sheet indicate personnel have read, and agree to implement this UFP-QAPP, as written. Certification and training records for identified personnel are maintained by the organization's human resources department and are available on request.

This page intentionally left blank

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications	Signature/Date
Rick Hanoski, Certified Quality Auditor, PMP, VP	**Program Manager**	**Undergraduate Course Work** - Bachelor of Science (B.S.), Psychology; University of La Vern; 1986 **Graduate Course Work** - Master of Public Administration.; Troy State University; 1994 Munitions Response Services National Service Line Program Manager with 40+ years of experience; currently responsible for managing and executing munitions and environmental projects under CERCLA, Resource Conservation and Recovery Act (RCRA), Military Munitions Response Program (MMRP), BRAC, and Formerly Used Defense Site (FUDS). Program Manager supporting three TOs valued at $10 Million (M) awarded under the Huntsville Pacific Ocean Division (POD) Contract, including a Remedial Investigation (RI)/Feasibility Study (FS) at the Area 101 FUDS in Yigo, Guam; Lonfit Drum Removal at a FUDS in Asan, Guam; and RI/FS at Kobler Naval Supply Center through Proposed Plan/Decision Document with options to perform the remedial action.	**Registrations/Certifications** • Certified Quality Auditor, American Society for Quality • PMP, Project Management Institute **Specialized Training** • Master Explosive Ordnance Disposal Technician • Occupational Safety and Health Administration (OSHA) 40-Hour Hazardous Waste Operations and Emergency Response (HAZWOPER) Training • OSHA 8-Hour Hazardous Waste Operations Supervisor Training • OSHA 8-Hour HAZWOPER Refresher • USACE Unexploded Ordnance Technician (No. 0139) • EA Project Management Training • USACE/Naval Facilities Engineering Command Quality Control Certification	12 June 2023
Ivy Harvey, PE, PMP	**Deputy Program Manager**	**Undergraduate Course Work** - Bachelor of Arts (B.A.), French; Montana State University; 2003 - B.S., Chemical Engineering; Montana State University; 2003 **Graduate Course Work** - Master of Science (M.S.); Environmental Engineering; Johns Hopkins University; 2009 15+ years of successfully executing environmental and munitions projects under various state and federal regulations including CERCLA and RCRA, as well as under guidance provided by DoD, Army, and USACE. 10 years of experience supporting and managing over 50 environmental services/remediation projects (including firm fixed price and performance-based contracts) valued at >$50M covering investigation, design, and removal actions under hazardous, toxic, and radioactive waste (HTRW) and MMRP. 3 years of experience serving as the Program Manager for the Strategic Environmental Research and Development Program and Environmental Security Technology Certification Program and as the Deputy Program Manager for the USACE–Huntsville Multiple Award TO Contract Indefinite Delivery/Indefinite Quantity POD Contract.	**Registrations/Certifications** PE—Maryland; 2015 (No. 46795) PMP; 2021 (No. 3182662) **Specialized Training** - OSHA 40-Hour HAZWOPER Training - OSHA 8-Hour Hazardous Waste Operations Supervisor Training - OSHA 8-Hour HAZWOPER Refresher - EA PM Training - EA Munitions Response Services Program Manager Training - Radiation Safety Officer Training - Naval Sea Systems Command (NAVSEA) Material Potentially Presenting an Explosive Hazard Training - Cardiopulmonary resuscitation (CPR) and First Aid/Bloodborne Pathogens Training - RCRA Hazardous Waste Regulations Training - CPR and First Aid Training - Bloodborne Pathogens Refresher Training	12 June 2023 Ivy M Harvey

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications	Signature/Date
Timothy Reese, PE	**PM**	**Undergraduate Course Work** - B.S., Civil Engineering; Syracuse University; 1989 31 years of experience performing and managing complex environmental, construction, munitions and explosives of concern (MEC) projects.; licensed Professional Engineer in NJ. 27 years of project management experience at munitions sites, managing over $40M in MMRP and HTRW projects at DoD facilities nationwide for the U.S. Air Force, Army, and Navy including small arms remediation/removal actions. In the past 10 years, managed 25+ TOs valued at $13M+ for munitions work at more than 80 installations nationwide.	**Registrations/Certifications** - PE—New Jersey; 2008 (No. 39951) **Specialized Training** - OSHA 40-Hour HAZWOPER Training - OSHA 8-Hour HAZWOPER Refresher; Annually - OSHA 8-Hour Hazardous Waste Operations Supervisor Training - Construction Quality Management for Contractors, USACE; 2016 - Material Potentially Presenting an Explosives Hazard Training by NAVSEA, 2018 - Geosynthetic Research Institute – Designing with Geosynthetics for Landfill Design, Drexel University - Hazardous Waste/Material Operations Training Course - U.S. Department of Transportation Regulation Training - International Air Transport Association (IATA) Training in the Shipment of Dangerous Goods - Visual Sample Plan Training - Bloodborne Pathogens Awareness Refresher Course; 2022 - CPR and First Aid Training; Biannually; 2022	12 MJune 2023
Frank Barranco, PhD, PG, PE, CMQ/OE	**Corporate QC Manager**	**Undergraduate Course Work** - B.S., Geology; Duke University; 1984 **Graduate Course Work** - M.S.; Geology; University of Texas Arlington; 1988 - PhD, Environmental Science and Engineering; Colorado School of Mines; 1998 Serves as Director of EA's Quality Management Program; implements company-wide QA/QC policies, guidance documents, and standard operating procedures. 11 years as Corporate Quality Officer responsible for QC for $600M+ of federal projects covering investigation/design/remediation/long-term operation/LTM at FUDS, Formerly Utilized Sites Remedial Action Program, MMRP, Defense Environmental Restoration Program, Installation Restoration Program, Superfund, BRAC, etc. under CERCLA, RCRA, and other regulations. Corporate Quality Manager for Huntsville Small Business MEGA and Huntsville POD contracts.	**Registrations/Certifications** - PE—Maryland; 2012 (No. 43120) - PG—Tennessee; 2009 (No. 005603) - PG—New York; 2019 (No. 001202-1) - CMQ/OE (No. 53424) **Specialized Training** - OSHA 40-Hour HAZWOPER Training - OSHA 8-Hour Hazardous Waste Operations Supervisor Training - Contractor Quality Management (CQM) Training - CPR and First Aid Training	12 June 2023 Frank Barranco

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications	Signature/Date
Samantha Saalfield, PhD	**Programmatic QC Manager**	**Undergraduate Course Work** - B.A., Geology & Chemistry; Whitman College; 2004 **Graduate Course Work** - PhD, Earth Sciences; Dartmouth College; 2009 16 years of environmental chemistry experience; $230M+ environmental projects, including work for MMRP, FUDS, Formerly Utilized Sites Remedial Action Program, Installation Restoration Program, and Superfund Sites under CERCLA and RCRA. Developed 25+ UFP-QAPPs, using both full 37-sheet and optimized UFP-QAPP formats. Serves as Programmatic QA Manager for the Huntsville Small Business MEGA and Huntsville Chemical, Environmental, and Munitions (Unrestricted) (ChEM-RU) Contracts. Works extensively with DoD Environmental Laboratory Accreditation Program (ELAP)-certified laboratories, verifying appropriateness of sampling procedures, analytical methods, and laboratory quality systems.	**Specialized Training** - OSHA 40-Hour HAZWOPER Training; 2009 - OSHA 8-Hour HAZWOPER Refresher; 2021 - Confined Space Training; 2014 - INNOV-X Systems Radiation Safety and Operations Training for Field X-ray Fluorescence (XRF) analyzers - EA PM Training, 2013 - CPR and First Aid Training; 2022	12 June 2023 Samantha Saalfield
Donald Conan, PE, PG	**Senior Technical Reviewer (STR)**	**Undergraduate Course Work** - B.S., Civil and Environmental Engineering; Clarkson University; 1987 33 years of experience in environmental and civil engineering and remediation projects, including more than 10 years managing projects from planning and implementing, initial site investigations through remedial system installation, and operation at multiple locations across the United States, including both active and inactive military installations. Experienced at providing technical support to federal and state HTRW projects involving CERCLA/RCRA investigations, regulatory compliance, and remediation system implementation Designed, constructed, operated, and maintained remedial systems involving groundwater treatment for per- and polyfluoroalkyl substances and volatile organic compounds (VOCs), separate-phase product recovery, and soil remediation.	**Registrations/Certifications** - PE—Florida; 1994 (No. 48066) - New York; 1998 (No. 075666-1) - Maine; 2011 (No. 8729) - PG—New York; 2018 (No. 000665-1) **Specialized Training** - OSHA 40-Hour HAZWOPER; 1992 - OSHA 8-Hour HAZWOPER Refresher; Annual - OSHA 8-Hour Hazardous Waste Operations Supervisory; 1999 - OSHA 30-Hour Construction Safety and Health; 2011 - Activated Carbon – Application, Principles and Practices; PACS Laboratory, Pittsburgh, Pennsylvania; 2015 - USACE Construction Quality Management for Contractors; 2017 - University of Wisconsin, Designing Air-Based In Situ Soil and Groundwater Remediation Systems - U.S. Navy Northern Division, Data Quality Objectives/Assessment Workshop - American Public Works Association, Public Works Construction Inspection - Ductile Iron Pipe Research Association, Basic Corrosion Short Course - New York State Department of Environmental Conservation (NYSDEC) Soil Vapor Intrusion Training; 2005	12 June 2023 Donald

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications	Signature/Date
Adrian Hughes, V; PG, CSP	**Safety and Health Manager**	**Undergraduate Course Work** - B.S., Geology; Towson University; 2000 19 total years of experience performing occupational health and safety, project and program management, and Risk Management execution in accordance with Army Regulation 385-10, Engineer Manual (EM) 385-1-1, and EM 385-1-97 on HTRW and MEC sites. Authored/reviewed dozens of the following: APPs, Site Safety and Health Plans (SSHPs), Activity Hazard Analyses (AHAs), APP subplans, mishap investigations, inspections, monitoring data, and Explosives Safety Submittal/Explosives Safety Plan/Chemical Safety Submission/Chemical Safety Plans.	**Registrations/Certifications** - PG—Kentucky; 2014 - ASP; 2016 - CSP; 2020 **Specialized Training** - OSHA 40-Hour HAZWOPER Training; 2005 - OSHA 8-Hour HAZWOPER Refresher; Annual - OSHA 30-Hour Construction Oversight; 2011 - Excavation Safety Training (OSHA 1926.650-652) - Smith System Driver Training; 2009 - Loss Prevention System 8-Hour Training; 2007 - Department of Transportation Hazardous Materials Training; 2007 - Department of Transportation Security Awareness Training; 2007 - International Air Transport Association Dangerous Goods Transportation Training; 2007 - Federal Railroad Administration Training; 2007, 2008, and 2009 - ASTM International Certification for Phase I-II Environmental Site Assessments for Commercial Real Estate; 2009 - INNOV-X XFR; 2010 - Radon Measurement Proficiency Course; 2012 - Asbestos Management Planner/Inspector; 2021	12 May 2023 Adrian Hughes, V
Brenda Nuding	**Project Chemist**	**Undergraduate Course Work** - B.A., Chemistry; University of Oregon; 1987 35 years of experience in analytical chemistry methodologies, chemistry of remedial treatment technology, chemical fate and transport, and experience in sampling and analysis of toxic/hazardous chemicals in environmental matrices. Supported more than $400M in environmental projects under CERCLA, RCRA, and other federal, state, and local regulations. Developed/approved DQOs and more than 25 UFP-QAPPs. Experienced with evaluation of laboratory audit compliance with DoD ELAP accreditation as well as Quality Systems Manual (QSM); provides senior chemistry review for Environmental Data Management System Tier 2 and Tier 3 validation reports. Project Chemist for multiple projects in New York with USACE oversight, including for the MMRP RI/FS through Decision Document/ Proposed Plan at Iona Island Ammunition Depot FUDS, New York.	**Specialized Training** - OSHA 40-Hour HAZWOPER Training; 1998 - OSHA 8-Hour HAZWOPER Refresher; Annual - OSHA 30-Hour Occupational Construction Safety and Health; 2010 - Air Force Civil Engineer Center (AFCEC) ERPTools/X Training; September 2010 - Air Shipment of Hazardous Goods; 2000 and 2003 - Construction Quality Management; USACE; 2004, 2010, 2015, and 2020 - DQOs Training; Managing Uncertainty with Systematic Planning for Environmental Decision Making; 2002 and 2004 - DQOs; U.S. Air Force School of Aerospace Medicine; 1999 - EA PM Training; 2005, and 2013 - INNOV-X Systems Radiation Safety and Operator Training for XRF Spectrum Analyzers; 2005 - Naval Facilities Engineering Systems Command, Remediation Innovative Technology Seminar; 2004, 2005, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, and 2021 - U.S. Department of Transportation Hazardous Materials Regulations; 1995 - CPR and First Aid Training; 2017	12 June 2023 Brenda O. Nuding

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications	Signature/Date
Amanda Kohn, PG	**Geologist**	**Undergraduate Course Work** - B.S., Geology and Concentration in Environmental Science; State University of New York (SUNY) at Cortland; 2004 **Graduate Course Work** - Geological Sciences; SUNY at Binghamton; 2005-2007 17 years of experience in the geological and environmental science fields; licensed Professional Geologist in New York and Pennsylvania. 14 years of experience in site characterization and remediation, qualitative and quantitative site assessments, site characterization, RI, and remediation projects involving metals, dense non-aqueous phase liquids and chlorinated solvents, and free-phase and dissolved-phase petroleum hydrocarbons for state, federal, and DoD facilities.	**Registrations/Certifications** - PG—New York; 2017 (No. 000115) —Pennsylvania; 2013 (No. PG005105) **Specialized Training** - OSHA 40-Hour HAZWOPER Training; 2007 - OSHA 8-Hour HAZWOPER Refresher; Annual - OSHA 8-Hour Hazardous Waste Operations Supervisor Training; 2012 - Department of Defense Joint Chiefs of Staff Anti-Terrorism Level I Training; 2014, 2016, 2017 - Bloodborne Pathogens Training; 2017 - EA PM Training; 2017 - CPR and First Aid Training; Biannual	12 June 2023
Frank DeSantis	**Technical Manager**	**Undergraduate Course Work** - B.S., Environmental and Forest Biology; SUNY College of Environmental Science and Forestry; 2000 **Graduate Course Work** - Environmental and Forest Biology (32 credit hours); SUNY College of Environmental Science and Forestry 19 years of experience performing and managing preliminary site assessments, site characterizations, RI/FS, and remedial design/remedial actions, including the Picatinny Arsenal Remedial Action Objective and LTM for U.S. Army Environmental Command under the Environmental Remediation Multiple Award I Contract. Has overseen preparation of Field Sampling Plans, QAPPs, and SSHPs, and provided coordination of multiple site investigation field efforts, staff and project scheduling, and subcontractor management.	**Specialized Training** - OSHA 40-Hour HAZWOPER Training - OSHA 8-Hour HAZWOPER Refresher - OSHA 8-Hour Hazardous Waste Operations Supervisor Training - 30-Hour Construction Safety and Health - Permit Required Confined Space Training - APP Training; 2015 - CPR and First Aid Training	12 June 2023
Chris Sanson	**RCRA Waste Manifest Official**	**Undergraduate Course Work** B.S., Environmental Science; SUNY Oneonta; 2006 More than 13 years of experience in environmental industry, including construction management and environmental remediation. He has direct experience with project management, site investigations, and site remediations on the federal, state, and local level.	**Specialized Training** - OSHA 40-Hour HAZWOPER Training - OSHA 8-Hour HAZWOPER Refresher - OSHA 10-Hour Construction Safety and Health Training - OSHA 8-Hour Site Supervisor Training - Permit Required Confined Space Training (Entrant, Attendant and Supervisor) - RCRA/Department of Transportation Waste Handling and Packaging training - Indoor Air Quality/Industrial Hygiene Sampling - CPR and First Aid Certified - EA PM Training	12 June 2023

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications	Signature/Date
Michael Wright	**Site Safety and Health Officer**	**Undergraduate Course Work** - B.S., Geology; SUNY Oswego; 2018 5+ years of experience, including 3 years of experience as SSHO providing health and safety oversight and environmental monitoring during investigation and sampling activities and on-site training relating to project safety. Has prepared Site Safety, Health, and Emergency Response Plans on various site characterization and remediation projects. Served as SSHO for USACE-Kansas City and USACE-Omaha projects.	**Specialized Training** - OSHA 40-Hour HAZWOPER Training; 2018 - OSHA 8-Hour HAZWOPER Refresher; 2019 - OSHA 8-Hour HAZWOPER Supervisor Training; 2019 - OSHA 10-Hour Construction Safety Training; 2019 - OSHA 30-Hour Construction Safety Training; 2020 - Confined Space Entry Training; 2019 - Bloodborne Pathogens Training; 2021 - First Aid CPR Automated External Defibrillator Training; 2020 - CQM-C Training; 2021	12 June 2023
Chuck Aquilina	**UXOQCS**	Over 10 years of Explosive Ordnance Disposal (EOD)/Unexploded Ordnance (UXO) experience in all phases of munitions response actions and applicable safety standards including supporting DoD installation operations. He has experience complying with CERCLA/RCRA, and DoD requirements. Performed range maintenance activities, UXO disposal operations, demolitions training, remediation, and removal actions.	**Specialized Training** - OSHA 40-Hour HAZWOPER Training; 2010 - OSHA 8-Hour HAZWOPER Response Refresher; 2018 - OSHA 8-Hour Supervisor Course; 2016 - OSHA 10-Hour Construction Safety - Navy Dive and Salvage Training Center, Panama City, Florida; 1989 - U.S. Naval Explosive Ordnance Disposal School, Eglin Air Force Base, Florida; 1989 - First Aid CPR Automated External Defibrillator Training; 2017 - Bloodborne Pathogens Training; 2017 - Front End Loader Operator; 2018 - Excavator Operator; 2018 - Skid Steer Operator; 2018 - Excavation and Trenching for the Competent Person Course; 2018 - Class 7; Rough Terrain Forklift Operator Course; 2018 - 30-Hour Construction Safety; 2019	12 June 2023
Cynthia Cheatwood	**Risk Assessor**	**Undergraduate Course Work** - B.S., Civil Engineering; University of Maryland; 1993 **Graduate Course Work** - Master of Science in Public Health, Environmental Health; Johns Hopkins Bloomberg School of Public Health; 2016 27 years performing human health risk assessments and environmental site assessments; managed and/or performed over 200 human health risk assessments. Completed risk assessments under CERCLA, RCRA, various state guidance, and MMRP. Successfully negotiated approval from regulators and stakeholders for all aspects of the assessment process. Managed human health risk assessments for the environmental remediation services at West Point and the HTRW and MMRP RI/FS through Decision Document at the Iona Island Naval Ammunition Depot FUDS, New York.	**Specialized Training** - EA PM Training; 2007	12 June 2023 Cynthia Cheatwood

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications	Signature/Date
Tara Lamond	**Database Manager**	**Undergraduate Course Work** - B.S., Environmental Studies; Shepherd University; 2006 15 years of experience in data management/visualization, laboratory coordination, soil classification, geotechnical investigations, GIS, environmental site assessments, and UFP-QAPP and Electronic QAPP creation. Experienced working with various database platforms (EQuIS, Environmental Restoration Information System [ERIS], Environmental Resources Program Information Management System, SCRIBE Environmental Data Management Microsoft Access and Excel, and Environmental Data Management System). Maintained project database of site information for USACE–Baltimore District, HTRW Branch.	**Specialized Training** - OSHA 40-Hour HAZWOPER Training; 2019 - EA PM Training; 2014 - Environmental Restoration Information Systems Training, U.S. Army Environmental Command; 2009 - Environmental Resources Planning Tools Training, Air Force Center for Engineering and the Environment; 2011 - EA STR; 2021 - EA Supervisor Training; 2016	12 June 2023 Tara W Lamond
Mark Dhruv, GISP	**GIS Manager**	**Undergraduate Course Work** - B.S., Marine Biology; Texas A&M University at Galveston; 1994 **Graduate Course Work** - M.S., Environmental Science and Policy; Johns Hopkins University; 2006 15 years of experience as GIS Coordinator/Specialist/System Manager for Environmental Services/Remediation projects for DoD and EPA clients. 11 years of experience as GIS Specialist supporting FUDS RIs. Experience in providing Government and other stakeholders internet access to curated GIS databases.	**Specialized Training** - OSHA 40-Hour HAZWOPER Training; 2006 - OSHA 8-Hour HAZWOPER Refresher - OSHA Hazardous Waste Operations Supervisor Training - OSHA 30-Hour Construction Confined Space Entry Supervisor Training - Certified GISP; 2011 - STR for GIS Deliverables; 2016 - EA PM Training; 2010 - CPR and First Aid Training	12 June 2023
Ed Ashton	**Regulatory Specialist/Community Relations**	**Undergraduate Course Work** B.A., Geology Sciences with Minor in Math; SUNY Oneonta; 1991 More than 31 years of experience in environmental industry, including construction management and environmental remediation. He has direct experience with project management, site investigations, and site remediations on the federal, state, and local level.	**Specialized Training**- OSHA 40-Hour HAZWOPER Training- OSHA 8-Hour HAZWOPER Refresher - OSHA 30-Hour Construction Safety and Health Training - OSHA 8-Hour Site Supervisor Training - CPR and First Aid Certified - Annual Bloodborne Pathogens Trained - Professional Geologist – New State (License # 000260-01) - BCSP Safety Trained Supervisor - NYSDEC Erosion and Sediment Control Training - Excavation and Trenching Competent Person Training	12 June 2023 Edward J Ashton

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications
Kevin Gibbons	Laboratory Contact	On file with SGS Orlando laboratory	On file with laboratory
Svetlana Izosimova	Laboratory QA Manager	On file with SGS Orlando laboratory	On file with laboratory
Diane Waldschmidt	Data Validator	On file with Environmental Data Services, Ltd.	On file with Environmental Data Services, Ltd.

This page intentionally left blank

Worksheet #6 Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Contractual modification and/or program performance	USACE Contracting Officer (KO)	Todd Henderson	256-895-3953	Overall responsibility for overseeing and monitoring the Contractor's performance and assures the Contractor receives impartial, fair, and equitable treatment under the Delivery Order. Ultimately responsible for the final determination of the adequacy of the Contractor's performance and authorized to obligate the Government on this Delivery Order.
Contractual modification and/or program performance	USACE Contracting Officer's Representative (COR)	Hud Heaton, PE	256-895-1657	Contractual modification and/or program performance. Communicates directly with USACE KO and Contractor Program Manager. Reports any performance issues or delays by the contractor to the KO.
Contractual modification and/or program performance	Contractor Program Manager	Richard Hanoski, PMP, CQA	443-632-4887	Communication with USACE at the Programmatic Level regarding overall performance. Acts as an advocate for USACE to ensure that project needs are met. Supports the Contractor PM. Provides corporate commitment to allocate necessary resources.
PM with USACE	USACE PM	Chris Gallo	917-790-8230	Primary USACE POC. Overall management of the project. Reviews and approves project plans and their modifications. Performs project management for USACE. Ensures the project Scope of Work requirements are fulfilled. Oversees the project cost and schedule. Directs the Contractor's Project Delivery Team in accordance with USACE's contracting process. Acts as lead interface with regulatory agencies.
Project Lead with USACE	USACE Project Lead	Hud Heaton, PE	256-895-1657	Overall management of the project and it's contract. Reviews and approves project plans and their modifications. Performs project management for USACE. Ensures the project Scope of Work requirements are fulfilled. Oversees the project cost and schedule. Directs the Contractor's Project Delivery Team in accordance with USACE's contracting process.
Technical Manager with USACE	USACE Technical Manager	Barry Hodges	256-895-1894	Reviews and approves project plans and their modifications. Performs project management for USACE, ensures the project Scope of Work requirements are fulfilled, oversees the project cost and schedule, directs the Contractor's Project Delivery Team in accordance with USACE's contracting process, and acts as lead interface with regulatory agencies.
Chemical actions	USACE Chemist	Alex Chesnut	256-895-1392	A technical member of the USACE Project Delivery Team. Provides chemical reviews of project plans, data, change requests, reports, and modifications to ensure the project scope of work is fulfilled. Ensures the chemical data meets project objectives. Communicates with the contractor's chemist as needed to discuss technical issues, concerns, and approaches. Provides Quality Assurance actions for the project.
Geophysical actions	USACE Geophysicist	Chad Wood	256-895-1399	A technical member of the USACE Project Delivery Team. Provides geophysical reviews of project plans, data, change requests, reports, and modifications to ensure the project scope of work is fulfilled. Ensures the geophysical data meets project objectives. Communicates with the contractor's geophysicist as needed to discuss technical issues, concerns, and approaches. Provides QA actions for the project.
OE Safety actions	USACE Ordnance and Explosive Safety Specialist	Tony Isadore	256-895-8098	A technical member of the USACE Project Delivery Team. Provides explosive/munitions reviews of project plans, data, change requests, reports, and modifications to ensure the project scope of work is fulfilled. Ensures the munitions data meets project objectives. Communicates with the contractor's Senior UXO Supervisor as needed to discuss technical issues, concerns, and approaches. Provides QA actions for the project. Provides safety reviews for actions involving munitions and/or explosives.
Remedial PM with EPA	EPA Remedial PM	Bob Morse	212-637-4331	Primary EPA POC. Reviews project plans and their modifications.
Remedial PM with NYSDEC	NYSDEC Remedial PM	Melissa Sweet	518-402-9614	Primary NYSDEC POC. Reviews project plans and their modifications.
Manage all project phases/overall technical lead	Contractor PM	Tim Reese, PE	410-935-3887	Overall contractor management of the project. Maintains lines-of-communication between USACE and contractor. Communicates with CEHNC Project Lead and Technical Manager, and CENAN PM regarding project direction as well as notification of any project issues. Ensures that project is on time and within budget. Ensures that project team maintains technical, quality, and safety and health standards. Leads communication with stakeholders. Manages subcontractors. Completes final review of all deliverables.
Contractor communication with USACE	Contractor PM	Tim Reese, PE	410-935-3887	POC for all technical, QA, and administrative matters regarding the Contractor's implementation of the project (verbal, written, or electronic).
Modifications to Contractor Program	Contractor PM	Tim Reese, PE	410-935-3887	Coordinate fieldwork, programmatic direction, and issue resolution.
Change to UFP-QAPP	Contractor Project Chemist	Brenda Nuding	808-256-8268	Will notify Contractor PM of approval of minor change (verbal, written, or electronic); complete field change request for efficiency or changed conditions.
Change to UFP-QAPP	Contractor PM	Tim Reese, PE	410-935-3887	For field change requests, the UFP-QAPP does not need to be revised, a field change request should be sent to the USACE Project Lead, USACE Technical Manager, and USACE PM for approval. In the case of a UFP-QAPP addendum, amendment, or revision, the UFP-QAPP must go through the USACE, NYSDEC, and EPA for approval.

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Project completion and performance deficiencies	Corporate QA/QC Manager	Frank Barranco	410-329-5137	Monitor work, procedures, and documentation to ensure compliance with QC procedures and engineering practices. Develops and oversees implementation of a corrective action plan, if necessary. Reviews all aspects of project completion and stop work if deficiencies in the work are noted. Communicates with the Contractor PM.
Mobilization and demobilization	Contractor PM	Tim Reese, PE	410-935-3887	Communication with USACE Project Lead, USACE Technical Manager, and USACE PM regarding timelines and access requirements. USACE Project Lead, USACE Technical Manager, and USACE PM to relay information to other parties.
Coordination of field activities	Technical Manager	Frank DeSantis	315-565-6554	Coordination of site activities with sub-contractors and communication of site issues and progress with the Contractor PM, USACE Project Lead, USACE Technical Manager, and USACE PM.
Coordination of sample bottle/sample receipt and analytical data processing	Contractor Project Chemist and Database Manager	Brenda Nuding Tara Lamond	808-256-8268 410-329-5172	Coordination of sample bottles, confirmation of samples, issues at the laboratory, and data availability will be communicated to the Project Chemist and/or Database Manager.
Modifications to/deviations from UFP-QAPP once in Execution	CQM	Grant Reeder	315-565-6570	Notify the Contractor PM/Technical Manager of field-related problems by phone, email, or fax by close of business the same day.
Modifications to Technical Direction or Modification of Approved Documents	Contractor PM	Tim Reese, PE	410-935-3887	Direct the SSHO in the implementation of the field activities.
Approval of Amendments to UFP-QAPP	Contractor PM	Tim Reese, PE	410-935-3887	Notify Technical Manager, Field Quality Control Manager, SSHO, and Project Chemist of approval of UFP-QAPP amendments by phone, email, or fax by close of business the next business day.
Project QA/QC responsibilities	Corporate QA/QC Manager	Frank Barranco	410-329-5137	Report on the adequacy, status, and effectiveness of the QA program by phone or email during the quarterly project review meetings and as needed
Technical issues during implementation of the project	Technical Manager	Frank DeSantis	315-565-6554	Will notify Contractor PM of any significant technical or QC issues.
Significant corrective actions	Technical Manager	Frank DeSantis	315-565-6554	Coordinate field work, programmatic direction and issue resolution. Notification of issues to Contractor PM.
Significant corrective actions	Contractor PM	Tim Reese, PE	410-935-3887	Coordination and resolution of issues between USACE Project Lead, USACE Technical Manager, and USACE PM.
RCRA Waste Manifests	Capitol Environmental Services or Contractor Official	TBD or Chris Sanson	TBD or 315-930-3762	Review and prepare RCRA compliant hazardous waste manifests for disposal of investigation-derived waste (IDW).
Laboratory oversight	Contractor Project Chemist	Brenda Nuding	808-256-8268	Provides oversight of laboratory sample analysis (event planning, uploading staged electronic data deliverable files by laboratory, and data validation).
Data oversight	Contractor Project Chemist	Brenda Nuding	808-256-8268	Provides technical oversight of data evaluation and summary.
Analytical corrective actions	Contractor Project Chemist	Brenda Nuding	808-256-8268	Report on the adequacy, status, and effectiveness of the QA program to Contractor PM/Technical Manager.
Technical issues during implementation of the project	Contractor PM	Tim Reese, PE	410-935-3887	Will notify the USACE Project Lead, USACE Technical Manager, and USACE PM of any significant technical or QC issues during the field investigation.
Analytical laboratory QA issues	Contractor Project Chemist	Brenda Nuding	808-589-1455	Notify Contractor PM within 1 week of performance problems encountered by the analytical laboratory by phone, email, or fax.
Analytical laboratory QA issues	SGS Orlando Laboratory PM	Kevin Gibbons	732-406-1471	The Laboratory PM will report project nonconformance issues within 1 week to the Project Chemist by phone, email, or fax.
Analytical laboratory QA issues	SGS Orlando Laboratory QA/QC Manager	Svetlana Izosimova	407-425-6700 ext. 14928	Report project nonconformance issues within 1 week to the Laboratory PM in person or by phone, email, or fax.
Sample Receipt Issues	SGS Orlando Laboratory PM	Kevin Gibbons	732-406-1471	Cooler receipt form will be emailed to the Project Chemist within 24 hours of delivery
Release of data	Contractor Project Chemist	Brenda Nuding	808-256-8268	No analytical data will be released until review is complete and the Project Chemist has approved the release.
Data validation	EDS PM	Diane Waldschmidt	561-475-2000	Notify Project Chemist once data have been validated or of any issues identified during validation.
Emergency in the field	SSHO	Mike Wright	315-565-6572	Notify the Contractor PM, who will relay the emergency to the appropriate entities. Provides direction to field staff and subcontractors.
Emergency in the field	Corporate H&S Officer	Adrian Hughes	410-527-2059	Notify the Contractor PM, who will relay emergency to appropriate entities. Provides direction to the SSHO and Contractor PM.

Worksheet #9 Project Scoping Session Summary

9.1 A kickoff meeting was conducted on 6 October 2022 to discuss project deliverables, scope, and to introduce the project team. Meeting minutes were provided to meeting attendees.

On Call	Name of Attendee	Role	Contact Information
Project Team – USACE			
X	Hud Heaton	OEDC PM/COR	Charles.H.Heaton@usace.army.mil 256-895-1657 Desk 256-324-9097 Cell
X	Barry Hodges	Technical Manager	Barry.A.Hodges@usace.army.mil 256-895-1894 Desk 256-503-0153 Cell
X	Tony Isadore	OE Safety Specialist	Anthony.N.Isadore@usace.army.mil 256-895-8098 Desk
X	Christy Tallant	Contract Specialist	Christy.N.Tallant@usace.army.mil 256-895-5238 Desk
EA Team			
X	Brenda Herman	Program Manager	bherman@eaest.com 410-527-2474 Cell 443-823-9965 Cell
X	Tim Reese	PM	treese@eaest.com 410-935-3887 Cell
X	Frank DeSantis	Technical Manager	fdesantis@eaest.com 315-395-7689 Cell

Also in attendance:

Cheryl Smith C Civilian U.S. ARMY CEHNC
Brandon Lee B Civilian U.S. ARMY CEHNC – Contracting Officer
Eric Yan –EA, Project Controls Specialist

9.2 The UFP-QAPP was discussed and will be prepared in accordance with the requirements of the current LTM programs and LUC inspections. This document satisfies the requirements for Task 4 – UFP-QAPP for LTM/LUC outlined in the contract PWS structure. The UFP-QAPP for LTM/LUC activities will be submitted in early winter for USACE review and will include an associated Accident Prevention Plan. It was discussed that this UFP-QAPP will be specific to current LTM/LUC program and that a separate document would be developed for any recommended optimization activities at a later date. It was discussed that sampling would likely begin in Spring 2023.

Worksheet #10 Conceptual Site Model

10.1 This worksheet presents a CSM for SEAD that identifies the relationship between sources, migration pathways, exposure media, routes of exposure, and potential current and future human and ecological receptors. This CSM is a summary of the previous CSMs that have been provided in the previous UFP-QAPP (Parsons 2017), and Final 5-year review (Parsons 2021a). The CSM is a working, iterative model that depicts the current understanding of sources, pathways, and receptors. The CSM is based on site-specific details such as location, historical land use, chemicals of concern, and exposure profile. The site-specific data provide a basis for the technical approach. The CSM is updated throughout the project life cycle, as new data are collected and the knowledge of site conditions and exposure pathways changes; however, these do not require an update to the UFP-QAPP.

SITE DESCRIPTION

Site Location

10.2 SEAD is a 10,587-acre former military facility bordered by New York State Highway 96 on the east and New York State Highway 96A on the west in the towns of Romulus and Varick in Seneca County, New York (**Figure 1-1**). The former depot is located in an uplands area, where the ground elevation ranges from approximately 600 feet (ft) along the western boundary to nearly 760 ft in the central portion of the eastern boundary. The uplands area where SEAD is located form a divide separating two of the New York Finger Lakes: Cayuga Lake on the east and Seneca Lake on the west.

Site History

10.3 **Table 10-1** presents a site chronology for SEAD. The Seneca Army Depot was owned by the U.S. Government and operated by the DA between 1941 and 2000. The Depot began its primary mission of receipt, maintenance, and supply of ammunition in 1943. After the end of World War II, the mission of the Depot shifted from supply to storage, maintenance, and disposal of ammunition. SEAD was selected for closure under the DoD’s BRAC in 1995; in 1999, SEAD’s military mission was terminated, and the installation was closed in 2000 under DoD’s BRAC process.

10.4 Since 2000, the Army has assumed a caretaker role at SEAD, pending close-out of environmental investigations, studies, and remedial activities that are required at the former facility. Environmental concerns at SEAD are being addressed through an FFA between the Army, EPA (EPA Site ID NY0213820830), and the State of New York (Site ID 850006). As part of SEAD close-out activities, approximately 9,250 acres of land within the former Depot was transferred to new owners for reuse.

10.5 To address employment and economic impacts associated with SEAD’s closure, the Seneca County Board of Supervisors established the SEAD Local Redevelopment Authority in October 1995. The primary responsibility assigned to the Local Redevelopment Authority was to prepare a plan for redevelopment of the SEAD property. Following a comprehensive planning process, a

Reuse Plan and Implementation Strategy for SEAD was completed and adopted by the Local Redevelopment Authority on 8 October 1996. The Seneca County Board of Supervisors subsequently approved this Reuse Plan on 22 October 1996. In 2005, after it had acquired portions of the former Depot from the Army, Seneca County Industrial Development Agency changed the planned use of land in many portions of the Depot.

10.6 There are currently eight zones with separate land use designations at SEAD (**Figure 1-2**). These include the following:

- Conservation/Recreation
- Data Storage/Telecommunications
- Farming
- FED to FED Transfer
- Former Airfield County Fire Training & Factory
- Institutional Area
- Planned Industrial/Office Development and Warehousing Area
- Prison Area

PHYSICAL PROFILE

Geology

10.7 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 shale, sandstone, conglomerate, limestone, and dolostone. In the vicinity of SEAD, Devonian age (approximately 385 million year old) rocks of the Hamilton Group are monoclinally folded and dip gently to the south. The Hamilton Group is a sequence of limestone, calcareous shale, siltstone, and sandstone.

10.8 Geology at SEAD is characterized by gray Devonian shale with a thin weathered zone where it contacts the overlying mantle of Pleistocene age (Wisconsin event, 20,000 years ago) glacial till. This stratigraphy is consistent over the entire SEAD facility.

10.9 The bedrock underlying the northwestern half of SEAD is composed of the Ludlowville Formation. The southeastern half of SEAD is underlain by the Moscow Formation. Both formations are Devonian in age and part of the Hamilton Group. Regionally, the bedrock is vertically jointed in three predominant directions: northeast, north-northwest, and east-northeast (Mozola 1951; Merin 1992). Within the Hamilton Group, many of the gray-black, calcareous shales are fissile and exhibit parting (or separation) along bedding planes.

10.10 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. The till matrix varies locally but generally consists of horizons of unsorted silt, clay, sand, and gravel. In the central and eastern portions of SEAD, the till is thin, and bedrock is exposed or within 3 ft of the surface.

10.11 Surface soil overlying glacial till consists of Darien silt-loam soils, 0 to 18 inches thick. In general, the topographic relief associated with these soils ranges from 3 to 8 percent (%).

Hydrogeology

10.12 Regionally, four distinct hydrologic units were identified within Seneca County (Mozola, 1951). From north to south, the oldest of these, located in northern Seneca County, is the Camillus shale of the Salina Group. A series of younger limestone units extends east-west across Geneva and Seneca Falls. South of Geneva, a thick series of shale formations is present. Unconsolidated beds of Pleistocene glacial drift, and recent deposits, overlie the bedrock units. Water yield from the glacial units and shales is generally poor. Overall, the groundwater in the county is very hard, and therefore, the quality is minimally acceptable for use as potable water.

10.13 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 were constructed by the State of New York (Mozola 1951; Crain 1974). Regional geologic cross-sections suggest that a groundwater divide exists approximately halfway between the two Finger Lakes. SEAD 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.

Surface Water

10.14 Surface drainage from SEAD flows to five primary creeks (**Figure 1-2**). In the southern portion of the Depot, the surface drainage flows through man-made drainage ditches and streams into Indian Creek. These creeks then merge and flow into Seneca Lake just south of the SEAD airfield. The central part and the administration area of the SEAD 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 SEAD former Lake Shore Housing Area. The majority of the northwestern and north-central portion of the SEAD drain into Reeder Creek. The northeastern portion of the Depot, which includes a marshy area, 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.

Land and Resource Use

10.15 In October 1995, SEAD was designated for closure under the DoD 1995 BRAC process. As part of the BRAC process, the Army commissioned an Environmental Baseline Survey (EBS) of the Depot. Under the EBS, all of the property identified as subject to transfer or lease at the facility was classified into one of the seven standard environmental conditions of property area types as defined by the Community Environmental Response Facilitation Act (CERFA) guidance and the DoD BRAC Cleanup Plan Guidebook. This was achieved by identifying, characterizing, and documenting the obviousness of the presence or likely presence of a release or a threatened release of a hazardous substance or petroleum product associated with the historical and current use of SEAD.

10.16 Areas that were designated as Category 1, 2, 3, or 4 under the CERFA process were suitable for transfer or lease, subject to consideration of the qualifiers. Areas that were designated as Category 5, 6, or 7 were not suitable for transfer, pending further investigation and remediation, as may be needed. The complete details of the EBS are summarized in the document U.S. Army Base Realignment and Closure 95 Program, Environmental Baseline Survey Report, Seneca Army Depot Activity, New York (Woodward-Clyde Federal Services 1997).

10.17 At the completion of the EBS, 113 BRAC parcels of land were identified and classified within the 10,634 acre Depot. Of the total area, approximately 8,690 acres were found to be suitable for lease or transfer (as designated by Categories 1 through 4), while the remaining areas (approximately 1,945 acres) were designated as Categories 5 through 7 and were not deemed suitable for immediate transfer for reuse. Once SEAD was added to the 1995 BRAC list, the primary objective of the Army was expanded from performing RIs and completing necessary remedial actions to include the release of non-affected portions of the Depot to the surrounding community for their reuse for other, non-military purposes (i.e., industrial, municipal, and residential). The designated future use of land within the SEAD was first defined and approved by the Seneca County Local Redevelopment Authority (LRA) in 1996. The planned use for portions of the SEAD was modified by Seneca County Industrial Development Agency (SCIDA) in 2005.

10.18 Ecological site characterizations conducted at the Depot were based on compilation of existing ecological information and on-site reconnaissance activities. The methods used to characterize the ecological resources included site-walkovers for the evaluation of existing wildlife and vegetative communities; interviews with local, state, and SEAD resource personnel; and review of environmental data obtained from previous Army reports. Ecological communities identified at SEAD included successional old-field areas, successional shrub areas, and successional hardwoods areas. Animals that have been identified at the Depot during various ecological surveys include beaver, eastern coyote, white-tailed deer, red and gray fox, eastern cottontail rabbit, muskrat, raccoon, gray squirrel, striped skunk, and the woodchuck. Bird species that have been identified include the blue jay, black-capped chickadee, American crow, mourning dove, northern flicker, ruffed grouse, ring-billed gull, red-tailed hawk, northern junco, American kestrel, white breasted nuthatch, ring-necked pheasant, American robin, eastern starling, turkey vulture, and pileated woodpecker. Vegetation across the Depot consists of successional old field, successional shrub, and successional hardwoods.

10.19 SEAD has a strong wildlife management program that is reviewed by NYSDEC. The Army formerly managed an annual white-tailed deer (*Odocoileus virginiana*) harvest and has constructed a large wetland called the "Duck Pond" in the northeastern portion of the facility to provide a habitat for migrating waterfowl.

REGULATORY HISTORY AND PREVIOUS REMOVAL ACTIONS

10.21 **Table 10-1** presents a site chronology for SEAD. SEAD was proposed for the National Priorities List (NPL) in July 1989. In August 1990, the listing of SEAD as an NPL site was finalized in Group 14 on the Federal Section. After SEAD was listed on the NPL, the Army, EPA Region II, and NYSDEC identified 57 Solid Waste Management Units (SWMUs) where data or information suggested, or evidence existed to support, that hazardous substances or hazardous wastes had been handled, and where releases to the environment may have occurred. Additionally, the EPA, NYSDEC, and the Army negotiated and finalized an FFA for the site in 1993 (EPA, Army, and NYSDEC 1993).

10.22 The FFA established if SWMUs required action or not. If no action was required at an SWMU it was closed out and documented in a ROD. If the SWMU required action, it became designated as an AOC. The number of SWMUs (identified with the acronym SEAD and a unique number, e.g., SEAD-25) was subsequently expanded to include 72 AOCs once the Army finalized the SWMU Classification Report (Parsons ES 1994a) for the Depot in 1994.

10.23 The SEAD was a generator and a treatment, storage, and disposal facility for hazardous wastes and thus, subject to regulation under the RCRA. Under the RCRA permit system, corrective action is required at all SWMUs, as needed. Remedial goals are the same for CERCLA and RCRA; thus, once the 72 AOCs were listed, the Army recommended that they be identified as either areas requiring No Action or as AOCs under CERCLA and the FFA, where additional investigation, study, or actions were needed. SWMUs listed as AOCs were then scheduled for investigations based upon data and potential risks to the environment. The 72 AOCs included 4 areas (SEAD-12 A and B; SEAD-44 A and B; SEAD-64 A, B, C, and D; and SEAD-65 A, B, and C) that consisted of multiple sites (for a total of 79 sites to be investigated).

10.24 Once SEAD was selected and approved for closure as part of the BRAC 1995 process, the Army commissioned an EBS to assess the condition of all property relative to its status under CERFA guidance and the DoD BRAC Cleanup Plan guidebook. At the conclusion of this effort, approximately 1,945 of the 10,634 acres of land within the Depot, including all of the land previously designated as SWMUs and several additional properties not previously designated as sites of interest, were classified as CERFA Category 5, 6 or 7 sites (i.e., not suitable for transfer, pending further investigation and remediation). Subsequently in 1998, the Army authorized and conducted site inspections and limited site investigations of 32 additional potential sites identified as CERFA Category 5 – 7 properties, and because of these efforts an additional 4 sites (SEADs 121C, 121I, 122B, and 122E) were classified as AOCs requiring further assessment and actions under CERCLA.

10.25 Per the requirements of BRAC properties, where ordnance had been located, the Army also commissioned an Ordnance and Explosives Archives Search and conducted site inspections to: 1) identify all areas where ordnance activities occurred; 2) assess the likelihood that ordnances remained due to historical activities; and 3) make recommendations regarding the areas that required further action or investigation. Based on these assessments and evaluations, two additional SWMUs (SEAD 007-R-01, and SEAD 002-R-01 that consisted of two separate areas, EOD-2 and EOD-3) were added to the list of sites that were to be assessed under CERCLA. Additionally, the DoD Munitions Response program required the Army to rename and regroup sites that involved munitions (e.g., SEAD xxxx-R-01 designation). Any site with a prior SEAD – XX number is called an "alias" in the DOD reporting system.

10.26 Finally, in 1998, once the Army had completed its initial investigations of SEAD-12 (Radiological Waste Burial Sites) and begun a more comprehensive RI, SEAD-12A and SEAD-12B were consolidated into SEAD-12, an area encompassing more than 350 acres at the north end of the Depot and subject to continuing CERCLA investigations. Based on these additions, sites investigated under CERCLA rose from the 72 listed in the FFA to 78, the 4 EBS sites (SEADs 121C, 121I, 122B, and 122E), and the 2 Ordnance and Explosives SWMUs (SEADs 002-R-01, including EOD-2), resulting in 84 sites (**Table 10-2**).

10.27 SEAD currently consists of 22 OUs and 84 SEADs (i.e., individual AOCs specific to SEAD) (Parsons 2021a). RODs have been signed for 83 out of 84 AOCs at SEAD (**Table 10-3**). As of the 2021 5-year review (Parsons 2021a), there is one OU (SEAD-45) that is under assessment and does not have a signed ROD. Historically, the RODs generally combined AOCs by OU and added No Action/No Further Action Sites based on timing; however, the remedial approach was targeted at individual or groups of AOCs and not by the OU designation. For consistency with the historical designations used throughout the site and RI documents, Construction Completion Reports (CCR), and RODs, the issues/recommendations and protectiveness statements are per AOC instead of per OU.

10.28 41 AOCs (38 sites plus SEAD-65A, B, and C) have been closed with as No Action or No Further Action determination (**Table 10-2**). Generally, an action was required at the AOCs to ensure the remedy or land use remains protective of site users. Currently, there are 42 AOCs at SEAD (SEAD 1, 2, 5, 12, 13, 16, 17, 23, 25, 26, 27, 39, 40, 41, 43, 44A, 44B, 46, 52, 56, 59, 62, 64A, 64B, 64C, 64D, 66, 67, 69, 71, 121C, 121I, 122B, 122E, 002-R-01, 003-R-01, 007-R-01, and the Ash Landfill Operable Unit [SEADs 3, 6, 8, 14, and 15]) that are in LTM, LUC, or both (**Figure 1-2, Table 1-1**).

Long-Term Monitoring Sites

10.29 Currently seven SEAD sites (SEAD-16, SEAD-25, and the Ash Landfill [SEADs 3, 6, 8, 14, and 15]) require ongoing LTM. These AOCs are further discussed below. An overview of preliminary CSM for each of the AOCs is provided in **Table 10-4** (SEAD-16), **Table 10-5** (SEAD-25), and **Table 10-6** (Ash Landfill).

10.30 **SEAD-16:** SEAD-16 is located in the east-central portion of the Depot (**Figure 1-2**) within the former ammunition storage area in an area where vehicular and pedestrian access is restricted. SEAD-16 is located an area presently designated for future PID uses.

10.31 SEAD-16, the former Abandoned Deactivation Furnace, was used from approximately 1945 until the mid-1960s when its use ceased, and the site was vacated. The site consisted of 2.6 acres of fenced land with grasslands in the north, east, and west; a storage area for empty boxes and wooden debris located to the west; and an unpaved roadway in the south (**Figure 10-1**). Building S-311, which previously housed the deactivation furnace, was located at the approximate center of this area, and was demolished as part of the remedial action at SEAD-16.

10.32 The selected remedy for SEAD-16 included excavation of soil impacted with metals and polycyclic aromatic hydrocarbons (PAHs) at concentrations greater than the site-specific cleanup standards. Excavation of impacted soil occurred in 2007. Subsequent to the soil removal action, long-term groundwater monitoring was initiated with the most recent sampling event occurring in 2019 (Parsons 2021b). Groundwater use is prohibited by the area-wide LUC and an alternate potable water source is available. The land use and groundwater use restrictions imposed at SEAD-16 are maintained as part of both the approved RODs for SEAD 16/17 and the larger PID area (Parsons 2004a; 2006).

10.33 Remaining contaminants of concern (COCs) in groundwater are limited to metals (antimony, lead, and manganese). There are six monitoring wells on-site sampled at a 5-year frequency for metals. Annual LUC inspections are conducted to ensure that the groundwater is not accessed.

10.34 **SEAD-25:** SEAD-25 is a former Fire Training and Demonstration Pad located in the east-central portion of SEAD (**Figure 1-2**). The site is bounded to the east by Administration Avenue, to the south by Ordnance Drive, to the west by a drainage ditch running from the northeast, to the north by an undeveloped area. A site map of the SEAD-25 area and its location within the SEAD is included as **Figure 10-2**.

10.35 SEAD-25 was in use from the late 1960s to the late 1980s. The former pad was used for fire control training. During the 1980s, the pad was used twice for fire-fighting demonstrations, including one demonstration in 1982 or 1983, and one in 1987.

10.36 Excavation of benzene, toluene, ethylbenzene, and xylene (BTEX)-impacted soil at the former demonstration pad and the adjacent drainage swale was completed in 2005. Groundwater LTM began in January 2006 with the most recent sampling event conducted in 2020. Groundwater use is prohibited by the area-wide LUC and an alternate potable water source is available.

10.37 Remaining COCs in the current LTM program for groundwater include VOCs (primarily BTEX[1]). There are currently 20 monitoring wells associated with the site with two wells in the LTM program[2]: MW25-31 and MW25-2. MW25-31 will be sampled for VOCs annually for 5

---

[1] Groundwater sampling and investigations for emerging contaminants, specifically per- and polyfluoroalkyl substances, are independent of the LTM for VOCs at SEAD-25 and are currently ongoing.

[2] Per 18 January 2022 Army response to comments on the 2021 Technical Memo for SEAD-25 VOC LTM

years and MW25-2 will be sampled at a 5-year frequency for VOCs. Annual LUC inspections are conducted to ensure that the groundwater is not accessed.

10.38 **Ash Landfill:** The Ash Landfill OU is located in the west-central portion of SEAD (**Figure 1-2**) where vehicular and pedestrian access is restricted. The Ash Landfill is composed of five SEAD sites including the Incinerator Cooling Water Pond (SEAD-3), the Ash Landfill (SEAD-6), the Non-combustible fill landfill (NCFL) (SEAD-8), the former Debris Piles (SEAD-14), and the former Abandoned Solid Waste Incinerator Building (SEAD-15) (**Figure 10-3**).

10.39 Prior to the Army's purchase of land for construction of the SEAD, the area of the Ash Landfill OU was used for farming. From 1941 (the date SEAD was constructed) to 1974, uncontaminated trash was burned in a series of burn pits located near a former abandoned incinerator building with the ash from the refuse burning pits subsequently buried in the Ash Landfill (SEAD-6) from the late 1950s or early 1960s. The incinerator building (Building 2207) was built in 1974. Between 1974 and 1979, domestic waste from Depot activities and family housing were transported to the incinerator for disposal. Ash and other residue from the former incinerator were temporarily disposed in an unlined cooling pond immediately north of the incinerator building. The cooling pond consisted of an unlined depression approximately 50 ft in diameter and approximately 6 to 8 ft deep. When the pond filled, the fly ash and residues were removed, transported, and buried in the adjacent ash landfill east of the cooling pond. The refuse was dumped in piles and occasionally spread and compacted. No daily or final cover was applied during operation. Large items that could not be incinerated were disposed of at the NCFL (SEAD-8). The NCFL encompasses approximately three acres located southeast of the former incinerator building, immediately south of a SEAD railroad line. The NCFL was used as a disposal site for non-combustible materials, including construction debris, from 1969 until 1977. A fire destroyed the incinerator on 8 May 1979, and the landfill was subsequently closed. Post-closure, the landfill was apparently covered with native soil of various thicknesses, but was not closed with an engineered cover or cap. Other areas at the site were used as a grease pit and for burning debris.

10.40 Prior to the listing of SEAD on the NPL, two removal actions were performed at the Ash Landfill. The first action was the removal of a former 1000-gallon underground storage tank (UST) that was used to store heating oil and was located on the east side of the abandoned Incinerator Building. The second, a Non-Time Critical Removal Action, was conducted by the Army in 1994/1995 and consisted of the excavation and thermal treatment of soil impacted with VOCs (Parsons 2005a). Remedial actions were completed in 2006 to address VOC impacted groundwater and impacted soils (VOCs, PAHs, and metals) included the installation of three biowall systems to passively treat impacted groundwater migrating from the site, construction of a 12-inch thick vegetative cover over the Ash Landfill (SEAD-6) and NCFL (SEAD-8), excavation and disposal of several debris piles on-site, and regrading of the Incinerator Cooling Water Pond (SEAD-3) to promote positive drainage. Following the RAs, LTM of groundwater began with the most recent sampling events (Round 31 and 32) occurring in 2021.

10.41 The LTM program for groundwater at Ash Landfill consists of performance and compliance monitoring. The performance monitoring is conducted to determine if, and when, any biowall maintenance is required (e.g. recharging the mulch). The overall objectives of the performance monitoring are to:

- Monitor the long-term performance and sustainability of the biowalls;
- Monitor substrate depletion and geochemical conditions under which the effectiveness of the biowalls may decline; and
- Determine if, and when, the biowalls need maintenance (i.e., need to be recharged with additional organic substrate).

10.42 Compliance monitoring is being conducted to monitor the groundwater plume and ensure that downgradient areas are not being impacted. The plume originates near the northwestern edge of the Ash Landfill and is approximately 1,100 ft long by 625 ft wide. The nearest exposure points for groundwater are a pond and one residential well (open borehole 90ft deep drawing from bedrock) approximately 150 ft downgradient from the leading edge of the plume and 160 ft south of the plume, and three farmhouse wells located approximately 1,250 ft from the leading edge of the plume. The overall objectives of the compliance monitoring are to:

- Confirm that there are no exceedances of groundwater standards for COCs at an off-site compliance monitoring well (MW-56R).
- Document the effectiveness of the biowalls to remediate and attenuate the chlorinated ethene plume
- Confirm that groundwater concentrations throughout the plume are decreasing such that NYS Class GA groundwater standards will eventually be met.

10.43 There are currently 13 monitoring wells associated with the site and one down-gradient off-site well which are sampled annually as part of the LTM program.

Land Use Control Sites

10.44 The RODs for 42 AOCs (SEAD 1, 2, 5, 12, 13, 16, 17, 23, 25, 26, 27, 39, 40, 41, 43, 44A, 44B, 46, 52, 56, 59, 62, 64A, 64B, 64C, 64D, 66, 67, 69, 71, 121C, 121I, 122B, 122E, 002-R-01, 003-R-01, 007-R-01, and the Ash Landfill OU [SEADs 3, 6, 8, 14, and 15]) require implementation of LUCs that will continue until the concentrations of hazardous substances in the soil and groundwater are reduced to levels that allow for unlimited use and unrestricted exposure (**Table 10-7**).

Table 10-1. Chronology of Site Events

Site Chronology Events Date	Date
U.S. Army announced decision to build depot and acquires land (approximately 10,600 acres)	6/11/1941
U.S. Army begins construction of the Seneca Ordnance Depot	7/9/1941
SEAD proposed for the NPL	7/14/1989
SEAD was finalized and listed in Group 14 on the Federal Section of the NPL	8/30/1990
The Federal Facility Agreement signed between EPA, NYSDEC, and the Army	1/1/1993
SEAD was approved for closure under BRAC	10/1/1995
Seneca Army Depot LRA created by Seneca County Board of Supervisors	10/1/1995
The Reuse Plan was approved by the LRA and Seneca County Board of Supervisors	10/22/1996
The Environmental Baseline Study was completed (13 November – 12 December 1995) and reported	10/29/1996
ROD signed for Former Open Burning Grounds Site	6/14/1999
Institutional use at the former administration area in the northern end of the former depot property	7/1/2000
Depot transfers Prison Parcel to New York State	9/26/2000
SEAD was officially closed	9/30/2000
Seneca County Industrial Development Agency were transferred 9,500 acres (7,000 acres from conservation area, 900 acres from Planned Industrial Development/Warehouse Area [PID] Area, and 500 acres from airfield parcel)	9/30/2003
ROD signed for 20 No Action SWMUs and 8 No Further Action SWMUs	11/12/2003
26 acres of former depot property was transferred for creation of a county jail	12/31/2003
ROD signed for Sites Requiring Institutional Controls in the Planned Industrial/Office Development or Warehousing Areas (SEADs 27, 64A, and 66)	9/28/2004
ROD signed for the Fire Training and Demonstration Pad (SEAD-25) and the Fire Training Pit and Area (SEAD-26)	9/29/2004
ROD signed for the Ash Landfill OUs Including Sites (SEADs 3, 6, 8, 14, 15)	1/21/2005
ROD signed for No Further Actions for SWMUs SEAD 50/54	9/28/2005
ROD signed for Debris Area Near Booster Station 2131 (SEAD-58) and Miscellaneous Components Burial Site (SEAD-63)	9/28/2006
ROD signed for the Abandoned Deactivation Furnace (SEAD-16) and the Active Deactivation Furnace (SEAD-17)	9/29/2006
ROD signed for the 17 SWMUs Requiring LUCs (SEADs 13, 39, 40, 41, 43/56/69, 44A, 44B, 52, 62, 64B, 64C, 64D, 67, 122B, and 122E)	7/3/2007
SEAD-24, SEAD-50, SEAD-54, and SEAD-58 delisted from NPL	4/28/2008
ROD signed for the DRMO Yard (SEAD-121C) and the Rumored Cosmoline Oil Disposal Area (SEAD-121I)	8/7/2008
ROD signed for the Munitions Washout Facility (SEAD-4) and the Building 2079 Boiler Blowdown Pit (SEAD-38)	9/22/2008
ROD signed for the Fill Area West of Building 135 (SEAD-59) and the Alleged Paint Disposal Area (SEAD-71)	3/31/2009
ROD signed for Five Former SWMUs (SEAD 1, 2, 5, 24, 48)	5/6/2009
ROD signed for the Old Construction Debris Landfill (SEAD-11)	9/25/2009
A total of 9,808 acres transferred as of Fiscal Year 2009 with 878 acres remaining	2/1/2010
First Five-Year Review (Draft)	7/20/2011
ROD signed for Radioactive Waste Burial Sites (SEAD-12) and Mixed Waste Storage Facility (SEAD-72)	3/30/2015
ROD signed for Four Munitions Response Sites (SEAD-46, SEAD 003-R-01 [SEAD-57], SEAD 002-R-01, and SEAD 007-R-01) and SEAD 70	3/30/2017

Table 10-2. Site Status

Site Number	Site Name	OU	Site Status
Planned Industrial/Office Development (PID)/Warehouse Area			
SEAD 1	Hazardous Waste Container Storage Facility (Building 307)	OU13	LUC
SEAD 2	PCB Transformer Storage Facility (Building 301)	OU13	LUC
SEAD 5	Sewage Sludge Storage Piles	OU13	LUC
SEAD 9	Old Scrap Wood Site	OU14	No action
SEAD 10	Present Scrap Wood Site	OU14	No action
SEAD 16	Building S311, Abandoned Deactivation Furnace	OU4	LTM/LUC
SEAD 17	Building 367, Active Deactivation Furnace	OU4	LUC
SEAD 20	Sewage Treatment Plant No. 4	OU14	No action
SEAD 22	Sewage Treatment Plant No. 314	OU14	No action
SEAD 25	Fire Training and Demonstration Pad	OU3	LTM/LUC
SEAD 26	Fire Training Pit	OU3	LUC
SEAD 27	Steam Cleaning Waste Tank (Building 360)	OU12	LUC
SEAD 28	Building 360, Underground Waste Oil Tanks (2)	OU14	No further action
SEAD 30	Building 118, Underground Waste Oil Tank	OU14	No further action
SEAD 31	Building 117, Underground Waste Oil Tank	OU14	No further action
SEAD 33	Building 121, Underground Waste Oil Tank	OU14	No action
SEAD 34	Building 319, Underground Waste Oil Tank	OU14	No further action
SEAD 36	Building 121, Waste Oil Burning Boilers (2 units)	OU14	No action
SEAD 37	Building 319, Waste Oil Burning Boilers (2 units)	OU14	No action
SEAD 39	Building 121 Boiler Plant Blowdown Leach Pit	OU14	LUC
SEAD 40	Building 319 Boiler Plant Blowdown Leach Pit	OU14	LUC
SEAD 42	Building 106, Preventive Medicine Laboratory	OU14	No action
SEAD 47	Building 321 and 806, Radiation Calibration Source Storage	OU14	No action
SEAD 49	Building 356, Columbite Ore Storage	OU14	No action
SEAD 50	Tank Farm	OU15	No further action
SEAD 54	Asbestos Storage	OU15	No further action
SEAD 55	Building 357, Tannin Storage	OU14	No action
SEAD 59	Fill Area West of Building 135	OU6	LUC
SEAD 64A	Garbage Disposal Area, South of Storage Pad	OU12	LUC
SEAD 66	Pesticide Storage Area near Buildings 5 and 6	OU12	LUC
SEAD 67	Dump Site east of Sewage Treatment Plant No. 4	OU14	LUC
SEAD 68	Building S-355, Old Pest Control Shop	OU14	No action
SEAD 71	Alleged Paint Disposal Area	OU6	LUC
SEAD 121C	DRMO Yard	OU16	LUC
SEAD 121I	Rumored Cosmoline Disposal Area	OU16	LUC
Prison Area			
SEAD 43	Building 606 Old Missile Propellant Test Laboratory	OU14	LUC
SEAD 44A	Quality Assurance Test Laboratory, West of Building 616	OU14	LUC
SEAD 44B	Quality Assurance Test laboratory, Brady Road	OU14	LUC
SEAD 52	Building 608 and 612 Ammunition Breakdown Area	OU10 & OU14	LUC
SEAD 56	Building 606 Herbicide and Pesticide Storage	OU14	LUC
SEAD 60	Oil Discharge adjacent to Building 609	OU10 & OU14	No further action
SEAD 62	Nicotine Sulfate Disposal Area near Building 606 and 612	OU14	LUC

Table 10-2. Site Status

Site Number	Site Name	OU	Site Status
SEAD 64C	Garbage Disposal Area	OU14	LUC
SEAD 69	Building 606 Disposal Area	OU14	LUC
Other SEADs with LUC Requirements			
SEAD 12	Radiological Waste Burial Sites	OU5	LUC
SEAD 13	IRFNA Disposal Site	OU9 & OU14	LUC
SEAD 24	Abandoned Powder Burning Pit	OU13	No further action
SEAD 64B	Garbage Disposal Area, South of Classification Area	OU14	LUC
SEAD 64D	Garbage Disposal Area, West of Building 2203	OU14	LUC
North End Barracks Area			
SEAD 7	Shale Pit	OU14	No action
SEAD 18	Building 709, Classified Document Incinerator	OU14	No action
SEAD 19	Building 801, Classified Document Incinerator	OU14	No action
SEAD 21	Sewage Treatment Plant No. 715	OU14	No action
SEAD 32	Building 718, Underground Waste Oil Tanks (2)	OU14	No further action
SEAD 35	Building 718, Waste Oil Burning Boilers (3 units)	OU14	No action
SEAD 41	Building 718 Boiler Plant Blowdown Leach Pit	OU14	LUC
SEAD 61	Building 718, Underground Waste Oil Tank	OU14	No further action
Airfield Parcel			
SEAD 122B	Small Arms Range, Airfield	OU14	LUC
SEAD 122E	Plane Deicing Area	OU14	LUC
Ash Landfill Operable Unit			
SEAD 3	Incinerator Cooling Water Pond	OU1	LTM/LUC
SEAD 6	Abandoned Ash Landfill	OU1	LTM/LUC
SEAD 8	Non-Combustible Fill Area	OU1	LTM/LUC
SEAD 14	Refuse Burning Pits (2 units)	OU1	LTM/LUC
SEAD 15	Abandoned Solid Waste Incinerator (Building 2207)	OU1	LTM/LUC
Former Munitions Response Sites			
SEAD 46	Small Arms Range (aka 3.5-inch Rocket Range)	OU11	LUC
SEAD 003-R-01	Explosive Ordnance Disposal Area (#1) (SEAD 57)	OU11	LUC
SEAD 007-R-01	Grenade Range	OU11	LUC
SEAD 002-R-01	Explosive Ordnance Disposal Areas #2 and #3	OU11	LUC
Ongoing Remedial Action/ Pre-RODs			
SEAD 45	Open Detonation Area	OU17	LUC
Other SEADs with RODS, but no LUC Requirements			
SEAD 23	Open Burning Ground	OU2	LUC
Other No Action/No Further Action Sites			
SEAD 4	Munitions Washout Facility Leach Field	OU7	No further action
SEAD 11	Old Construction Debris Landfill	OU8	No further action
SEAD 29	Building 732, Underground Waste Oil Tank	OU14	No further action
SEAD 38	Building 2079, Boiler Plant Blowdown Leach Pit	OU7	No further action
SEAD 48	Pichblende Ore Storage Igloos	OU13	No further action
SEAD 51	Herbicide Usage, Perimeter of High Security Area	OU14	No action
SEAD 53	Munitions Storage Igloos	OU14	No action
SEAD 58	Debris Area near Booster Station 2131	OU14	No action

Table 10-2. Site Status

Site Number	Site Name	OU	Site Status
SEAD 63	Miscellaneous Components Burial Area	OU14	No further action
SEAD 65A	Acid Storage Area	OU14	No action
SEAD 65B	Acid Storage Area	OU14	No action
SEAD 65C	Acid Storage Area	OU14	No action
SEAD 70	Former Building T-2110, Filled Area	OU11	No action
SEAD 72	Building 803, Mixed Waste Storage Area	OU5	No action

Table 10-3. Operable Unit Crosswalk

OU	Name	SEAD ID	Decision Document Reference
0	Sitewide	N/A	N/A
1	Ash landfill	SEAD 3, 6, 8, 14, 15	ROD (January 2005)[1]
2	Open burning grounds	SEAD 23	ROD (January 1999)[2]
3	Fire training pad	SEAD 25, 26	ROD (September 2004)[3]
4	Deactivation furnaces	SEAD 16, 17	ROD (March 2006)[4]
5	Radioactive waste sites, etc.	SEAD 12, 72	ROD (March 2015)[5]
6	Fill area/paint disposal	SEAD 59, 71	ROD (March 2009)[6]
7	Munitions washout facility	SEAD 4, 38	ROD (August 2009)[7]
8	Old Construction Debris	SEAD 11	ROD (September 2009)[8]
9	IRFNA disposal site	SEAD 13	ROD (July 2004)[9]
10	Ammunition breakdown area, etc.	SEAD 52, 60	ROD (September 2003)[10] ROD (March 2007)[11]
11	Open detonation grounds	SEAD 46, 003-R-01, 002-R-01, 007-R-01, 70	ROD (May 2002)[12] ROD (March 2017)[13]
12	Pesticide storage area	SEAD 27, 64A, 66	ROD (May 2002)[12] ROD (March 2004)[14]
13	Pitchblende storage	SEAD 48; inc. SEADs 1, 2, 5, 24	ROD (April 2009)[15]
14	Multiple SEAD	No Action/No Further Action/IC Sites No Action: SEADs 7, 9, 10, 18, 19, 20, 21, 22, 33, 35, 36, 37, 42, 47, 49, 51, 53, 55, 65, 68 No Further Action: SEADs 28, 29, 30, 31, 32, 34, 58, 60, 61, 63 IC Sites: SEADs 13, 39, 40, 41, 43/56/69, 44A, 44B, 52, 62, 64B, 64C, 64D, 67, 122B and 122E	ROD (May 2002)[12] ROD (September 2003)[10] ROD (March 2007)[11]
15	SEAD 50/54	SEAD 50, 54	ROD (September 2005)[16]
16	DRMO yard	SEAD 121C, 121I	ROD (June 2008)[17]
17	SEAD-45 – OD grounds	SEAD 45	NA

Notes:

1) Parsons. 2005a. ROD The Ash Landfill Operable Unit. January.

2) Parsons. 1999. ROD Former Open Burning (OB) Grounds Site. January.

3) Parsons. 2004b. ROD The Fire Training and Demonstration Pad (SEAD 25) and the Fire Training Pit and Area (SEAD 26). September.

4) Parsons. 2006. ROD The Abandoned Deactivation Furnace (SEAD-16) and the Active Deactivation Furnace (SEAD-17). March.

5) Parsons. 2015. ROD The Radioactive Waste Burial Sites (SEAD-12) and the Mixed Waste Storage Facility (SEAD-72). March.

6) Parsons. 2009a. ROD for the fill area west of Building 135 (SEAD-59) and the Alleged Paint Disposal Area (SEAD-71). March.

7) Parsons. 2008. ROD for the Munitions Washout Facility (SEAD-4) and the Building 2079 Boiler Blowdown Pit (SEAD-38). August.

8) Parsons. 2009b. ROD for the Old Construction Debris Landfill (SEAD-11). September.

9) Parsons. 2004c. Decision Document, Mini Risk Assessment, SEAD-13, IRFNA Disposal Area. July.

10) Parsons. 2003. ROD for Twenty No Action SWMUs (SEADs 7, 9, 10, 18, 19, 20, 21, 22, 33, 35, 36, 37, 42, 47, 49, 51, 53, 55, 65, and 68) and Eight No Further Action SWMUs (SEADs 28, 29, 30, 31, 32, 34, 60, and 61). September.

Table 10-3. Operable Unit Crosswalk

OU	Name	SEAD ID	Decision Document Reference

11) Parsons. 2007. ROD for Seventeen SWMUs Requiring Land Use Controls (SEADs 13, 39, 40, 41, 43/56/69, 44A, 44B, 52, 62, 64B, 64C, 64D, 67, 122B, and 122E). March.

12) Parsons. 2002. Decision Document–- Mini Risk Assessment SEAD 9, 27, 28, 32, 33, 34, 43, 44A, 44B, 52, 56, 58, 62, 64A, 64B, 64C, 64D, 66, 68, 69, 70, and 120B. May.

13) Parsons. 2017. ROD SEAD-46, SEAD 003-R-01 (SEAD-57), SEAD 002-R-01 and SEAD 007-R-01 (Seneca AD Munitions Response Sites) and SEAD-70. March.

14) Parsons. 2004d. ROD for Sites Requiring Institutional Controls in the Planned Industrial/Office Development or Warehousing Areas. September.

15) Parsons. 2009c. ROD for Five Former SWMUs SEAD-1, 2, 5, 24, & 48. April.

16) Parsons. 2005b. ROD No Further Action SWMUs (SEAD-50/54). September.

17) Parsons. 2008. ROD for the Defense Reutilization and Marketing Office Yard (SEAD-121C) and the Rumored Cosmoline Oil Disposal Area (SEAD-121I). June.

N/A = No ROD for this site yet.

Table 10-4. Overview of Preliminary Conceptual Site Model, SEAD-16, Former Seneca Army Depot

Site Details	Known or Suspected Contamination Source(s)	Potential/Suspected Location and Distribution	Source or Exposure Medium	Current and Future Receptors	Potentially Complete Exposure Pathway
Name: SEAD-16 **Acreage:** 2.6 acres **Release Mechanism:** Demilitarization of munitions. **Current and Future Land Use:** No current use. Future use is planned industrial development.	Abandoned Deactivation Furnace Target Analyte List (TAL) Metals	Elevated metals present in groundwater. Former soil source was removed prior to initiation of groundwater LTM.	Groundwater	Current and future on-site worker, off-site residential. Future on-site residential	Exposure to groundwater (ingestion)

Table 10-5. Overview of Preliminary Conceptual Site Model, SEAD-25, Former Seneca Army Depot

Site Details	Known or Suspected Contamination Source(s)	Potential/Suspected Location and Distribution	Source or Exposure Medium	Current and Future Receptors	Potentially Complete Exposure Pathway
Name: SEAD-25 **Acreage:** 8 acres **Release Mechanism:** Former fire control training. Release of petroleum products **Current and Future Land Use:** No current use. Future use is planned industrial development.	Fire Training Activities VOCs (primarily benzene, toluene, ethylbenzene, and xylene) Fire Fighting Foams Per- and polyfluoroalkyl substances	Elevated levels in groundwater. Former soil source was removed prior to LTM.	Groundwater	Current and future on-site worker, off-site residential. Future on-site residential	Exposure to groundwater (ingestion)

Table 10-6. Overview of Preliminary Conceptual Site Model, Ash Landfill, Former Seneca Army Depot

Site Details	Known or Suspected Contamination Source(s)	Potential/Suspected Location and Distribution	Source or Exposure Medium	Current and Future Receptors	Potentially Complete Exposure Pathway
Name: Ash Landfill (SEADs 3, 6, 8, 14, 15) **Acreage:** 45 acres **Release Mechanism:** Former use of incinerator and burial of ash. **Current and Future Land Use:** No current use. Future use is planned industrial development.	Buried Ash and Buried Non-Combustible Items VOCs (predominantly chlorinated VOCs)	Elevated levels present in groundwater. Former soil source was removed prior to LTM.	Groundwater	Current and future on-site worker, off-site residential. Future on-site residential	Exposure to groundwater (ingestion)

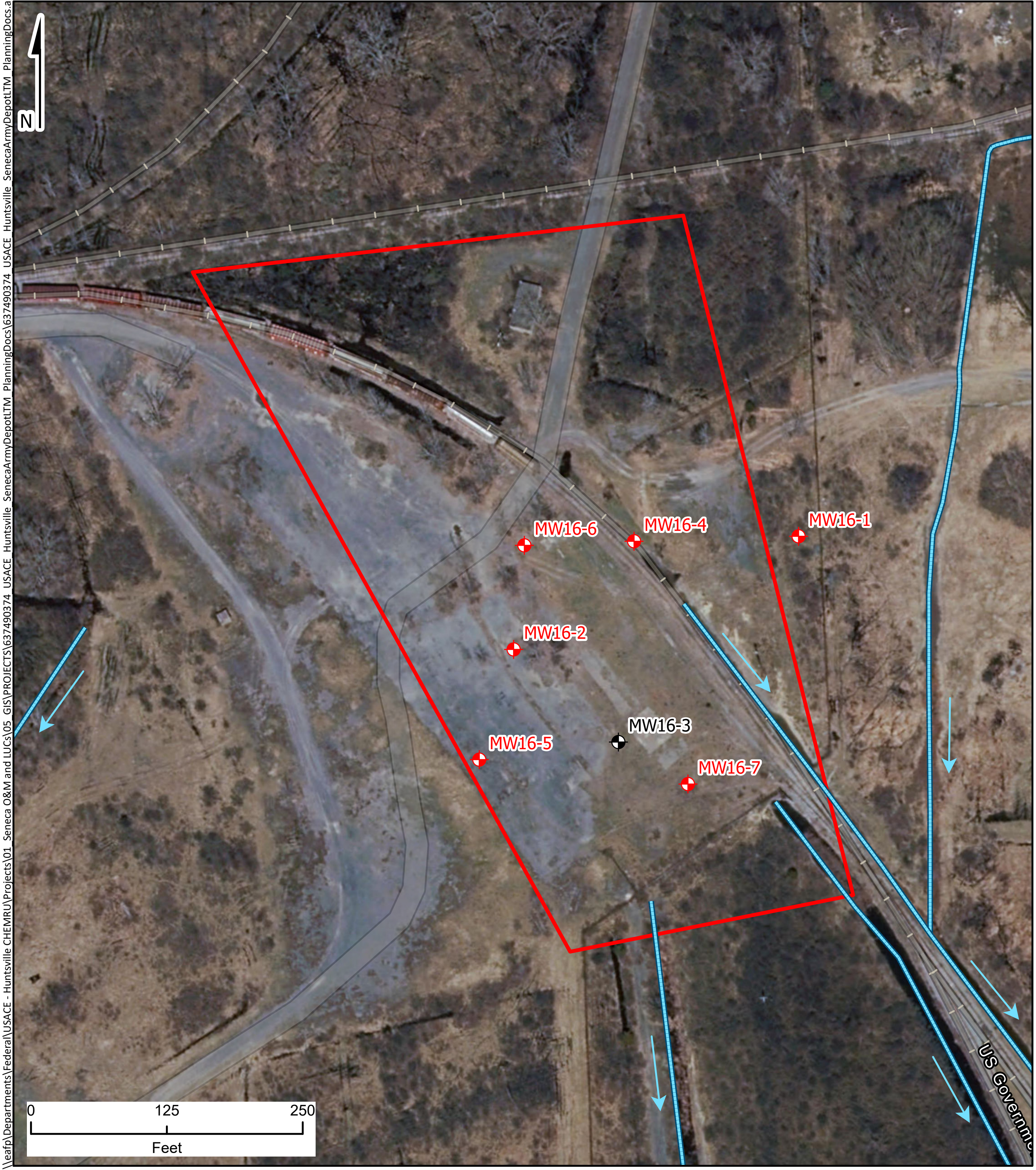
This page intentionally left blank

Table 10-7. Land Use Control Requirements

			LUC Requirements							Other Information			
Site No.	**Site Name**	**OU**	**Prohibit Residential, Schools, Childcare Facilities, & Playgrounds**	**Prohibit construction of habitable structures (temporary or permanent)**	**Groundwater Use Restriction (Prohibit Access or Use of)**	**Unauthorized Excavation Restriction**	**Maintain Soil Cap and/or Vegetative Cover**	**Maintain Remedial & Monitoring Wells System**	**3R Explosives Safety Education Program**	**Army Sites Not Ready For Transfer**	**Groundwater Use Deed Restriction**	**Prison Parcel Reversionary Deed**	**Environmental Easement**
Planned Industrial/Office Development (PID)/Warehouse Area													
SEAD 1	Hazardous Waste Container Storage Facility (Building 307)	OU13	X		X								X
SEAD 2	PCB Transformer Storage Facility (Building 301)	OU13	X		X								X
SEAD 5	Sewage Sludge Storage Piles	OU13	X		X	X	X						X
SEAD 16	Building S311, Abandoned Deactivation Furnace	OU4	X		X								X
SEAD 17	Building 367, Active Deactivation Furnace	OU4	X		X								X
SEAD 25	Fire Training and Demonstration Pad	OU3	X		X			X					X
SEAD 26	Fire Training Pit	OU3	X		X			X					X
SEAD 27	Steam Cleaning Waste Tank (Building 360)	OU12	X		X								X
SEAD 39	Building 121 Boiler Plant Blowdown Leach Pit	OU14	X		X								X
SEAD 40	Building 319 Boiler Plant Blowdown Leach Pit	OU14	X		X								X
SEAD 59	Fill Area West of Building 135	OU6	X		X								X
SEAD 64A	Garbage Disposal Area, South of Storage Pad	OU12	X		X	X							X
SEAD 66	Pesticide Storage Area near Buildings 5 and 6	OU12	X		X								X
SEAD 67	Dump Site east of Sewage Treatment Plant No. 4	OU14	X		X								X
SEAD 71	Alleged Paint Disposal Area	OU6	X		X								X
SEAD 121C	DRMO Yard	OU16	X		X								X
SEAD 121I	Rumored Cosmoline Disposal Area	OU16	X		X								X
Prison Area													
SEAD 43	Building 606 Old Missile Propellant Test Laboratory	OU14										X	
SEAD 44A	Quality Assurance Test Laboratory, West of Building 616	OU14										X	
SEAD 44B	Quality Assurance Test laboratory, Brady Road	OU14										X	
SEAD 52	Building 608 and 612 Ammunition Breakdown Area	OU10 & OU14										X	
SEAD 56	Building 606 Herbicide and Pesticide Storage	OU14										X	
SEAD 62	Nicotine Sulfate Disposal Area near Building 606 and 612	OU14										X	
SEAD 64C	Garbage Disposal Area	OU14										X	
SEAD 69	Building 606 Disposal Area	OU14										X	
Other SEADs with LUC Requirements													
SEAD 12	Radiological Waste Burial Sites	OU5	X	X	X								
SEAD 13	IRFNA Disposal Site	OU9 & OU14			X					X			

Table 10-7. Land Use Control Requirements

			LUC Requirements							**Other Information**			
Site No.	**Site Name**	**OU**	**Prohibit Residential, Schools, Childcare Facilities, & Playgrounds**	**Prohibit construction of habitable structures (temporary or permanent)**	**Groundwater Use Restriction (Prohibit Access or Use of)**	**Unauthorized Excavation Restriction**	**Maintain Soil Cap and/or Vegetative Cover**	**Maintain Remedial & Monitoring Wells System**	**3R Explosives Safety Education Program**	**Army Sites Not Ready For Transfer**	**Groundwater Use Deed Restriction**	**Prison Parcel Reversionary Deed**	**Environmental Easement**
SEAD 64B	Garbage Disposal Area, South of Classification Area	OU14				X	X						X
SEAD 64D	Garbage Disposal Area, West of Building 2203	OU14			X	X	X	X					X
North End Barracks Area													
SEAD 41	Building 718 Boiler Plant Blowdown Leach Pit	OU14			X						X		X
Airfield Parcel													
SEAD 122B	Small Arms Range, Airfield	OU14	X										X
SEAD 122E	Plane Deicing Area	OU14	X										X
Ash Landfill Operable Unit													
SEAD 3	Incinerator Cooling Water Pond	OU1		X	X	X	X	X					X
SEAD 6	Abandoned Ash Landfill	OU1		X	X	X	X	X					X
SEAD 8	Non-Combustible Fill Area	OU1		X	X	X	X	X					X
SEAD 14	Refuse Burning Pits (2 units)	OU1		X	X	X	X	X					X
SEAD 15	Abandoned Solid Waste Incinerator (Building 2207)	OU1		X	X	X	X	X					X
Former Munitions Response Sites													
SEAD 46	Small Arms Range (i.e., 3.5-inch Rocket Range)	OU11	X						X				
SEAD 003-R-01	Explosive Ordnance Disposal Area (#1) (SEAD 57)	OU11	X						X				
SEAD 007-R-01	Grenade Range	OU11	X						X				
SEAD 002-R-01	Explosive Ordnance Disposal Areas #2 and #3	OU11	X						X				
Ongoing Remedial Action/ Pre-RODs													
SEAD 45	Open Detonation Area	OU17								X			
Other SEADs with RODS, but no LUC Requirements													
SEAD 23	Open Burning Ground	OU2				X							



Legend

🟩 Former Depot Boundary

🟥 SEAD-16 Boundary

〰 Drainage

→ Surface Water Flow

Existing Monitoring Well Network

⊕ Destroyed

⊕ LTM Sampling

Figure 10-1

SEAD-16 Site Features
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 3:48 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

\\eafp\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01_Seneca O&M and LUCs\05_GIS\PROJECTS\637490374_USACE_Huntsville_SenecaArmyDepotLTM_PlanningDocs\637490374_USACE_Huntsville_SenecaArmyDepotLTM_PlanningDocs.aprx

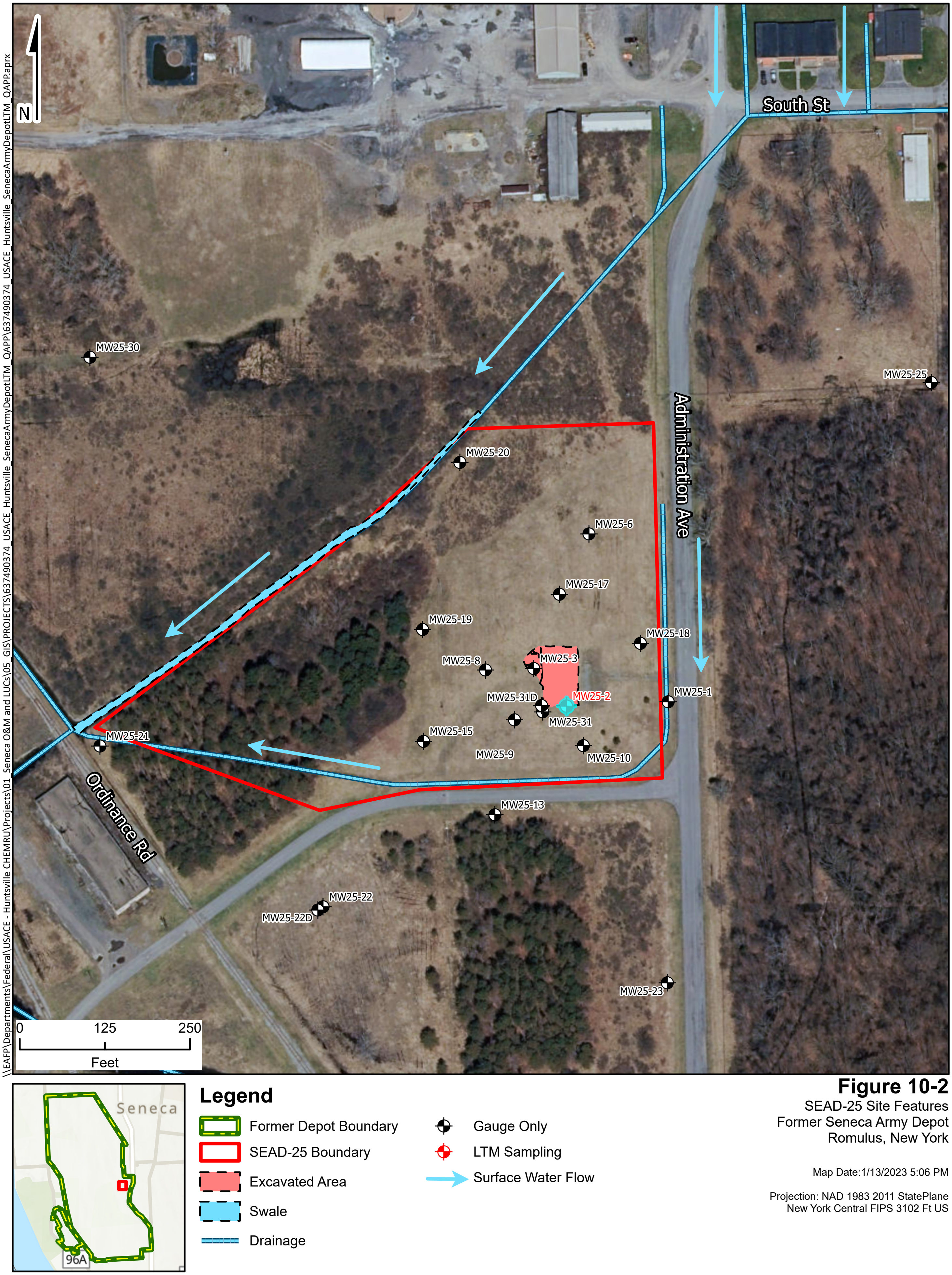


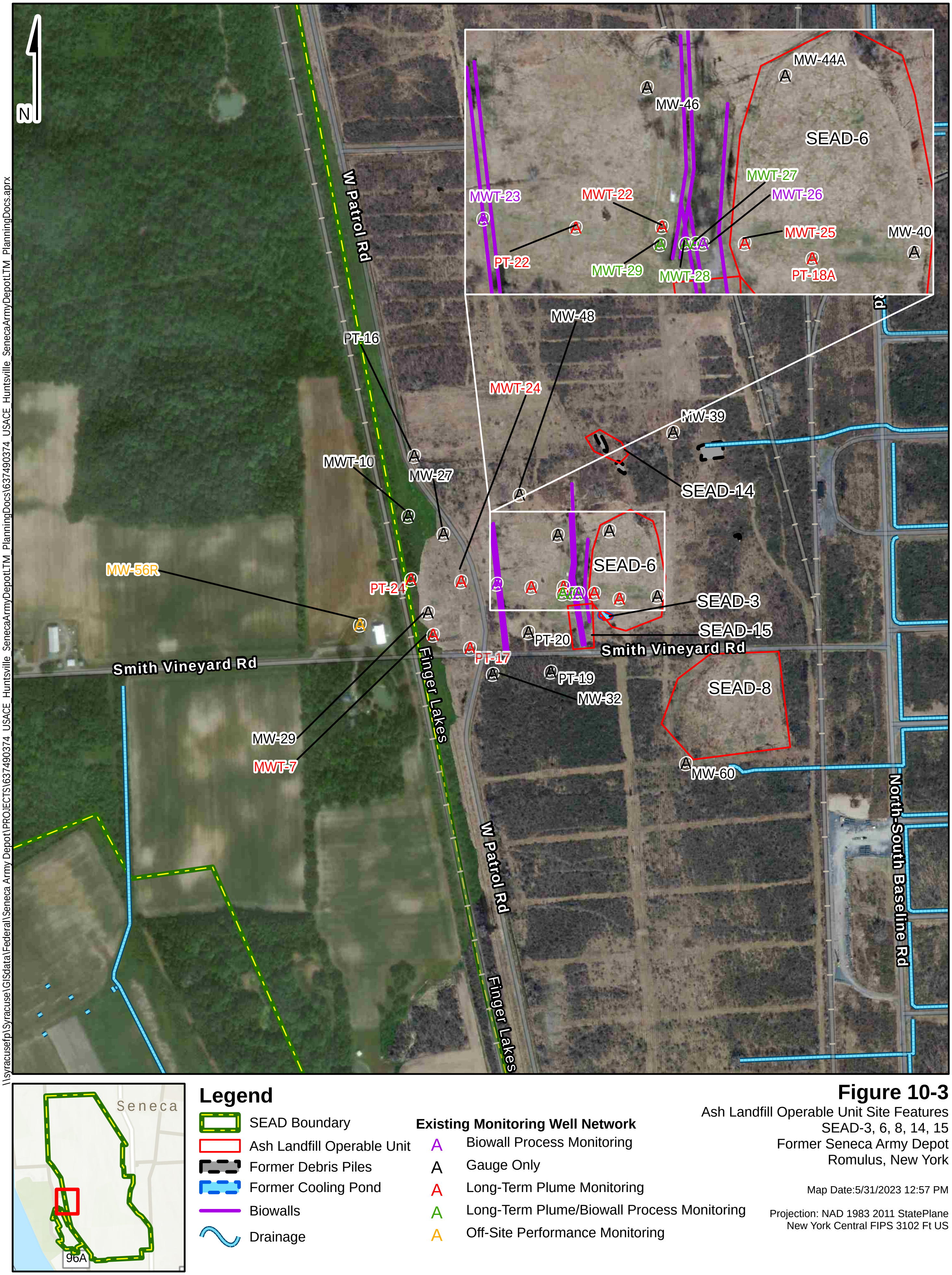
Figure 10-2

SEAD-25 Site Features
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 5:06 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01_Seneca O&M and LUCs\05_GIS\PROJECTS\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP.aprx



Legend

- 🟩 SEAD Boundary
- 🟥 Ash Landfill Operable Unit
- ▬ Former Debris Piles
- ▬ Former Cooling Pond
- ▬ Biowalls
- ~ Drainage

Existing Monitoring Well Network

A	Biowall Process Monitoring
A	Gauge Only
A	Long-Term Plume Monitoring
A	Long-Term Plume/Biowall Process Monitoring
A	Off-Site Performance Monitoring

Figure 10-3

Ash Landfill Operable Unit Site Features
SEAD-3, 6, 8, 14, 15
Former Seneca Army Depot
Romulus, New York

Map Date:5/31/2023 12:57 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

\\syracusefp\Syracuse\GISdata\Federal\Seneca Army Depot\PROJECTS\637490374_USACE_Huntsville_SenecaArmyDepotLTM_PlanningDocs\637490374_USACE_Huntsville_SenecaArmyDepotLTM_PlanningDocs.aprx

This page intentionally left blank

Worksheet #11 Project/Data Quality Objectives

11.1 This worksheet is used to develop and document DQOs using a systematic planning process in accordance with Guidance on Systematic Planning Using the Data Quality Objectives Process (EPA 2006). The specific QA/QC requirements developed for the site are consistent with those presented in the DoD QSM, Version 5.4 (DoD 2021).

11.2 The DQO process is used to establish performance and acceptance criteria, which serve as the basis for designing a plan for collecting data of sufficient quality and quantity to support the goals of a study. In the context of DQOs, there are two types of intended use for the data: decision making and estimation. Decision making is defined as making a choice between alternative conditions (e.g., does the contamination pose a risk to human health and the environment and therefore necessitate remediation, or is the contamination below risk concerns and does not require remediation?). Estimation studies often include the collection of data intended for further research, modeling, or design and may eventually support decision making. The defining characteristic of an estimation problem is the intended use of the data is not directly associated with a well-defined decision (EPA 2006).

11.3 The DQO process established by EPA, and incorporated into the 2012 UFP-QAPP guidance, consists of seven steps that are used during the planning of the data collection process to ensure that field and analytical activities, and the resulting data, meet the project objectives. The seven steps of the DQO process are as follows: (1) State the Problem; (2) Identify the Goals of the Study; (3) Identify Information Inputs; (4) Define the Boundaries of the Study; (5) Develop the Analytic Approach; (6) Specify Performance or Acceptance Criteria; and (7) Develop the Detailed Plan for Data Collection.

11.4. This project involves LTM/LUC activities at 42 sites as presented below. The SEAD sites are shown on **Figure 1-2**. The RODs for each AOC require the implementation of LUCs that will continue until the concentrations of hazardous substances in the soil and groundwater are reduced to levels that allow for unlimited use and unrestricted exposure, as summarized below.

- LTM of groundwater to maintain ROD compliance at: SEAD 16, SEAD 25, and the Ash Landfill (SEADs 3, 6, 8, 14, and 15). The seven steps of the DQO process for each of the LTM sites are presented in **Table 11-1**.

- Annual inspections of LUCs at each of the 42 SEADs to confirm compliance with their respective ROD. LUC requirements are presented in **Table 10-7**.

What type of data are needed (matrix, target analytes, analytical groups, field screening, on-site analytical or off-site laboratory techniques, sampling techniques)?

11.5 Physical data (survey, well inspection data, gauging data, and instrumentation data), chemical/analytical data (i.e., groundwater sampling for off-site laboratory analysis), and field screening data (HACH kits for manganese and ferrous iron, and water quality parameters) will be collected and monitored at the identified LTM sites (**Table 18-2**) throughout implementation of the TO.

11.6 Groundwater samples collected for off-site laboratory analysis will be analyzed by SGS Orlando in Orlando, Florida. Analytical groups will include metals, VOCs, anions, total organic carbon (TOC), and dissolved gases. In addition, as part of the Ash Landfill program, field screening for ferrous Fe and Mn will be performed using HACH kits at the identified LTM sites (**Table 18-2**). Laboratory certifications are provided in **Appendix A**.

11.7 Physical data (inspection data) will be collected at each of the LUC sites throughout implementation of the TO.

What will the data be used for?

11.8 LTM data will be used to achieve No Further Action declarations for the identified SEAD sites. LUC data will be used to monitor the integrity of identified SEADs (**Table 18-3**). More specifically:

- Groundwater samples will be used to monitor groundwater contaminant concentrations and trends over time until concentrations allow for unlimited use/unrestricted exposure.

- LUC inspections will be used to ensure the integrity of previous remedial actions and confirm that the LUC objectives are being met.

- LTM and LUC data will be used to determine whether additional monitoring wells need to be installed or existing wells can be abandoned at an AOC. Well installation and abandonment will be conducted following consultation with USACE, EPA, and NYSDEC.

How much data are needed (number of samples for each analytical group, matrix, and concentration)?

11.9 Worksheet #18 and #20 indicate the number of samples for each matrix to be analyzed by each method for each sampling event.

Who will collect and generate the data?

11.10 EA will complete monitoring well inspections and sampling, Global Positioning System (GPS) surveying, and environmental sampling at each LTM site, and LUC inspections at each of the 42 LUC sites.

11.11 EA will submit environmental samples to the off-site analytical laboratory for analysis. SGS Orlando will analyze and generate laboratory analytical data for each of the environmental samples. EA will conduct LUC inspections for the identified sites.

Where, when, and how should the data be collected/generated?

11.12 The field effort is scheduled to commence in Spring 2023. The general project schedule is described in Worksheets #14 and #16.

How "good" do the data need to be in order to support the environmental decision?

11.13 Analytical data must be technically defensible and of sufficient quality to support the project quality objectives. Worksheet #12 lists the Measurement Performance Criteria, and Worksheet #28 lists the Sample QC criteria. Worksheet #15, Reference and Evaluation Table, summarizes the analytical parameters as well as applicable project action levels, project QLs, and detection limits (DLs), limits of detection (LODs) and limits of quantitation (LOQs) for each parameter. Worksheet #22 lists field equipment calibration requirements. Worksheets #34, #35, and #36 describe data validation guidelines. Worksheet #37 describes data usability assessment.

Who will use the data?

11.14 The data collected during and generated during implementation of this TO will primarily be used by EA and USACE, in conjunction with NYSDEC, New York State Department of Health (NYSDOH), and EPA.

How will the data be reported?

11.15 Field data will be recorded in the dedicated logbook and on field forms provided in **Appendix B**.

11.16 The analytical laboratory will generate portable document format (PDF) reports and provide electronic data deliverables (EDDs). Analytical data will be validated by a third-party validator who will supply a report of the data to ensure compliance with this QAPP.

11.17 Inspection, maintenance, and sampling/monitoring data will be documented in groundwater and LUC Inspection reports as specified in Worksheet #14 and #16.

This page intentionally left blank

Table 11-1. Data Quality Objectives (DQOs) and Technical Approach Summary for LTM/LUC at SEAD

Site	1. State the Problem	2. Identify the goal of the study	3. Identify information inputs	4. Define the boundaries of the study	5. Develop the analytic approach	6. Specify performance or acceptance criteria	7. Develop the detailed plan for obtaining data
SEAD-16	• ROD requires groundwater LTM due to groundwater concentrations above New York State Class GA standards	• Monitor groundwater concentrations until standards are achieved • Implementation, maintenance, inspection, and periodic reporting of LUCs	• Existing groundwater data • Analytical groundwater data (TAL metals) • Visual LUC inspection	• Monitoring will be conducted at SEAD-16 at 6 existing wells (**Figure 10-1**). • Data will be collected every 5 years, during the spring months when conditions are favorable to fieldwork, with the next sampling event in 2025. If COCs continue to be under applicable groundwater standards LTM will be recommended to end; if COCs exceed groundwater standards, annual LTM will continue.	• Review groundwater concentrations for site COCs (Worksheet #17). If COC concentrations are at or below New York State Class GA standards for more than one round, then recommend future termination of LTM. LUCs would continue to be monitored. The LUC inspection team will check the site to make sure LUCs are in compliance.	• Once New York State Class GA groundwater cleanup standards are achieved, the groundwater use restrictions may be eliminated upon approval of the EPA and NYSDEC • Confirm land use is not for residential purposes and there is no access to and use of groundwater until applicable cleanup standards are met	• Collect groundwater samples using low flow techniques
SEAD-25	• ROD requires groundwater LTM due to groundwater concentrations above New York State Class GA standards	• Monitor groundwater concentrations until standards are achieved • Implementation, maintenance, inspection, and periodic reporting of LUCs	• Existing groundwater data • Analytical groundwater data (VOCs) • Visual LUC inspection	• Monitoring will be conducted at SEAD-25, at existing monitoring well MW25-2 and MW25-31 (**Figure 10-2**). • Gauging will be performed at all wells in the existing well network as shown in **Figure 10-2**, • Data will be collected every 5 years (next in 2025) from MW25-2, and annually for 5 years at MW25-31 during the spring months when conditions are favorable to fieldwork. • LTM will continue until COC concentrations are at or below applicable groundwater standards	• Review groundwater concentrations for site COCs (Worksheet #17). If COC concentrations are at or below New York State Class GA standards for more than one round, then recommend future termination of LTM. LUCs would continue to be monitored. • The LUC inspection team will check the site to make sure LUCs are in compliance.	• Once New York State Class GA groundwater cleanup standards are achieved, LTM program may be terminated upon approval of the EPA and NYSDEC • Confirm land use is not for residential purposes and there is no access to and use of groundwater until applicable cleanup standards are met	• Collect groundwater samples using low flow techniques
Ash Landfill	• RODs require groundwater LTM due to groundwater concentrations above New York State Class GA standards • Contaminated soil interred under vegetated caps throughout the site	• Prevent exposure to off-site receptors through possible off-site migration of VOC plume • Document effectiveness of biowalls to remediate and attenuate chlorinated ethene plume • Confirm that groundwater concentrations throughout plume are decreasing to eventually meet NYSDEC Class GA groundwater standards • Monitor the integrity of vegetative cover and LUC performance objectives	• Existing groundwater data • Analytical groundwater data (VOCs) and geochemical parameters • Visual inspections of vegetative caps	• Annual monitoring will be conducted at the Ash Landfill, at 14 existing monitoring wells (**Figure 10-3**). • Data will be collected during the Spring when conditions are favorable to fieldwork and to be consistent with timing of previous events. • LTM will continue until COC concentrations are below applicable groundwater standards for multiple rounds.	• Review groundwater concentrations for site COCs (Worksheet #17) and perform: - Long-term plume performance monitoring using existing monitoring wells PT-18A, MWT-25, MWT-28, MWT-29, MWT-22, PT-22, MWT-23, MWT-24, PT-17, MWT-7, and PT-24 - Biowall process monitoring using existing monitoring wells; MWT-26, MWT-27, MWT-28, MWT-29, and MWT-23 - Confirm no exceedances of groundwater standards for COCs at the off-site compliance monitoring well: MW-56R • Review groundwater geochemical conditions to: - Monitor the long-term performance and sustainability of the biowalls - Monitor substrate depletion and geochemical conditions under which the effectiveness of the biowalls may decline – Compare with EPA benchmark guidance for effective natural attenuation (EPA 1998). If site geochemical parameters are outside guidance values, a corrective action may be recommended. • If several lines of evidence (geochemical parameters) suggest the biowalls are no longer effective, a corrective action (e.g., biowalls recharge) will be recommended.	• Monitoring of both the on-site plume performance wells and off-site sentinel well will stop when GA standards for the COCs are achieved during two successive rounds of sampling the on-site plume wells. • Biowall recharge based on COC concentrations in the wall and geochemical parameters • No evidence of disturbance to vegetative cap	• Collect groundwater samples and geochemical parameters using low flow techniques • Visual inspections of vegetative caps

This page intentionally left blank

Worksheet #12 Measurement Performance Criteria

12.1 This worksheet is intended to document the quantitative measurement performance criteria for both field and laboratory measurements and is used to guide the selection of appropriate measurement techniques and analytical methods. Precision, accuracy, and sensitivity are further defined and discussed in Worksheet #37. Measurement performance criteria are developed to ensure that collected data will satisfy the DQOs documented on Worksheet #11. The measurement performance criteria identified in this worksheet reflect the requirements of the 2021 DoD QSM Version 5.4 as well as the current laboratory SOPs found in **Appendix C**.

This page intentionally left blank

Table 12-1. Measurement Performance Criteria – Dissolved Gases

Matrix	Aqueous
Analytical Group	Dissolved Gases
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)**
SOPs 001, 002, 004, 005, 010, 011, 013, 016, 039, 042, 043, and 048	RSK-175/ SGS Orlando SOP GC019	Completeness[3]	>95%	NA	S&A
		Bias Contamination	≤ LOQ	Field Blanks	S&A
		Precision - Overall	RPD ≤ 30%	Field Duplicates	S&A
		Accuracy	DoD QSM v5.4 %R limits	LCS, LCSD, MS, and MSD	A
		Precision	RPD ≤ 30%	LCS and LCSD, MS and MSD	A
		Accuracy/Bias/Laboratory Contamination	≤ ½ LOQ or ≤ 1/10 the amount measured in any sample	Method Blanks	A

Notes:

%R = Percent recovery

LCS = Laboratory control sample

LCSD = Laboratory control sample duplicate

MS = Matrix spike

MSD = Matrix spike duplicate

RPD = Relative percent difference

1) Referenced SOPs for sampling procedures are presented in Worksheet #21.

2) Referenced SOPs for the analytical method are presented in Worksheet #23.

3) Completeness will be evaluated on a per-analyte basis.

Table 12-2. Measurement Performance Criteria – Total Organic Carbon

Matrix	Aqueous
Analytical Group	TOC
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)
SOPs 001, 002, 004, 005, 010, 011, 013, 016, 039, 042, 043, and 048	SW-846 9060A/ SGS Orlando SOP GN215	Completeness[3]	>95%	NA	S&A
		Bias/Contamination	≤ LOQ	Field Blanks	S&A
		Precision - Overall	RPD ≤30%	Field Duplicates	S&A
		Accuracy/Bias/Contamination	≤½ LOQ or ≤ 1/10 the amount measured in any sample	Method Blanks	A
		Accuracy	90-110%R	LCS, MS, and MSD	A
		Precision and Accuracy	RPD ≤ 20%	MS and MSD	A

Notes:
1) Referenced SOPs for sampling procedures are presented in Worksheet #21.
2) Referenced SOPs for the analytical method are presented in Worksheet #23.
3) Completeness will be evaluated on a per-analyte basis.

Table 12-3. Measurement Performance Criteria – Anions

Matrix	Aqueous
Analytical Group	Anions
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)
SOPs 001, 002, 004, 005, 010, 011, 013, 016, 039, 042, 043, and 048	SW-846 9056A SGS Orlando SOP GN237	Completeness[3]	>95%	NA	S&A
		Accuracy/bias/contamination	≤½ LOQ or ≤ 1/10 the amount measured in any sample or 1/10 the regulatory limit	Blanks (field, method)	S&A
		Precision - Overall	RPD ≤30%	Field Duplicates	S&A
		Accuracy	DoD QSM v5.4 %R limits	LCS, MS, and MSD	A
		Precision	RPD ≤15%	MS and MSD	A

Notes:
1) Referenced SOPs for sampling procedures are presented in Worksheet #21.
2) Referenced SOPs for the analytical method are presented in Worksheet #23.
3) Completeness will be evaluated on a per-analyte basis.

Table 12-4. Measurement Performance Criteria – Mercury

Matrix	Aqueous
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)
SOPs 001, 002, 004, 005, 010, 011, 013, 016, 039, 042, 043, and 048	SW-846 7470A/ SGS Orlando SOP MET106	Completeness[3]	>95%	NA	S&A
		Accuracy/bias/contamination	≤½ LOQ or ≤ 1/10 the amount measured in any sample or 1/10 the regulatory limit	Blanks (field, method)	S&A
		Precision - Overall	RPD ≤30%	Field Duplicates	S&A
		Accuracy	DoD QSM v5.4 %R limits (82-119%)	LCS, MS, and MSD	A
		Precision	RPD ≤20%	MS and MSD	A

Notes:
1) Referenced SOPs for sampling procedures are presented in Worksheet #21.
2) Referenced SOPs for the analytical method are presented in Worksheet #23.
3) Completeness will be evaluated on a per-analyte basis.

Table 12-5. Measurement Performance Criteria – Metals

Matrix	Aqueous
Analytical Group	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)**
SOPs 001, 002, 004, 005, 010, 011, 013, 016, 039, 042, 043, and 048	SW-846 6020B SGS Orlando SOP MET107	Completeness[3]	>95%	NA	S&A
		Accuracy/bias/contamination	≤½ LOQ or ≤ 1/10 the amount measured in any sample or 1/10 the regulatory limit	Blanks (field, method)	S&A
		Precision - Overall	RPD ≤30%	Field Duplicates	S&A
		Accuracy	DoD QSM v5.4 %R limits	LCS, MS, and MSD	A
		Precision	RPD ≤20%	MS and MSD	A

Notes:
1) Referenced SOPs for sampling procedures are presented in Worksheet #21.
2) Referenced SOPs for the analytical method are presented in Worksheet #23.
3) Completeness will be evaluated on a per-analyte basis.

Table 12-6. Measurement Performance Criteria – Volatile Organic Compounds

Matrix	Aqueous
Analytical Group	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)
SOPs 001, 002, 004, 005, 010, 011, 013, 016, 039, 042, 043, and 048	SW-846 8260D SGS Orlando SOP MS020	Completeness[3]	>95%	NA	S&A
		Accuracy/bias/contamination	≤½ LOQ or ≤ 1/10 the amount measured in any sample or 1/10 the regulatory limit	Blanks (field, method)	S&A
		Precision - Overall	RPD ≤30%	Field Duplicates	S&A
		Accuracy/Bias/Laboratory Contamination	DoD QSM v5.4 %R limits	LCS, MS, and MSD	A
		Precision	RPD ≤ 20%	MS and MSD	A
		Accuracy/Bias	DoD QSM v5.4 %R limits	Surrogates	A

Notes:

1) Referenced SOPs for sampling procedures are presented in Worksheet #21.
2) Referenced SOPs for the analytical method are presented in Worksheet #23.
3) Completeness will be evaluated on a per-analyte basis.

Worksheet #13 Secondary Data Uses and Limitations

Data Source (Originating Organization, Report Title, and Date)	**Data Generator(s) (Originating Organization, Data Types, Data Generation/Collection Dates)**	**How Data May Be Used (if deemed usable during data assessment stage)**	**Factors affecting reliability of data and limitations on data use**
Parsons Engineering Science (1995) • Background metals concentrations in groundwater	USACE, New York District; and Parsons	Data will be used to provide background metals concentrations for results comparison.	No limitations on data use.
Parsons (1995 to 2021) • Final UFP-QAPP (2017) • Land Use Controls Inspection Report (2017) • Long-Term Monitoring Annual Report – (various) • Record of Decisions (various) • Final Five-Year Review (2021) • Geodatabases • Sampling databases	USACE, New York District; and Parsons	Used in preparation of UFP-QAPP to provide background for site history and previous investigations.	No limitations on data use

This page intentionally left blank

Worksheet #14 and #16 Project Tasks and Schedule

14/16.1 These worksheets provide an overview of project tasks, describe the procedures to be followed for activities to be performed, and present summaries of the project deliverables to be prepared in support of the planned project tasks. The primary tasks to be completed under this project are listed in this worksheet. The sampling design and rationale are discussed further in Worksheet #17. Worksheet #18 presents a comprehensive list of the current LTM well locations as well as LUC locations. Field SOPs are listed in Worksheet #21 and are provided in **Appendix D.** Field forms detailed in the sections below are presented in **Appendix B**.

14/16.2 The project schedule for this work is included at the end of this worksheet. The project schedule will be maintained throughout the course of the project. At a minimum, an updated project schedule will be provided with each Monthly Status Report. Submittals and due dates have been incorporated into the project schedule, included at the end of this worksheet.

14/16.3 The contractor retains overall management functions including overall project management, site supervision, H&S oversight, and QC. The contractor will execute tasks using contractual arrangements with regional subcontractors. The contractor PM will formulate subcontracts to reflect detailed scope and performance objectives and specifications. The PM will ensure provisions of the basic contract, H&S requirements, and QA/QC requirements are incorporated, and that other special conditions will be shared, as appropriate.

14/16.4 Other subcontract provisions will install procedures for implementing change orders, resolving disputes, and implementing corrective actions. The performance baseline will be developed jointly with subcontractors and discrete tasks and milestones will be entered into the management control system. Performance against the fiscal and project schedule baseline will be monitored by the Contractor PM on an ongoing basis, and formally as part of the total project status review. Before starting work, the PM will conduct a kick-off meeting to ensure that field personnel and subcontractors fully understand their responsibilities. During field operations, field staff will closely monitor field work and assess materials and equipment to ensure they meet contract requirements. Minor issues will be resolved at the site level. Issues that cannot be resolved at the site will be directed to the PM. Negative performance trends will result in an interim performance review and discussions with the contract management personnel. As required, a corrective action plan will be developed to bring schedule/cost performance back to baseline. If a corrective action plan is developed, the PM will inform the USACE PM Technical Lead.

MOBILIZATION AND DEMOBILIZATION TASKS

14/16.5 Mobilization includes the procurement of field equipment and supplies and mobilization of field staff. Mobilization/demobilization will occur based on the proposed field schedule.

14/16.6 The following tasks will be conducted prior to mobilization:

- Notify USACE prior to mobilizing equipment and field personnel to the site.
- Coordinate with field personnel as needed; ensure that field staff have proper training and certifications.
- Procure field equipment and supplies. The equipment necessary to execute the field work and complete the project tasks is detailed below, and in the SOPs identified in Worksheet #21. Sample bottle requirements are presented in Worksheet #19 and #30.
- Determine staging areas for equipment and IDW staging.

14/16.7 The following personnel will be mobilized to the project site to support field activities:

- Field QC Manager
- SSHO
- Field personnel and subcontractors (i.e., IDW removal) as needed.

14/16.8 The equipment necessary to execute the field work and complete the project will be selected with adequate capability and capacity to perform the designated tasks. Pumps, water quality instruments, tubing, and sample bottles will be inspected and tested prior to mobilization.

14/16.9 A field team orientation meeting will be conducted prior to the start of each task to familiarize the team personnel with site health and safety requirements, the objectives and scope-of-field activities, and the chain-of-command. The field team will be familiar with the site layout and sampling locations and will identify related field support areas and requirements. The following will be reviewed during the orientation meeting:

- Project plans (i.e., UFP-QAPP, APP/SSHP)
- Site hazards/site safety and health concerns, evacuation plans and procedures/route to the hospital
- Safety procedures
- LTM/LUC tasks
- Procedures to minimize environmental impacts

14/16.10 Demobilization activities include removing field equipment and supplies, returning rented equipment, managing IDW, performing general cleanup, and organizing field documentation.

HEALTH AND SAFETY TASKS

14/16.11 LTM/LUC activities will be conducted according to the project APP, which is included as **Appendix E**. Each team member will read and sign the USACE-accepted APP and receive site-specific training that covers site safety, emergency procedures, QC (pass/fail criteria), general daily activities protocols, site communication, and general site layout including safe areas, and natural resource/environmental and cultural/archaeological concerns. Site-specific training will be conducted by the SSHO.

14/16.12 Entrance briefing and safety meetings will be conducted prior to the start of fieldwork and daily to familiarize the team personnel with site health and safety requirements, the objectives and scope of field activities, and chain-of-command. Personnel mobilized to the site will meet requirements for OSHA hazardous waste operations training and medical surveillance requirements as specified in the APP (**Appendix E**). Site personnel will also be trained to perform the specific tasks to which they are assigned. At no time will site personnel be tasked with performing an operation or duty for which they do not have appropriate training. The field team will be familiar with sample locations and will identify related field support areas and requirements.

GROUNDWATER LONG-TERM MONITORING TASKS

Instrument Calibration

14/16.13 Field equipment including photoionization detectors and water quality meters will be calibrated each day prior to field activities in accordance with SOP 011 and SOP 043 (**Appendix D**). Requirements for calibration, maintenance, testing, and inspection of field equipment are summarized in Worksheet #22. Calibration forms and checklists are presented in **Appendix B**.

Monitoring Well Inspections

14/16.14 An inspection will be conducted during the initial sampling event of each of the 22 LTM monitoring wells. Inspections will also be conducted for monitoring wells that will be gauged but not sampled. During the inspection, surface soil/debris at the monitoring well locations will be removed in preparation for sampling. Well headspace will be screened with a photoionization detector in accordance with SOP 011. The Monitoring Well Inspection Checklist provided in **Appendix B** will be completed for each well. The maintenance of monitoring wells identified as in need of minor repair or upkeep (e.g., replacement of locks, bolts, etc.) will be conducted. Field personnel will have a kit with parts, locks, tags, replacement bolts, j-plugs, etc. on hand to complete minor repairs or upkeep at the time of the well inspections. Wells in need of major repairs (including painting of protective casing and bollards and repair and/or reinstallation of the concrete pad and associated flush mount or protective stickup casing and bollards) will be identified as in need of future repair or upkeep.

Groundwater Elevation and Synoptic Measurements

14/16.15 Prior to each sampling event, a synoptic round of water levels will be collected from each of the monitoring wells associated with the existing monitoring well network at each LTM site

(**Table 18-1**) within 24 hours, in accordance with SOP 010. Well headspace will be screened with a photoionization detector in accordance with SOP 011. Water levels and well depths will be gauged to the nearest 0.01 ft using an electric water-level tape. Measurements will be recorded from a common reference point; in most instances, a notch or a mark made with a permanent marker in the polyvinyl chloride or inner casing. The date, time, well number, and gauging data (water levels, well depths) will be recorded on the monitoring well gauging log provided in **Appendix B.**

Groundwater Sampling

14/16.16 Groundwater samples will be collected via low-flow methodologies in accordance with SOP 048. The sample collection locations, frequency, and analysis are presented in Worksheet #18. Equipment needed for groundwater sampling tasks is found in Worksheet #22 and applicable field SOPs are listed in Worksheet #21.

14/16.17 Wells will be purged using a low flow pump (either a peristaltic pump, or a submersible pump if the depth to water is beyond 20 ft below ground surface). Water quality parameters (including pH, temperature, conductivity, dissolved oxygen [DO], turbidity, and oxidation-reduction potential [ORP]) will be recorded throughout purging using a water quality meter and flow-through cell (Horiba U-22 water quality monitoring system or similar). Water depths will be recorded throughout purging to the nearest 0.01 ft using an electric water-level tape. Readings will be taken every 5 minutes until water quality parameters stabilize. Stabilization is considered to be achieved when 3 consecutive readings are within the limits as follows:

- Drawdown less than 0.3 ft; or stable drawdown if the minimal drawdown exceeds 0.3 ft
- pH readings within ± 0.1 pH units
- Water temperatures within ± 3%
- ORP within ± 10 millivolts
- DO within ± 10% for values greater than 0.5 milligrams per liter (mg/L); if three DO values are less than 0.5 mg/L, the values are considered stabilized.
- Specific conductance within ± 3%
- Turbidity within ± 10 % for values greater than 5 nephelometric turbidity units (NTU); if three turbidity values are less than 5 NTU, the values are considered stabilized.

14/16.18 Water quality parameters and pertinent sampling information will be recorded on groundwater purge and sample collection logs provided in **Appendix B**. Unusual conditions (colors, odors, surface sheens, etc.) noticed during well purging or sampling will be recorded and reported.

14/16.19 Prior to collecting field samples, samplers will don clean, protective gloves. Samples will be collected for constituents listed in Worksheet #18. Sample containers will be provided by the analytical laboratory and will be pre-preserved for those constituents that require chemical preservation, as detailed in Worksheet #19 and #30. A sample collection log provided in **Appendix B** will be completed for each sample collected and will provide the following information about the sample: sample location and identity, sampling team members, sample location ID, sample number, sample depth interval, analytical parameters, sample containers, QA/QC information, and any comments or observations.

14/16.20 Groundwater samples will be collected immediately after field measurements have stabilized. Samples will be collected in laboratory provided sample containers at the frequency and distribution presented in Worksheet #18 and submitted to the off-site laboratory, SGS Orlando, for the analysis of VOCs, TOC, anions, dissolved gases (methane, ethane, and ethene), and/or metals (sometimes including mercury). If wells purge dry, then samples will be collected as soon as sufficient sample water is available (80% of static water level). Primary site COCs will be sampled first. As performed previously, purge water generated during groundwater sampling will be purged to the ground surface away from the well being sampled.

14/16.21 Well locations will be photographed and identified on site plans. After sample collection, groundwater samples will be secured and shipped under proper chain-of-custody (CoC) by overnight carrier to SGS Orlando as described below and in Worksheet #26 and #27.

Field Quality Control Samples

14/16.22 QC tasks will be overseen by EA Field QC Manager. Requirements for calibration, maintenance, testing, and inspection of field equipment are summarized in Worksheet #22. QC forms are provided in **Appendix B** (Daily QC Report, Preparatory Phase Checklist, Initial Phase Checklist, Final/Pre-Final Inspection Checklist, QC Surveillance Report, Deficiency Management Record, Non-Conformance Report, and Corrective Action Request).

14/16.23 Field QC samples are intended to provide an indication of how consistent sample collection and analyses are over the course of the program. The analytical laboratory will analyze QC samples in accordance with the documents and procedures listed in Worksheet #28. Field QC samples are listed on Worksheet #20 and will include the following:

- ***Field Duplicates***—Collected at a minimum rate of 5% of project samples (1 per 20 field samples). Duplicates will be taken at the same time as primary samples. The purpose of these samples is to check the reproducibility of laboratory and field procedures and indicate non-homogeneity.

- ***MS/MSD***—Collected at a minimum rate of 5% of primary water samples (1 set per 20 field samples). MS/MSD samples are required by the laboratory to evaluate the matrix effect of the sample upon the analytical methodology. MS/MSD samples will be selected by the field staff and up to three times the normal sample volume will be collected to accommodate the extra volume required to prepare the MS/MSD samples at the laboratory.

- ***Trip Blanks***— A minimum of one, laboratory-supplied, trip blank will accompany each cooler containing groundwater VOC and/or dissolved gas (methane, ethane, ethene) samples sent to the laboratory for analysis. Trip blanks will be supplied by the laboratory in unopened, 40-milliliter (mL) volatile organic analysis vials filled with laboratory grade, analyte-free water.

- ***Field Blanks***—Collected at a rate of one per event for each group of water samples of similar matrix. Field blanks are collected to check cross contamination resulting from the use of non-dedicated or non-disposable sampling equipment. If reusable sample equipment is used and requires decontamination, then field blanks will be collected by pouring deionized water over the decontaminated sampling equipment and collecting water into empty sample bottles in the field.

Sample Handling and Management

14/16.24 Sample management is the process by which field samples are handled once collected. This process encompasses sample labeling, preservation, documentation, and shipment to the laboratory. Sample containers will be provided by the analytical laboratory, as detailed in Worksheet #19 and #30. Groundwater samples will be placed on ice in a cooler and maintained at less than 6 degrees Celsius (°C) immediately upon collection. Samples will be labeled, as detailed in Worksheet #26 and #27 and in accordance with SOP 001.

14/16.25 Sample custody documentation provides a written record of sample collection and analysis, and sample custody procedures provide for specific identification of samples associated with an exact location, the recording of pertinent information associated with the sample, and a CoC record that serves as physical evidence of sample custody. Sample CoC documents will be generated in accordance with SOP 002 (**Appendix D**). Analytical samples will be packed and shipped overnight to the analytical laboratory as detailed in Worksheet #26 and #27 and in accordance with SOP 004. Samples will be tracked by secure CoC protocol in accordance with SOP 002. Records concerning the custody and condition of the samples will be maintained in field and laboratory records. Air bills for overnight shipping will be retained.

LAND USE CONTROLS TASKS

14/16.26 Annual monitoring and maintenance of LUCs, including institutional controls, land use restrictions, and engineering controls is required for many SEADs in the program as described in applicable design documents and RODs. EPA and NYSDEC-approved LUC checklists and land use monitoring forms (**Appendix B**) will be used to document that LUC objectives for each site are being met and the inspections and any maintenance actions will be summarized in an annual LUC report. Annual inspections include land use evaluations, observations for intrusive activities, signs of erosion, and adequate signage. In addition to checklists and forms, photographs of each site will be collected and cataloged to document current site conditions. Figures detailing LUC site locations have been included in **Appendix G**.

MONITORING WELL INSTALLATION TASKS

14/16.27 No monitoring wells are currently planned for installation. However, well installation procedures are being provided in the event that new wells are needed. Well locations and well construction details will be approved by USACE and any necessary excavation permits will be obtained prior to the start of well installation activities. Monitoring well completion depths will be based on nearby receptor well depth and presumed average homeowner well production rate (5 gallons per minute) (NYSDOH 2006). A qualitative estimate of water produced from the well during drilling will be used to aid in selecting the final completion depth.

Subsurface Utility Clearance

14/16.28 Utility clearance will be conducted prior to monitoring well installation in accordance with SOP 003 (**Appendix D**). Dig Safely New York will be contacted at least 48 hours prior to well installation to obtain a routine ticket for utility location. Dig Safely New York ticket requests will be made by calling 811 (if inside New York) or 800-962-7962 if outside of New York or by placing a request online at http://www.digsafelynewyork.com using i-Notice. All utilities/communications lines would be marked before the exact well locations were determined. Additional methods to identify utilities may be used including geophysical survey and hand clearing. Proposed locations would be adjusted in the field based on utility clearance, as needed.

14/16.29 Monitoring well installation will be performed under the full-time supervision of an EA field geologist. Investigative derived waste generated during monitoring well installation handled as presented under investigative derived waste tasks. Well drilling equipment will be decontaminated between each location following the procedures presented under equipment decontamination tasks.

Overburden Monitoring Well Drilling

14/16.30 Overburden monitoring wells will be installed with a truck-mounted drill rig or an all-terrain vehicle mounted model rig equipped with hollow-stem augers in accordance with SOP 019 (**Appendix D**). Hollow stem augers will be used to advance the borehole through the overburden to auger refusal or the top of bedrock. A minimum 2-inch annular space between the borehole and the well casing will be maintained for placement of the filter pack and bentonite seal. Split spoon sampling will be conducted in accordance with American Society for Testing and Materials (ASTM) Method D1586 to allow for logging of subsurface soil and collection of geotechnical information. Subsurface soil will be collected continuously from the ground surface to the bottom of the borehole using a 2-inch diameter by 2-ft stainless steel splitspoon. Soil samples retrieved from the borehole will be logged by the EA field geologist. Monitoring well installation log field sheets are provided in Appendix B. Soil samples will not be submitted for laboratory analysis. At a minimum, the following information will be recorded:

- Global positioning system coordinates and projection/datum information
- Date/times drilling occurred
- Drill rig behavior and blow counts
- Percent recovery

- Headspace photoionization detector readings in accordance with SOP 011 (**Appendix D**).
- Lithology description in accordance with the Unified Soil Classification system ASTM Method D2487 and Burmeister Classification (including soil type, color, moisture content, density, texture, grain size and shape, consistency, etc.)
- Any unusual characteristics (e.g., odor, sheens, staining, etc.)
- Depth to water
- Depth to bedrock
- Borehole depth information

14/16.31 Overburden monitoring wells will be constructed with 2-inch internal diameter, threaded, flush-joint, polyvinyl chloride casings and 0.010-inch slotted well screens. The well screen, plug, and riser should be certified clean from the manufacturer. If they are not, they will be cleaned using a high-pressure steam cleaner. Joints and end caps will be threaded or force fitted. No Teflon tape, solvents, or glues will be used to connect well sections.

14/16.32 Overburden wells will be installed with a 5- to 10-ft section of well screen intersecting the water table at the overburden-bedrock interface unless greater lengths are required to meet project objectives. A locking compression plug will be installed at the top of the well riser. A filter pack consisting of Morie size #0 sand pack or equivalent, will be installed from a minimum of 6 inches below the bottom of the screen to a minimum of 3 ft above the screen. The filter pack will be tremied in and will be installed in increments as the augers are withdrawn to enable monitoring of progress and to prevent bridging. If bridging occurs, the bridge will be broken before proceeding with installation. If vertical space allows, and if required by USACE, a finer grained "choke" sand (100% passing a No. 30 sieve and less than 2% passing the No. 200 sieve) will be installed between the sand pack and the bentonite seal described below.

14/16.33 A bentonite chip or pellet seal with a minimum thickness of 2 ft will be placed above the filter pack. The seal will be manually hydrated using potable water in 6-inch lifts to allow proper hydration of bentonite. The remainder of the annular space will be filled with cement-bentonite grout to ground surface using a tremie pipe. The grout will be allowed to set before wells are developed. Overburden monitoring wells either will be completed at ground surface with an 8-inch flush mount curb box or as a stick-up well with a 4-inch steel protective casing pipe with lockable lid. An approximate 2-ft diameter 6-inch thick concrete pad will be installed around the curb box or protective casing. The well pad will be sloped away from the protective casing to shed surface water away from the well head. The annulus of the curb box or protective casing will be filled with gravel and a locking well cap will be installed at the top of the protective casing. For stick-up wells, a drain hole will be installed at the base of the protective casing and vent hole will also be located at the top of the protective casing. The well identification will be clearly visible on the inside and outside of the lid of the curb box or protective casing.

Bedrock Monitoring Well Drilling

14/16.34 Bedrock monitoring wells will be installed with a mobile air rotary drill mounted on an all-terrain vehicle or truck bed. Hollow stem augers will be used to advance the borehole through the overburden to the top of bedrock. During overburden drilling, split spoon sampling will be conducted and subsurface soil will be logged by the EA field geologist as discussed under Overburden Monitoring Well Installation.

14/16.35 Upon reaching bedrock, a 4-inch diameter steel drill casing will be placed in the borehole. The drill casing will be placed a minimum of 2 ft into competent bedrock. A cement-bentonite grout seal will be placed at the interface between the steel casing and the unconsolidated overburden/bedrock and allowed to cure. The borehole will be advanced using air rotary drilling techniques through the seal to the targeted depth. The project geologist will log bedrock chips on monitoring well installation log field sheets.

14/16.36 The borehole in bedrock will be developed with an air hammer to the desired depth as a 4-inch drill casing set into a minimum of 2 ft of competent bedrock. Wells will be grouted and the well screen will be established with a minimum of 10 ft of well screen (10 slot with #0 filter sand). If bedrock is unstable and likely to collapse into the borehole, a bedrock well will be installed in the borehole with the screened interval intersecting the water table interface following the specifications and procedures presented under Overburden Monitoring Well Installation. Bedrock wells will be completed with a steel protective cover and lock.

Well Survey

14/16.37 Horizontal and vertical elevations of newly installed monitoring wells will be surveyed by a state-licensed surveyor under the oversight of EA. Surveying will include the natural ground surface (not the top of the grout collar) of monitoring well and the highest point on the riser casing rim of the uncapped well casing and the protective casing. Vertical control will be established to the nearest +/-0.1 ft for all ground surface elevations. Elevations will be determined relative to the North American Vertical Datum of 1988, with reference made to an existing monument in the vicinity of the site. Horizontal control will be established by traverse runs to establish location with respect to the New York State planar horizontal coordinate grid system and provided in New York State Plane (North American Datum of 1983). Horizontal traverses will be tied into established permanent benchmarks. Horizontal traverse runs will be tied back to initial control points as a check for closure and error of closure was recorded. Horizontal coordinates will be reported in the New York State Plane West Zone (ft), North American Datum of 1983, to an accuracy of +/-0.5 ft.

MONITORING WELL DEVELOPMENT AND REDEVELOPMENT TASKS

14/16.38 Monitoring well development will be conducted for each newly installed monitoring well and existing monitoring wells identified as needing to be redeveloped. Groundwater turbidity data will be used to determine whether there are monitoring wells that should be redeveloped prior to sampling, with monitoring well redevelopment based on previous turbidity readings consistently greater than 50 NTU.

14/16.39 Well development will be conducted in accordance with SOP 019 (**Appendix D**) using surge and pump techniques to remove fines from the filter pack and assure effective communication between the well and the surrounding aquifer. Well development would be conducted no later than one month before planned sampling events. Newly installed monitoring wells will be developed a minimum of 24 hours after well installation.

14/16.40 Water levels and well depths will be measured prior to initiation of well development with an electronic water level indicator with an accuracy of 0.01 ft in accordance with SOP 010 (**Appendix D**). Wells will be purged with a submersible pump. Water depths, flow rates, and water quality parameters (pH, specific conductance, temperature, ORP, DO, TDS, and turbidity) will be monitored at 5-minute intervals throughout the development process using an electronic water level indicator with an accuracy of 0.01 ft; a flow measurement device (containers graduated in mL) and stop watch; and a multi-parameter water quality monitor with flow-through cell (Horiba U-22 water quality monitoring system or similar). A PID will be used to monitor vapor concentrations during purging and sampling in accordance with SOP 011 (**Appendix D**).

14/16.41 Liquid levels and water quality parameters will be recorded on well development logs presented in **Appendix B**. Any unusual conditions (colors, odors, surface sheens, etc.) noticed during well development, purging, or sampling will be recorded and reported.

14/16.42 Monitoring well development will be considered complete when water quality parameters have stabilized, a turbidity of less than 50 NTU units has been achieved, and a minimum of three to five times the standing water volume in the well (to include the well screen, casing, plus saturated annulus, assuming 30 percent annular porosity) has been removed.

- pH: ±0.1 standard units.
- Specific conductance: ±3 %
- Temperature: ±10 %
- ORP: ±10 millivolts
- DO: ±0.3 mg/L
- Turbidity: <50 NTU

MONITORING WELL ABANDONMENT TASKS

14/16.43 Wells will be approved for abandonment by USACE, NYSDEC, and EPA. Wells will be abandoned by overdrilling and removal of the well protective cover and well casing, as well as filling the borehole with cement-bentonite grout.

14/16.44 During well abandonment, an attempt will be made to remove the well before abandoning the borehole. Well abandonment, and any maintenance of wells, such as lock replacements, pad repairs, and cap replacements, will be detailed in subsequent groundwater reports.

EQUIPMENT DECONTAMINATION TASKS

14/16.45 Environmental sampling supplies will be dedicated whenever possible. All downhole drilling equipment used during monitoring well installation activities (if conducted) and non-dedicated/non-disposable sampling equipment that contacts or potentially could contact samples will be decontaminated prior to and between drilling/sampling locations in accordance with EA-SOP-005. Non-dedicated/non-disposable equipment including submersible pumps used during well development and purging activities and electric water level tapes will be decontaminated prior to starting work on the first location, and between locations. Decontamination fluid contained in the 5-gallon buckets will be properly disposed of at the end of the day or more frequently as presented under IDW Tasks, below.

14/16.46 Purging and sampling equipment will be protected from contamination until ready for use. In addition, care will be taken to prevent samples from coming into contact with potentially contaminating substances, such as tape, oil, engine exhaust, corroded surfaces, and dirt.

INVESTIGATIVE DERIVED WASTE TASKS

14/16.47 IDW generated during monitoring well installation and abandonment activities (if conducted), well development/re-development, and groundwater sampling will be disposed of at the ground surface as historically handled during previous investigation activities at the site.

14/16.48 IDW anticipated during the groundwater LTM effort is expected to consist of purge water, decontamination wastewater, and expendable waste used in completing the investigation (disposable gloves, tubing, and general trash). No hazardous waste is anticipated. As performed previously, purge water generated during monitoring well sampling activities will be purged to ground surface unless otherwise directed by USACE and NYSDEC.

14/16.49 IDW generated during monitoring well installation will be spread on the ground in the vicinity of the well-head. Materials recovered during well abandonment such as well protective cover and well casing will be disposed of in municipal waste receptacles as general refuse.

14/16.50 Other generated waste such as plastic tubing, gloves, etc. will be disposed of in municipal waste receptacles as general refuse.

LABORATORY ANALYSIS TASKS

Sample Analysis

14/16.51 The analytical laboratory will process and analyze samples according to the sample CoC documents and the requirements of this UFP-QAPP. Following receipt at the laboratory, samples will be tracked using laboratory sample logs.

14/16.52 The planned analyses of samples are presented in Worksheet #18.

14/16.53 Project QLs and the selected screening criteria for each of the methods, matrices, and analytes that will be evaluated are presented in Worksheet #15. The analytical testing methodologies are listed in Worksheet #19 and #30. Analytical SOPs are listed in Worksheet #23 and provided in **Appendix C**.

Laboratory Quality Control Tasks

14/16.54 Laboratory QC tasks provide an indication of accuracy, precision, and sensitivity of analytical methods for each analytical batch of field samples that are analyzed. The laboratory must adhere to a QA program that is used to monitor and control laboratory QC activities and must have a written QA manual that describes the QA program in detail. The laboratory will be responsible for conducting laboratory QC procedures and reporting laboratory QC results in accordance with laboratory SOPs. The Laboratory QA Manager is responsible for ensuring that laboratory internal QC checks are conducted in accordance with applicable methods and protocols, the laboratory's QA manual and the requirements of this UFP-QAPP.

14/16.55 Details regarding analytical method QC are provided in Worksheet #28. Internal and continuing calibration verification and instrument maintenance will be conducted as summarized in Worksheet #24 and #25. Measurement performance criteria is specified in Worksheet #12. Worksheet #15 presents PALs and laboratory reference limits. Laboratory QC samples including method blanks, LCS, MS/MSDs, and calibration check standards will be prepared and analyzed in accordance with the analytical method requirements, the laboratory's QA Plan, and laboratory SOPs as listed in Worksheet #23 and provided in **Appendix D**, as well as this UFP-QAPP.

LABORATORY REPORTING TASKS – LABORATORY

14/16.56 The analytical laboratory will provide EQuIS NYSDEC electronic data deliverable (EDD) version 7.22.1 deliverables in accordance with the most recently published NYSDEC EDD Manual and EDDs in ERIS or Headquarters Army Environmental System (HQAES) format, as well as portable document formats (PDFs) of the final analytical reports, including supporting documentation such as chromatograms and instrument calibrations. The laboratory will send the EDDs and final analytical reports to the Contractor.

14/16.57 The analytical data package will contain adequate information and be presented in a clear and concise manner, in a format consistent with Appendix A of the Quality Systems Manual (QSM) Version 5.4 (DoD 2021) and the DoD General Data Validation Guidelines (DoD 2019a) and associated modules.

14/16.58 A reviewer should be able to determine the precision, accuracy, representativeness, comparability, completeness, and sensitivity of the data, based on the information contained in the data package. Additional information may be required, depending on the detail of the data review performed.

14/16.59 The complete laboratory data report will be submitted as an Adobe Acrobat™ PDF file. The PDF file will be searchable. A table of contents is required in the PDF file; bookmarks shall be created such that there is a logical organization/presentation of the analytical data. Data shall be organized at least by analytical method, and preferably also by laboratory batch. Elements required for third-party data validation will be present. Note that laboratory procedures used to generate the chemistry data shall also adhere to the 2021 DoD QSM Version 5.4, or most current version to which the laboratory is accredited.

DATA REVIEW TASKS

14/16.60 Data review process will consist of verification, validation, and usability assessment. Data review activities for analytical data and other project inputs are summarized in Worksheets #34, #35, #36, and #37. Corrective actions will be made upon decision of necessity to maintain the overall quality of the project data.

Data Verification and Validation

14/16.61 Analytical data will be verified by the laboratory QC Manager prior to laboratory return of data packages to the Project Chemist. Analytical data will be verified by the Project Chemist for completeness upon receipt prior to submitting to the independent third-party validator, Environmental Data Services, Ltd. for manual data validation. Analytical data packages will be reviewed by the third-party validator to ensure that required laboratory components are included, QA/QC requirements were performed, and data use restrictions were well defined. The analytical data will be qualified and appropriately flagged by the data validator. The validator will supply a data validation report to ensure compliance. Analytical data that are qualified will be taken into account during the interpretation of the data.

Data Usability Assessment

14/16.62 An assessment of data usability will be performed as described in Worksheet #37 using precision, accuracy, representativeness, completeness, comparability, and sensitivity parameters. Limitations will be compared to the DQOs and evaluation criteria. Corrective actions will be made upon decision of necessity to maintain the overall quality of the project. A data usability report will be provided as an appendix to Periodic Review Reports and will include an evaluation addressing how data quality issues may impact decision-making and the DQOs.

Data Evaluation

14/16.63 Field data will be compiled from field logs and presented in the subsequent report within tables, text, figures, and appendixes, as appropriate. Analytical data will be validated and presented in tables.

14/16.64 A data package will be generated for this project by the analytical laboratory and will include a case narrative, CoC record, QC summary data, sample results, standards data, raw QC data, and bench sheets for each analytical method. The concentration measurements not known to be in error will be considered valid; suspect outliers will not be removed from the data set and will be included in the analyses. Concentrations below the DL will be reported as non-detect at the LOD with a U qualifier (e.g., if the LOD is 0.5 micrograms per liter [µg/L], a concentration below the DL will be set at 0.5 µg/L); a positive concentration detected below the LOQ but above the DL will be at the concentration with a J qualifier (e.g., 0.2 µg/L J).

FIELD DOCUMENTATION AND RECORDS TASKS

14/16.65 Daily field reports will be used to record information about each field activity, including field personnel at the site, daily weather conditions, site conditions, tasks completed, general field notes, samples collected, field screening results, and deviations from the approved UFP-QAPP and other plans as detailed in SOP 016. Field reports are the main reference documents. Field activities will be recorded daily using black or blue ballpoint pens. Each page of field notes shall be numbered and dated, and initials of all crew members will be defined. Errors shall be crossed out with a single line, initialed, and dated, and correct data entered adjacent to the error.

14/16.66 Pertinent information collected during site LUC inspections will be logged in the field forms, including the following:

- Date and time of site inspection
- Weather conditions
- SEAD number
- Condition of site
- State of LUC objectives
- Field observations
- Photographs

14/16.67 Pertinent information collected during groundwater LTM will be logged in the field forms, including the following:

- Date and time of sample collection
- Weather conditions
- Location number and name
- Location of sampling point
- Sample ID number
- Type of sample
- Condition of monitoring well or sample location
- Field observations
- References, such as maps or photographs of the sampling site
- Collection of QC samples

14/16.68 The following field documentation procedures will be followed:

- Ensure that the date and start/end time of activities, personnel on-site, site conditions (including presence of airborne particulates [soot, dust, etc. from heavy truck traffic], and presence of unusual odors) and visitors on-site (as well as arrival and departure times) for each day are recorded.

- Ensure that weather entry for each day includes cloud cover (partly cloudy, full sun, etc.), precipitation (type and intensity), wind direction, temperature, wind speed, and humidity.

- Ensure that well condition, including signs of damage or vandalism, is recorded.

- Ensure that the personal protective equipment, contract documents being followed, serial numbers of equipment utilized, serial/tracking number of shipments, deviances from the site plan, and times on-site and off-site are listed in the appropriate field forms.

- Ensure specific times are listed for each activity observed at the site in the field forms.

- Ensure when author releases a specific field form that the new author must print his/her name and sign the field forms prior to making entries.

14/16.69 Field sheets will be maintained by the sampling team to provide a daily record of significant events, observations, and measurements taken during the field investigation. The field log sheets are intended to provide sufficient data and observations to enable the field team to reconstruct events that occur during the project. Field sheets will include daily field logs, daily calibration forms, and checklists, sample forms, and sample collection checklists. Additional field forms, including H&S forms, provided in the APP (**Appendix E**) will be completed for this project.

14/16.70 Photographs will be used to document site work and the progress of field activities, as well as unusual conditions observed during field activities.

14/16.71 Hard copy data (field forms, photographs, hard copies of CoC records, airbills, etc.) will be kept in the project files.

ASSESSMENT/AUDIT TASKS

14/16.72 SOPs will be reviewed prior to the performance of tasks. Technical system audits will be performed as required (Worksheet #31, #32, and #33). Independent technical review, and deliverable checks will be performed to assess the quality of field and reporting tasks. The project development team will perform interdisciplinary checks to ensure minimal interference between tasks. The PM will be responsible for responding to the assessment findings, including corrective actions.

14/16.73 The Laboratory QA Manager will conduct assessments of the laboratory procedures and data as described in the laboratory’s QA manual. The DoD-accredited laboratories are periodically audited through the DoD ELAP as part of the certification process.

DATA MANAGEMENT TASKS

14/16.74 Validated analytical data will be housed in EA’s EQuIS database platform. Data and documentation will be provided to the COR in the Headquarters Army Environmental System. Validated analytical EDDs will be exported from EA EQuIS database and provided to the COR in the ERIS format and in NYSDEC EQuIS EDD format on a quarterly basis. Data and field notes will be maintained in the EA Syracuse, New York, office. Hard copies of data will also be stored in project files. Worksheet #29 discusses project documents and records.

Geographical Information System Data Management

14/16.75 For GIS data, a site-specific file geo-database will be created/maintained in accordance with all applicable federal, DoD, and Army geospatial data standards (Engineer Regulation 1110-1-8156, EM 1110-1-2909, EM 200-1-2, EM 1110-1-1200, EM 200-1-15, and Data Item Description HNC-006.02). Specifically, this geospatial database will be generated using an Environmental Systems Research Institute GIS software platform (ArcGIS Desktop versus 10.7/ArcGIS Pro Version 2.50) and will conform to Spatial Data Standards for Facilities, Infrastructure, and Environment Version 2.6 compliant feature datasets, which are accompanied by metadata conforming to the Federal Geographic Data Committee Content Standard for Digital Geospatial Metadata and the Army Installation Geospatial Information and Services Metadata Standard, v1.

14/16.76 The geospatial database will be routinely updated throughout the project life cycle. Geospatial database feature classes will include all historical data and data created during the project including, but not limited to cultural resources; and environmental, biological, and socioeconomic information. All data collected during the field activities will be stored, managed, and available to stakeholders designated by USACE in the geospatial database(s) maintained throughout this project. Georeferencing utilizing GPS receivers where possible and land survey techniques where it is not, will be used to position data elements at the site. Data unique to individual field events will be identified as such and updated in the geodatabase within 10 days after completion of field activities.

14/16.77 Geospatial data will be provided in the horizontal coordinate system and vertical datum requested by the Government. The horizontal accuracy of geospatial data will be tested and reported in accordance with the National Standard for Spatial Data Accuracy and the results will be recorded in the metadata. Feature class attribute tables will be populated with relevant records data (e.g., sample location names, etc.).

14/16.78 Project stakeholders will be provided internet access to the GIS database via SharePoint and/or a secure online web portal for near real-time GIS data updates. The web portal will be accessible via a secure login for the duration of the project. The portal will consist of an interactive mapping interface that will allow viewing of geospatial data and groundwater sampling status updates once the data has undergone QC checks by the Contractor. Personal data associated with property owner names will not be utilized in map output documents and archaeological and ecological data, if discovered, will be segregated For Official Use Only and not be released to the public without written approval from USACE.

14/16.79 During project closeout, the final geospatial database and associated metadata will be transmitted to the USACE for final acceptance and approval.

REPORTING TASKS

14/16.80 Recurring reports will consist of weekly, monthly, and annual groundwater and LUC inspection reports documenting field activities. Reports will include the following:

- Weekly reports during ongoing field activities detailing work and quantities completed for that week, forecast estimated activities for upcoming week, detail QC and safety progress, and any other significant issues.

- Monthly project status reports providing summary information that includes, but is not limited to, work performed, work scheduled for the upcoming period, technical issues, regulatory issues that may hamper project schedule, and any other project-related issues raised by any of the stakeholders.

- Groundwater and LUC inspection reports that include summaries of previous investigations, (including prior events, treatments, and injections), findings of the most recent event, and recommendations for future events.

14/16.81 Additional reports will be prepared to document non-recurring field activities/events on an as needed basis and will include, but are not limited to:

- UFP-QAPP Addendum

- Accident and/or injury reports.

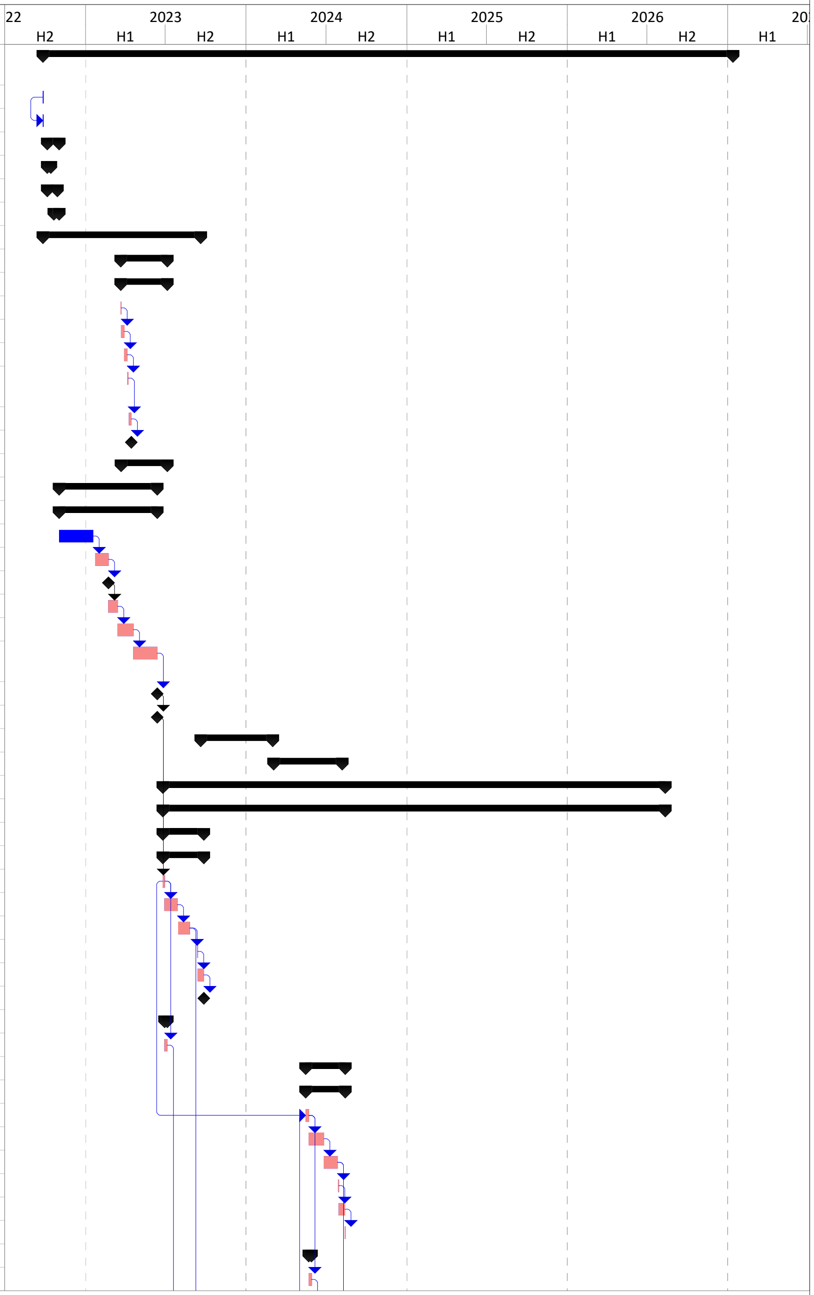
- Nonconformance Item of Work ID and the subsequent Corrective Action Reports.

14/16.82 Major deliverables will be submitted in three phases (Internal Deliberative, Draft, and Final) unless otherwise coordinated with USACE.

This page intentionally left blank

Long Term Monitoring/Land Use Control (LTM/LUC) Management and LTM/LUC Optimization
at the Former Seneca Army Depot, Romulus, NY

ID	Task Name	Duration	Calendar Days	Start	Finish
1	**Long Term Monitoring/Land Use Control (LTM/LUC) Management and LTM/LUC Optimization at the Former Seneca Army Depot, Romulus, NY**	**1078 days**		**Mon 9/26/22**	**Tue 1/12/27**
2	Contract Award (Contract POP = 10 Years, 9/25/2032)	1 day	1 day	Mon 9/26/22	Mon 9/26/22
3	Notice to Proceed	1 day	1 day	Mon 9/26/22	Mon 9/26/22
4	**BASE CLIN 0001 - Project Management Plan (PMP)**	**18 days**		**Thu 10/6/22**	**Tue 11/1/22**
5	**Project Kick-off Meeting**	**5 days**		**Thu 10/6/22**	**Thu 10/13/22**
8	**Project Management Plan (PMP)**	**16 days**		**Thu 10/6/22**	**Fri 10/28/22**
14	**Site Visit**	**8 days**		**Fri 10/21/22**	**Tue 11/1/22**
18	**CLIN 0002 - LTM/LUC Optimization Research and Report (ON HOLD PENDING BACKGROUND S**	**248 days**		**Mon 9/26/22**	**Tue 9/19/23**
29	**CLIN 0003 - Systematic Project Planning**	**73 days**		**Wed 3/22/23**	**Wed 7/5/23**
30	**SPP Meeting #1**	**73 days**		**Wed 3/22/23**	**Wed 7/5/23**
31	SPP Meeting #1	1 day	1 day	Wed 3/22/23	Wed 3/22/23
32	Prepare/Submit Meeting Minutes	5 days	7 days	Thu 3/23/23	Wed 3/29/23
33	Army Review of Draft Meeting Minutes	5 days	7 days	Thu 3/30/23	Wed 4/5/23
34	Respond to Comments on Army Review of Draft Meeting Minutes and Prepare/Submit Final Meeting Minutes	2 days	2 days	Thu 4/6/23	Fri 4/7/23
35	Army Review of Final Meeting Minutes	5 days	5 days	Mon 4/10/23	Fri 4/14/23
36	Army Approval of Final Meeting Minutes	0 days	0 days	Fri 4/14/23	Fri 4/14/23
37	**SPP Memorandum (If Needed)**	**72 days**		**Thu 3/23/23**	**Wed 7/5/23**
46	**CLIN 0004 - UFP-QAPP LTM/LUC**	**154 days**		**Wed 11/2/22**	**Mon 6/12/23**
47	**Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP) - Includes APP**	**154 days**		**Wed 11/2/22**	**Mon 6/12/23**
48	Prepare/Submit Internal Deliberative UFP-QAPP	52 days	77 days	Wed 11/2/22	Tue 1/17/23
49	Army Review of Internal Deliberative UFP-QAPP	21 days	30 days	Mon 1/23/23	Tue 2/21/23
50	Army Acceptance of Internal Deliberative LTM/LUC UFP-QAPP	0 days	0 days	Tue 2/21/23	Tue 2/21/23
51	Respond to Comments and Prepare/Submit Draft UFP-QAPP	15 days	21 days	Wed 2/22/23	Tue 3/14/23
52	Regulatory Review of Draft UFP-QAPP	26 days	36 days	Wed 3/15/23	Wed 4/19/23
53	Respond to Comments on Regulatory Review of Draft UFP-QAPP and Prepare/Submit Final UFP-QAPP	37 days	54 days	Thu 4/20/23	Mon 6/12/23
54	Army & Regulatory Review of Final UFP-QAPP	0 days	0 days	Mon 6/12/23	Mon 6/12/23
55	Army & Regulatory Approval of Final LTM/LUC UFP-QAPP	0 days	0 days	Mon 6/12/23	Mon 6/12/23
56	**OPTION CLIN 0005 - UFP-QAPP for Optimization Effort**	**112 days**		**Wed 9/20/23**	**Fri 3/1/24**
66	**CLIN 0005a - Site Specific Addendum QAPP for Opt Sampling for 5 Sites**	**109 days**		**Mon 3/4/24**	**Tue 8/6/24**
76	**CLIN 0008 - Field Activities**	**786 days**		**Mon 6/26/23**	**Tue 8/11/26**
77	**CLIN 0008a - O&M Field Sampling Activities for 42 sites, Years 1 - 4**	**786 days**		**Mon 6/26/23**	**Tue 8/11/26**
78	**LTM Sampling - Year 1**	**65 days**		**Mon 6/26/23**	**Tue 9/26/23**
79	**Annual Sampling (including Ash Landfill)**	**65 days**		**Mon 6/26/23**	**Tue 9/26/23**
80	Annual Sampling (including Ash Landfill)	4 days	4 days	Mon 6/26/23	Thu 6/29/23
81	Lab Analysis	20 days	29 days	Fri 6/30/23	Fri 7/28/23
82	Data Validation	20 days	26 days	Mon 7/31/23	Fri 8/25/23
83	Submission of Annual LTM - Data Report	1 day	1 day	Tue 9/12/23	Tue 9/12/23
84	Army Review Annual LTM - Data Report	10 days	14 days	Wed 9/13/23	Tue 9/26/23
85	Army Approval of LTM - Data Report	0 days	0 days	Tue 9/26/23	Tue 9/26/23
86	**Site Inspections**	**3 days**		**Fri 6/30/23**	**Wed 7/5/23**
87	Site Inspections	3 days	6 days	Fri 6/30/23	Wed 7/5/23
88	**LTM Sampling - Year 2**	**61 days**		**Thu 5/16/24**	**Tue 8/13/24**
89	**Annual Sampling (including Ash Landfill)**	**61 days**		**Thu 5/16/24**	**Tue 8/13/24**
90	Annual Sampling (including Ash Landfill)	5 days	7 days	Thu 5/16/24	Wed 5/22/24
91	Lab Analysis	22 days	34 days	Thu 5/23/24	Tue 6/25/24
92	Data Validation	22 days	31 days	Wed 6/26/24	Fri 7/26/24
93	Submission of Annual LTM - Data Report	1 day	1 day	Mon 7/29/24	Mon 7/29/24
94	Army Review Annual LTM - Data Report	10 days	14 days	Tue 7/30/24	Mon 8/12/24
95	Army Approval of LTM - Data Report	1 day	1 day	Tue 8/13/24	Tue 8/13/24
96	**Site Inspections**	**3 days**		**Thu 5/23/24**	**Tue 5/28/24**
97	Site Inspections	3 days	6 days	Thu 5/23/24	Tue 5/28/24

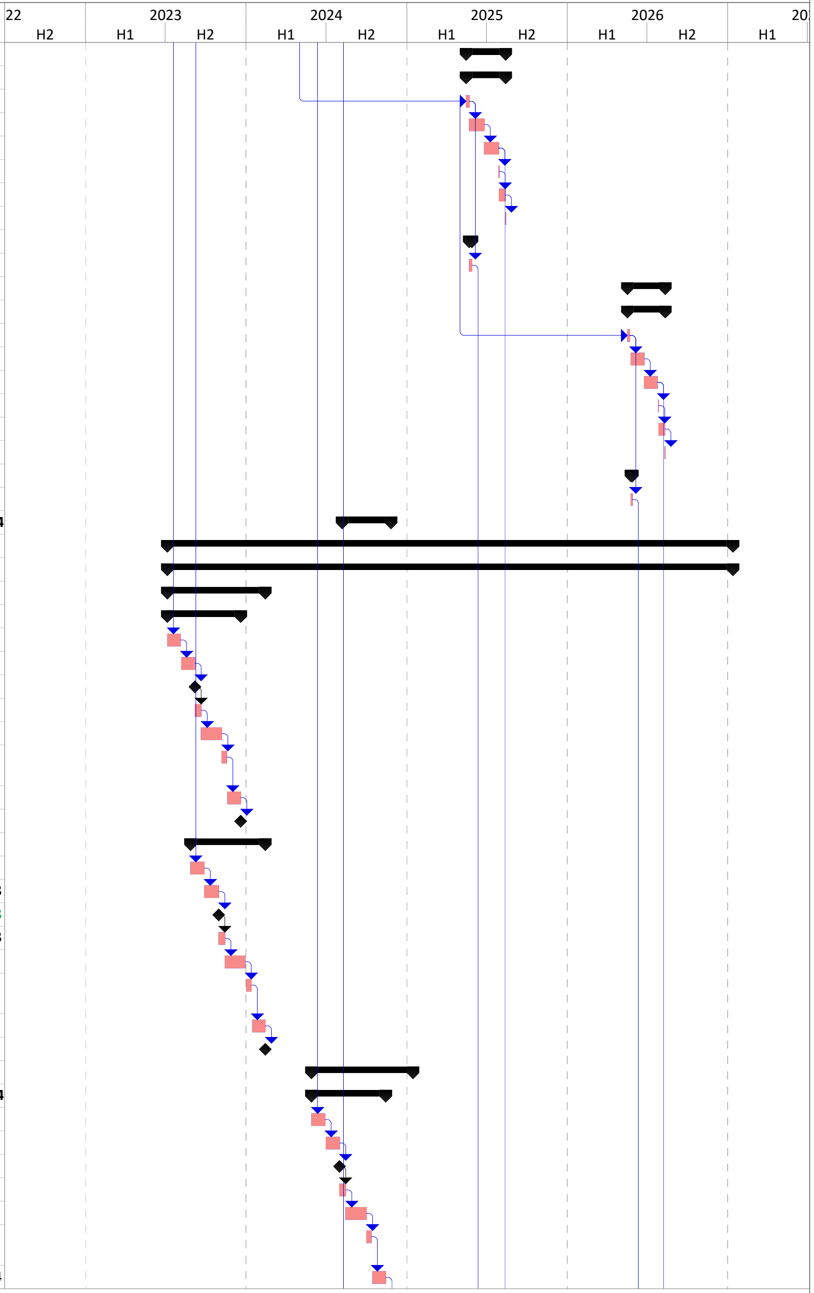


Last Update: 14 June 2023
SEAD LTM/LUC Project Schedule

Task	Milestone	Summary	Critical
🟦	◆	▬	🟥

Long Term Monitoring/Land Use Control (LTM/LUC) Management and LTM/LUC Optimization
at the Former Seneca Army Depot, Romulus, NY

ID	Task Name	Duration	Calendar Days	Start	Finish
98	**LTM Sampling - Year 3**	**61 days**	1 day	**Fri 5/16/25**	**Wed 8/13/25**
99	**Annual Sampling (including Ash Landfill)**	**61 days**	1 day	**Fri 5/16/25**	**Wed 8/13/25**
100	Annual Sampling (including Ash Landfill)	5 days	7 days	Fri 5/16/25	Thu 5/22/25
101	Lab Analysis	22 days	34 days	Fri 5/23/25	Wed 6/25/25
102	Data Validation	22 days	33 days	Thu 6/26/25	Mon 7/28/25
103	Submission of Annual LTM - Data Report	1 day	1 day	Tue 7/29/25	Tue 7/29/25
104	Army Review Annual LTM - Data Report	10 days	14 days	Wed 7/30/25	Tue 8/12/25
105	Army Approval of LTM - Data Report	1 day	1 day	Wed 8/13/25	Wed 8/13/25
106	**Site Inspections**	**3 days**	1 day	**Fri 5/23/25**	**Wed 5/28/25**
107	Site Inspections	3 days	6 days	Fri 5/23/25	Wed 5/28/25
108	**LTM Sampling - Year 4**	**61 days**	1 day	**Mon 5/18/26**	**Tue 8/11/26**
109	**Annual Sampling (including Ash Landfill)**	**61 days**	1 day	**Mon 5/18/26**	**Tue 8/11/26**
110	Annual Sampling (including Ash Landfill)	5 days	5 days	Mon 5/18/26	Fri 5/22/26
111	Lab Analysis	22 days	30 days	Tue 5/26/26	Wed 6/24/26
112	Data Validation	22 days	30 days	Thu 6/25/26	Fri 7/24/26
113	Submission of Annual LTM - Data Report	1 day	1 day	Mon 7/27/26	Mon 7/27/26
114	Army Review Annual LTM - Data Report	10 days	14 days	Tue 7/28/26	Mon 8/10/26
115	Army Approval of LTM - Data Report	1 day	1 day	Tue 8/11/26	Tue 8/11/26
116	**Site Inspections**	**3 days**	1 day	**Tue 5/26/26**	**Thu 5/28/26**
117	Site Inspections	3 days	3 days	Tue 5/26/26	Thu 5/28/26
118	**CLIN 0008d - Field Sampling Activities for LTM/LUC Optimization Effort each Site for 5 Sites**	**76 days**		**Wed 8/7/24**	**Mon 11/25/24**
127	**CLIN 0009 - Report(s)**	**883 days**		**Thu 7/6/23**	**Tue 1/12/27**
128	**CLIN 0009a - ROD Required Documents for 42 sites, Years 1 - 4**	**883 days**		**Thu 7/6/23**	**Tue 1/12/27**
129	**Annual Site Specific LTM/LUC Reports - Year 1**	**153 days**		**Thu 7/6/23**	**Tue 2/13/24**
130	**LUC Report**	**116 days**		**Thu 7/6/23**	**Tue 12/19/23**
131	Prepare/Submit Internal Deliberative Annual LUC Report	22 days	30 days	Thu 7/6/23	Fri 8/4/23
132	Army Review of Internal Deliberative Annual LUC Report	22 days	31 days	Mon 8/7/23	Wed 9/6/23
133	Army Acceptance of Internal Deliberative Annual LUC Report	0 days	0 days	Wed 9/6/23	Wed 9/6/23
134	Respond to Comments and Prepare/Submit Draft Annual LUC Report	10 days	14 days	Thu 9/7/23	Wed 9/20/23
135	Regulatory Review of Draft Annual LUC Report	32 days	47 days	Thu 9/21/23	Mon 11/6/23
136	Respond to Comments on Regulatory Review of Draft Annual LUC Report and Prepare/Submit Final Annual LUC Report	9 days	11 days	Tue 11/7/23	Fri 11/17/23
137	Army & Regulatory Review of Final Annual LUC Report	21 days	30 days	Mon 11/20/23	Tue 12/19/23
138	Army & Regulatory Approval of Final Annual LUC Report	0 days	0 days	Tue 12/19/23	Tue 12/19/23
139	**Annual LTM Report**	**116 days**		**Mon 8/28/23**	**Tue 2/13/24**
140	Prepare/Submit Internal Deliberative Annual LTM Report	22 days	31 days	Mon 8/28/23	Wed 9/27/23
141	Army Review of Internal Deliberative Annual LTM Report	22 days	33 days	Thu 9/28/23	Mon 10/30/23
142	Army Acceptance of Internal Deliberative Annual LTM Report	0 days	0 days	Mon 10/30/23	Mon 10/30/23
143	Respond to Comments and Prepare/Submit Draft Annual LTM Report	10 days	14 days	Tue 10/31/23	Mon 11/13/23
144	Regulatory Review of Draft Annual LTM Report	32 days	46 days	Tue 11/14/23	Fri 12/29/23
145	Respond to Comments on Regulatory Review of Draft Annual LTM Report and Prepare/Submit Final Annual LTM Report	9 days	11 days	Tue 1/2/24	Fri 1/12/24
146	Army & Regulatory Review of Final Annual LTM Report	21 days	29 days	Tue 1/16/24	Tue 2/13/24
147	Army & Regulatory Approval of Final Annual LTM Report	0 days	0 days	Tue 2/13/24	Tue 2/13/24
148	**Annual Site Specific LTM/LUC Report - Year 2**	**157 days**		**Wed 5/29/24**	**Tue 1/14/25**
149	**LUC Report**	**116 days**		**Wed 5/29/24**	**Wed 11/13/24**
150	Prepare/Submit Internal Deliberative Annual LUC Report	22 days	31 days	Wed 5/29/24	Fri 6/28/24
151	Army Review of Internal Deliberative Annual LUC Report	22 days	31 days	Mon 7/1/24	Wed 7/31/24
152	Army Acceptance of Internal Deliberative Annual LUC Report	0 days	0 days	Wed 7/31/24	Wed 7/31/24
153	Respond to Comments and Prepare/Submit Draft Annual LUC Report	10 days	14 days	Thu 8/1/24	Wed 8/14/24
154	Regulatory Review of Draft Annual LUC Report	32 days	47 days	Thu 8/15/24	Mon 9/30/24
155	Respond to Comments on Regulatory Review of Draft Annual LUC Report and Prepare/Submit Final Annual LUC Report	9 days	11 days	Tue 10/1/24	Fri 10/11/24
156	Army& Regulatory Review of Final Annual LUC Report	21 days	30 days	Tue 10/15/24	Wed 11/13/24

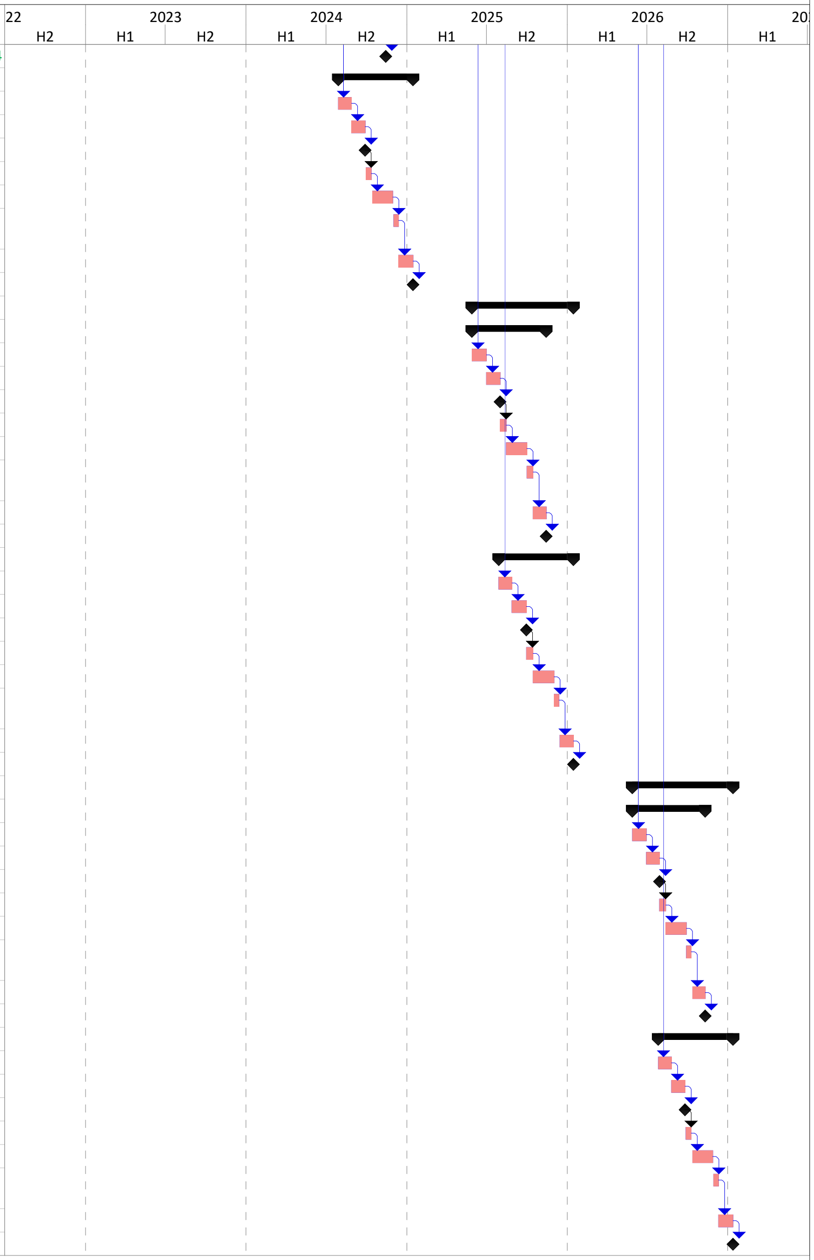


Last Update: 14 June 2023
SEAD LTM/LUC Project Schedule

Task ▬ Milestone ◆ Summary ▬ Critical 🟥

Long Term Monitoring/Land Use Control (LTM/LUC) Management and LTM/LUC Optimization
at the Former Seneca Army Depot, Romulus, NY

ID	Task Name	Duration	Calendar Days	Start	Finish
157	Army& Regulatory Approval of Final Annual LUC Report	0 days	0 days	Wed 11/13/24	Wed 11/13/24
158	**Annual LTM Report LTM**	**116 days**		**Mon 7/29/24**	**Tue 1/14/25**
159	Prepare/Submit Internal Deliberative Annual LTM Report	22 days	30 days	Mon 7/29/24	Tue 8/27/24
160	Army Review of Internal Deliberative Annual LTM Report	22 days	31 days	Wed 8/28/24	Fri 9/27/24
161	Army Acceptance of Internal Deliberative Annual LTM Report	0 days	0 days	Fri 9/27/24	Fri 9/27/24
162	Respond to Comments and Prepare/Submit Draft Annual LTM Report	10 days	12 days	Mon 9/30/24	Fri 10/11/24
163	Regulatory Review of Draft Annual LTM Report	32 days	46 days	Tue 10/15/24	Fri 11/29/24
164	Respond to Comments on Regulatory Review of Draft Annual LTM Report and Prepare/Submit Final Annual LTM Report	9 days	11 days	Mon 12/2/24	Thu 12/12/24
165	Army & Regulatory Review of Final Annual LTM Report	21 days	33 days	Fri 12/13/24	Tue 1/14/25
166	Army & Regulatory Approval of Final Annual LTM Report	0 days	0 days	Tue 1/14/25	Tue 1/14/25
167	**Annual Site Specific LTM/LUC Report - Year 3**	**157 days**		**Thu 5/29/25**	**Wed 1/14/26**
168	**LUC Report**	**116 days**		**Thu 5/29/25**	**Thu 11/13/25**
169	Prepare/Submit Internal Deliberative Annual LUC Report	22 days	33 days	Thu 5/29/25	Mon 6/30/25
170	Army Review of Internal Deliberative Annual LUC Report	22 days	31 days	Tue 7/1/25	Thu 7/31/25
171	Army Acceptance of Internal Deliberative Annual LUC Report	0 days	0 days	Thu 7/31/25	Thu 7/31/25
172	Respond to Comments and Prepare/Submit Draft Annual LUC Report	10 days	14 days	Fri 8/1/25	Thu 8/14/25
173	Regulatory Review of Draft Annual LUC Report	32 days	47 days	Fri 8/15/25	Tue 9/30/25
174	Respond to Comments on Regulatory Review of Draft Annual LUC Report and Prepare/Submit Final Annual LUC Report	9 days	14 days	Wed 10/1/25	Tue 10/14/25
175	Army&Regulatory Review of Final Annual LUC Report	21 days	30 days	Wed 10/15/25	Thu 11/13/25
176	Army&Regulatory Approval of Final Annual LUC Report	0 days	0 days	Thu 11/13/25	Thu 11/13/25
177	**Annual LTM Report LTM**	**116 days**		**Tue 7/29/25**	**Wed 1/14/26**
178	Prepare/Submit Internal Deliberative Annual LTM Report	22 days	30 days	Tue 7/29/25	Wed 8/27/25
179	Army Review of Internal Deliberative Annual LTM Report	22 days	33 days	Thu 8/28/25	Mon 9/29/25
180	Army Acceptance of Internal Deliberative Annual LTM Report	0 days	0 days	Mon 9/29/25	Mon 9/29/25
181	Respond to Comments and Prepare/Submit Draft Annual LTM Report	10 days	15 days	Tue 9/30/25	Tue 10/14/25
182	Regulatory Review of Draft Annual LTM Report	32 days	48 days	Wed 10/15/25	Mon 12/1/25
183	Respond to Comments on Regulatory Review of Draft Annual LTM Report and Prepare/Submit Final Annual LTM Report	9 days	11 days	Tue 12/2/25	Fri 12/12/25
184	Army & Regulatory Review of Final Annual LTM Report	21 days	31 days	Mon 12/15/25	Wed 1/14/26
185	Army & Regulatory Approval of Final Annual LTM Report	0 days	0 days	Wed 1/14/26	Wed 1/14/26
186	**Annual Site Specific LTM/LUC Report - Year 4**	**157 days**		**Fri 5/29/26**	**Tue 1/12/27**
187	**LUC Report**	**116 days**		**Fri 5/29/26**	**Tue 11/10/26**
188	Prepare/Submit Internal Deliberative Annual LUC Report	22 days	32 days	Fri 5/29/26	Mon 6/29/26
189	Army Review of Internal Deliberative Annual LUC Report	22 days	30 days	Tue 6/30/26	Wed 7/29/26
190	Army Acceptance of Internal Deliberative Annual LUC Report	0 days	0 days	Wed 7/29/26	Wed 7/29/26
191	Respond to Comments and Prepare/Submit Draft Annual LUC Report	10 days	14 days	Thu 7/30/26	Wed 8/12/26
192	Regulatory Review of Draft Annual LUC Report	32 days	47 days	Thu 8/13/26	Mon 9/28/26
193	Respond to Comments on Regulatory Review of Draft Annual LUC Report and Prepare/Submit Final Annual LUC Report	9 days	11 days	Tue 9/29/26	Fri 10/9/26
194	Army&Regulatory Review of Final Annual LUC Report	21 days	29 days	Tue 10/13/26	Tue 11/10/26
195	Army&Regulatory Approval of Final Annual LUC Report	0 days	0 days	Tue 11/10/26	Tue 11/10/26
196	**Annual LTM Report LTM**	**116 days**		**Mon 7/27/26**	**Tue 1/12/27**
197	Prepare/Submit Internal Deliberative Annual LTM Report	22 days	30 days	Mon 7/27/26	Tue 8/25/26
198	Army Review of Internal Deliberative Annual LTM Report	22 days	31 days	Wed 8/26/26	Fri 9/25/26
199	Army Acceptance of Internal Deliberative Annual LTM Report	0 days	0 days	Fri 9/25/26	Fri 9/25/26
200	Respond to Comments and Prepare/Submit Draft Annual LTM Report	10 days	12 days	Mon 9/28/26	Fri 10/9/26
201	Regulatory Review of Draft Annual LTM Report	32 days	46 days	Tue 10/13/26	Fri 11/27/26
202	Respond to Comments on Regulatory Review of Draft Annual LTM Report and Prepare/Submit Final Annual LTM Report	9 days	11 days	Mon 11/30/26	Thu 12/10/26
203	Army & Regulatory Review of Final Annual LTM Report	21 days	33 days	Fri 12/11/26	Tue 1/12/27
204	Army & Regulatory Approval of Final Annual LTM Report	0 days	0 days	Tue 1/12/27	Tue 1/12/27



Last Update: 14 June 2023
SEAD LTM/LUC Project Schedule

Task ▬ Milestone ◆ Summary ▬ Critical 🟥

This page intentionally left blank

Worksheet #15 Project Action Levels and Laboratory Quantitation Limits

15.1 This worksheet presents the analytes groups, project action levels, and achievable laboratory DLs and QLs including LOQs, LODs, and DLs (Tables 15-1 through 15-6). The purpose of this worksheet is to determine if laboratory limits for groundwater will meet either the NYSDEC Class GA Ambient Water Quality Standard (AWQS) for groundwater or the EPA Regional Screening Levels.

15.2 The DL is the smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration at the 99% level of confidence. Although a result at or above the DL indicates that the analyte is present, the absence of a result at or above the DL is inconclusive (i.e., one cannot confidently state whether the analyte is present or absent), because the false negative rate at the DL is 50%. The DL is used to determine the LOD for each analyte and matrix as well as for preparatory and cleanup methods routinely used on samples.

15.3 The LOD is the smallest amount or concentration of a substance that must be present in a sample in order to be detected at a 99% confidence level. If a sample has a true concentration at the LOD, there is a minimum probability of 99% of reporting a detection (a measured value greater than or equal to the DL) and a 1% chance of reporting a non-detect (a false negative). Due to the false negative rate at the LOD (1%), the laboratory will report non-detectable values as less than the LOD.

15.4 The LOQ is the lowest concentration of a substance that produces a quantitative result within specified limits of precision and bias. Quantitative concentration results within specified limits of precision and bias can only be achieved at or above the LOQ; however, the analytical laboratory may identify analytes between the DL and the LOQ. In these instances, the laboratory will report concentration values between the DL and the LOQ as estimated (J) values.

15.5 To meet project objectives for sensitivity, the LODs for non-detected COCs and LOQs for detected COCs in groundwater must be equal or below either the NYSDEC Class GA AWQS or EPA Maximum Contaminant Levels. When LODs and/or LOQs for COCs are greater than NYSDEC Class GA AWQS or EPA Maximum Contaminant Levels, results are not usable for determining whether the analyte concentrations are above or below the PALs.

15.6 The most sensitive commercially available analytical methods will be used for the analyses presented in this UFP-QAPP. LODs for groundwater analytes are less than either the NYSDEC Class GA AWQS or EPA Regional Screening Levels. Laboratory LOQs are the same or lower than the NYSDEC Class GA AWQS or EPA Maximum Contaminant Levels. There is some uncertainty in the data for analytes with LOQs that are higher than the screening values. This will be addressed as an uncertainty associated with the project.

This page intentionally left blank

Table 15-1. Project Action Limits and Detection/Quantitation Limits – Volatile Organic Compounds

Matrix: Aqueous
Analytical Group: VOCs by SW8260D
Concentration Level: Low

Analyte	**CAS No.**	**NYSDEC Class GA AWQS[1]**	**EPA MCL[2]**	**Project Action Limits (PAL)[3]**	**Project Quantitation Limit (PQL) Goal[4]**	**Analytical Method Limits (Laboratory – Specific)**		
						DL	**LOD**	**LOQ**
		(µg/L)	**(µg/L)**	**(µ/L)**	**(µg/L)**	**(µg/L)**	**(µg/L)**	**(µg/L)**
Acetone	67-64-1	50	NSL	50	25.0	10.0	20.0	25.0
Benzene	71-43-2	1	5	1	1.0	0.3	0.5	1.0
Bromochloromethane	74-97-5	5	NSL	5	1.7	0.4	0.5	1.0
Bromodichloromethane	75-27-4	50	80	50	16.7	0.2	0.5	1.0
Bromoform	75-25-2	50	80	50	16.7	0.4	0.5	1.0
2-Butanone (MEK)	78-93-3	50	NSL	50	16.7	2.0	3.5	5.0
Carbon Disulfide	75-15-0	60	NSL	60	20.0	0.5	1.0	2.0
Carbon Tetrachloride	56-23-5	5	5	5	1.7	0.4	0.5	1.0
Chlorobenzene	108-90-7	5	100	5	1.7	0.2	0.5	1.0
Chloroethane	75-00-3	5	NSL	5	2.0	0.7	1.0	2.0
Chloroform	67-66-3	7	80	7	2.3	0.3	0.5	1.0
Cyclohexane	110-82-7	NSL	NSL	NSL	1.0	0.4	0.5	1.0
Dibromochloromethane	124-48-1	50	80	50	16.7	0.3	0.5	1.0
1,2-Dibromo-3-chloropropane	96-12-8	0.04	0.2	0.04	5.0	1.0	2.0	5.0
1,2-Dibromoethane	106-93-4	NSL	0.05	0.05	2.0	0.3	1.0	2.0
Dichlorodifluoromethane	75-71-8	5	NSL	5	2.0	0.5	1.0	2.0
1,2-Dichlorobenzene	95-50-1	3	600	3	1.0	0.3	0.5	1.0
1,3-Dichlorobenzene	541-73-1	3	NSL	3	1.0	0.2	0.5	1.0

Analyte	CAS No.	NYSDEC Class GA AWQS[1]	EPA MCL[2]	Project Action Limits (PAL)[3]	Project Quantitation Limit (PQL) Goal[4]	Analytical Method Limits (Laboratory – Specific)		
						DL	LOD	LOQ
		(µg/L)	(µg/L)	(µ/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
1,4-Dichlorobenzene	106-46-7	3	75	3	1.0	0.3	0.5	1.0
1,1-Dichloroethane	75-34-3	5	NSL	5	1.7	0.3	0.5	1.0
1,2-Dichloroethane	107-06-2	0.6	5	0.6	1.0	0.3	0.5	1.0
1,1-Dichloroethylene	75-35-4	5	7	5	1.7	0.3	0.5	1.0
cis-1,2-Dichloroethylene	156-59-2	5	70	5	1.7	0.3	0.5	1.0
trans-1,2-Dichloroethylene	156-60-5	5	100	5	1.7	0.2	0.5	1.0
1,2-Dichloropropane	78-87-5	1	5	1	1.0	0.4	0.5	1.0
cis-1,3-Dichloropropene	10061-01-5	0.4	NSL	0.4	1.0	0.3	0.5	1.0
trans-1,3-Dichloropropene	10061-02-6	0.4	NSL	0.4	1.0	0.2	0.5	1.0
Ethylbenzene	100-41-4	5	700	5	1.7	0.4	0.5	1.0
Freon 113 (1,1,2-Trichloro-1,2,2-trifluoroethane)	76-13-1	5	NSL	5	1.7	0.5	0.5	1.0
2-Hexanone	591-78-6	50	NSL	50	16.7	2.0	5.0	10.0
Isopropylbenzene	98-82-8	5	NSL	5	1.7	0.2	0.5	1.0
Methyl Acetate	79-20-9	NSL	NSL	NSL	20.0	5.0	10.0	20.0
Methyl Bromide	74-83-9	5	NSL	5	5.0	2.0	4.0	5.0
Methyl Chloride	74-87-3	NSL	NSL	NSL	2.0	0.5	1.0	2.0
Methylcyclohexane	108-87-2	NSL	NSL	NSL	1.0	0.4	0.5	1.0
Methylene Chloride	75-09-2	5	5	5	5.0	2.0	4.0	5.0
4-Methyl-2-pentanone (MIBK)	108-10-1	NSL	NSL	NSL	5.0	1.0	2.0	5.0
Methyl Tert Butyl Ether	1634-04-4	10	NSL	10	3.3	0.2	0.5	1.0
Styrene	100-42-5	5	100	5	1.7	0.2	0.5	1.0
1,1,2,2-Tetrachloroethane	79-34-5	5	NSL	5	1.7	0.3	0.5	1.0
Tetrachloroethylene	127-18-4	5	5	5	1.7	0.2	0.5	1.0

Analyte	CAS No.	NYSDEC Class GA AWQS[1]	EPA MCL[2]	Project Action Limits (PAL)[3]	Project Quantitation Limit (PQL) Goal[4]	Analytical Method Limits (Laboratory – Specific)		
						DL	LOD	LOQ
		(µg/L)	(µg/L)	(µ/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Toluene	108-88-3	5	1000	5	1.7	0.3	0.5	1.0
1,2,3-Trichlorobenzene	87-61-6	5	NSL	5	2.0	0.6	1.0	2.0
1,2,4-Trichlorobenzene	120-82-1	5	70	5	2.0	0.5	1.0	2.0
1,1,1-Trichloroethane	71-55-6	5	200	5	1.7	0.2	0.5	1.0
1,1,2-Trichloroethane	79-00-5	1	5	1	1.0	0.5	0.5	1.0
Trichloroethylene	79-01-6	5	5	5	1.7	0.3	0.5	1.0
Trichlorofluoromethane	75-69-4	5	NSL	5	2.0	0.5	1.0	2.0
Vinyl Chloride	75-01-4	2	2	2	1.0	0.4	0.5	1.0
Xylenes, Total[5]	1330-20-7	5	10,000	5	3.0	0.7	1.5	3.0
m- and p-Xylenes	108-38-3, 106-42-3	NSL	NSL	NSL	2.0	0.5	1.0	2.0
o-Xylene	95-47-6	NSL	NSL	NSL	1.0	0.3	0.5	1.0

Notes:

[1] NYSDEC AWQS are based on the Division of Water Technical and Operation Guidance Series June 1998 Memorandum (NYSDEC 1998; as amended)

[2] EPA Maximum Contaminant Levels

[3] The Project Action Limit is identified as the lower value of either the NYSDEC Class GA AWQS or the EPA MCL.

[4] The practical quantitation limit (PQL) Goal is set to 1/3 of the NYSDEC AWQS. If the LOQ is greater than 1/3 the NYSDEC AWQS or there is no NYSDEC AWQS, then the PQL goal is set to the LOQ.

[5] Provided laboratory analytical method limits are for o,m,p xylenes and are included as total Xylenes.

Shading indicates LOD/LOQ greater than the AWQS.

CAS = Chemical Abstract Service

Table 15-2. Project Action Limit and Detection/Quantitation Limits Total Organic Carbon (SGS Orlando)

Matrix: Water
Analytical Group: TOC by SW9060
Concentration Level: Low

Analyte	CAS No.	NYSDEC Class GA AWQS[1]	EPA MCL[2]	Project Action Limit (PAL)[3]	Project Quantitation Limit Goal (mg/L)[4]	Analytical Method Limits (Laboratory - Specific)		
						DL (mg/L)	LOD (mg/L)	LOQ (mg/L)
TOC	7440-44-0	NSL	NSL	NSL	1.0	0.2	0.5	1.0

Notes:
[1] NYSDEC AWQS are based on the Division of Water Technical and Operation Guidance Series June 1998 Memorandum (NYSDEC 1998; as amended)
[2] EPA Maximum Contaminant Levels
[3] The Project Action Limit is identified as the lower value of either the NYSDEC Class GA AWQS or the EPA MCL.
[4] There is no NYSDEC AWQS or EPA standard for TOC. The PQL Goal is set to the LOQ.

Table 15-3. Project Action Limits and Detection/Quantitation Limits Anions (SGS Orlando)

Matrix: Water
Analytical Group: Anions by SW9056A
Concentration Level: Low

Analyte	CAS No.	NYSDEC Class GA AWQS[1] (mg/L)	EPA MCL[2] (mg/L)	Project Action Limit (PAL)[3] (mg/L)	Project Quantitation Limit Goal[4] (mg/L)	Analytical Method Limits (Laboratory - Specific) DL (mg/L)	LOD (mg/L)	LOQ (mg/L)
Chloride	16887-00-6	250	NSL	250	83.0	0.8	1.0	2.0
Nitrate	14797-55-8	10	10	10	3.3	0.05	0.05	0.1
Sulfate	18785-72-3	250	NSL	250	83.0	0.6	1.0	2.0

Notes:
[1] NYSDEC AWQS are based on the Division of Water Technical and Operation Guidance Series June 1998 Memorandum (NYSDEC 1998; as amended)
[2] EPA Maximum Contaminant Levels
[3] The Project Action Limit is identified as the lower value of either the NYSDEC Class GA AWQS or the EPA MCL.
[4] The PQL Goal is set to 1/3 of the NYSDEC AWQS.

Table 15-4. Project Action Limits and Detection/Quantitation Limits Dissolved Gases (SGS Orlando)

Matrix: Aqueous
Analytical Group: Dissolved Gases by RSK-175
Concentration Level: Low

Analyte	CAS No.	NYSDEC Class GA AWQS[1] (µg/L)	EPA MCL[2] (µg/L)	Project Action Limit (PAL)[3] (µg/L)	Project Quantitation Limit Goal[4] (µg/L)	Analytical Method Limits (Laboratory - Specific) DL (µg/L)	LOD (µg/L)	LOQ (µg/L)
Methane	74-82-8	NSL	NSL	NSL	0.50	0.2	0.2	0.50
Ethane	74-84-0	NSL	NSL	NSL	1.0	0.3	0.5	1.0
Ethene	74-85-1	NSL	NSL	NSL	1.0	0.4	0.5	1.0

Notes:

[1] NYSDEC AWQS are based on the Division of Water Technical and Operation Guidance Series June 1998 Memorandum (NYSDEC 1998; as amended)

[2] EPA Maximum Contaminant Levels

[3] The Project Action Limit is identified as the lower value of either the NYSDEC Class GA AWQS or the EPA MCL.

[4] There are no NYSDEC AWQSs or EPA standards for methane, ethane, or ethene. The PQL Goal is set to the LOQ.

Table 15-5. Project Action Limits and Detection/Quantitation Limits Metals (SGS Orlando)

Matrix: Water
Analytical Group: Metals (total) by EPA SW-846 6020B and Mercury by 7470A
Concentration Level: Low

		NYSDEC Class GA AWQS[1]	EPA MCL[2]	Project Action Limit (PAL)[3]	Project Quantitation Limit Goal[4]	Analytical Method Limits (Laboratory - Specific)		
						DL	LOD	LOQ
Analyte	CAS Number	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Aluminum	7429-90-5	NSL[5]	NSL	NSL	22.0	22.0	50.0	200.0
Antimony	7440-36-0	3.0	6.0	3.0	1.0	0.2	0.8	2.0
Arsenic	7440-38-2	25	10	10	8.3	0.21	0.8	2.0
Barium	7440-39-3	1000	2000	1000	333.3	0.2	0.8	2.0
Beryllium	7440-41-7	3	4	3	1.0	0.2	0.8	2.0
Cadmium	7440-43-9	5	5	5	1.7	0.2	0.8	2.0
Calcium	7440-70-2	NSL	NSL	NSL	36.0	36.0	100.0	200.0
Chromium	7440-47-3	50	100	50	16.7	0.2	0.8	2.0
Cobalt	7440-48-4	NSL	NSL	NSL	0.2	0.2	0.8	2.0
Copper	7440-50-8	200	1300	200	66.7	0.2	0.8	2.0
Iron	7439-89-6	300	NSL	300	100.0	23.2	50.0	200.0
Lead	7439-92-1	25	15	15	8.3	0.2	0.8	2.0
Magnesium	7439-95-4	35000	NSL	35000	11666.7	50.0	100.0	200.0
Manganese	7439-96-5	300	NSL	300	100.0	0.2	0.8	2.0
Mercury[6]	7439-97-6	0.7	2	0.7	0.2	0.03	0.1	0.5
Nickel	7440-02-0	100	NSL	100	33.3	0.2	0.8	2.0
Potassium	7440-09-7	NSL	NSL	NSL	75.0	75.0	150.0	200.0
Selenium	7782-49-2	10	50	10	3.3	0.22	0.8	2.0
Silver	7440-22-4	50	NSL	50	16.7	0.2	0.8	2.0

Analyte	CAS Number	NYSDEC Class GA AWQS[1] (µg/L)	EPA MCL[2] (µg/L)	Project Action Limit (PAL)[3] (µg/L)	Project Quantitation Limit Goal[4] (µg/L)	Analytical Method Limits (Laboratory - Specific) DL (µg/L)	LOD (µg/L)	LOQ (µg/L)
Sodium	7440-23-5	20000	NSL	20000	6666.7	50.0	100.0	200.0
Thallium	7440-28-0	0.5	2	0.5	0.2	0.2	0.8	2.0
Vanadium	7440-62-2	NSL	NSL	NSL	0.2	0.24	0.8	2.0
Zinc	7440-66-6	2000	NSL	2000	666.7	1.68	5.0	10.0

Notes:

[1] NYSDEC AWQS are based on the Division of Water Technical and Operation Guidance Series June 1998 Memorandum (NYSDEC 1998; as amended)

[2] EPA Maximum Contaminant Levels (TR=1E-06 THQ=0.1)

[3] The Project Action Limit is identified as the lower value of either the NYSDEC Class GA AWQS or the EPA MCL.

[4] The PQL Goal is set to 1/3 of the NYSDEC AWQS. If the LOQ is greater than 1/3 the NYSDEC AWQS or there is no NYSDEC AWQS, then the PQL goal is set to the LOQ.

[5] NSL = No Screening Level.

[6] Mercury analyzed by 7470A

Worksheet #17 Sample Design and Rationale

17.1 This UFP-QAPP worksheet documents the overall process for the design and rationale of the sampling program. This worksheet is used to develop and document the investigative approach, in terms of the types of activities/procedures to be conducted, investigative locations, field methodologies, matrices to be sampled, analytical groups to be analyzed and at what concentration levels (QC samples), the number of samples to be taken, and the sampling frequency.

17.2 If the field conditions warrant changes to the field tasks or analytical approach, the Technical Manager will notify the Contractor PM immediately upon discovery. Field changes will be communicated as presented in Worksheet #6. Specifically, once notified, the Contractor PM will notify the USACE Technical Lead within 24 hours verbally or via email. Based on a review of the proposed change, and if required by the USACE, a field change request memorandum will be submitted within 1 week to the USACE Technical Lead for review and approval. It should be noted that unanticipated field changes may require a UFP-QAPP addendum, amendment, and/or revision. This requirement will be determined in consultation with the USACE Technical Lead following notification of the proposed change. Any UFP-QAPP addendum, amendment, and/or revision will be submitted to USACE for review, comment, and approval.

17.3 The objective of this project is to execute the LTM program to monitor the effectiveness of the implemented remedies at SEAD-16, SEAD-25, and the Ash Landfill OUs. In addition, LUC inspections will be conducted to evaluate the conditions of 42 sites on the former Seneca Army Depot.

17.4 The number of groundwater samples to be taken, sample locations, and sampling frequencies are summarized in Worksheet #18.

17.5 Field methodologies will be consistent with the tasks presented in Worksheet #14 and #16, and with the SOPs listed in Worksheet #21 and included in **Appendix D.** Field activities will be conducted in accordance with the APP (**Appendix E**). A dedicated field logbook will be maintained for the site activities in accordance with EA-SOP-016. Field forms will be used during on-site work (**Appendix B**). Photographs will also be taken to document field activities, as appropriate.

GROUNDWATER SAMPLING

17.6 Prior to sampling events, synoptic groundwater level measurements will be collected from each of the 21 monitoring wells to evaluate groundwater conditions at the identified LTM sites. Groundwater sampling will be conducted to monitor and characterize the type and nature of COCs at well locations, recommend changes to subsequent sampling events, support determinations of further actions needed to achieve No Further Actions, and determine whether remedial goals have been achieved. Groundwater samples from each well sampled will be submitted to SGS Orlando for off-site laboratory analysis of VOCs by EPA Method 8260D, metals by EPA Method 6020B, mercury by EPA Method 7470A, anions by EPA Method 9056A, TOC by EPA Method 9060A, and dissolved gases by EPA Method RSK-175. A summary of samples to be collected and the sampling rationale is presented in **Table 17-1**.

17.7 Information regarding QC samples can be found in Worksheet #20. Generally, QC samples will consist of the following:

- Field duplicate samples will be collected at a minimum rate of 5% (1 every 20 samples or once per event)
- MS/MSDs (extra volume) will be collected at a minimum rate of 5% (1 every 20 samples or once per event)
- Field blanks will be collected at a minimum rate of 1 per event
- Trip blanks will accompany each cooler containing samples for analysis of VOCs or dissolved gases, when applicable.

17.8 See **Figure 1-1** for the site location; **Figures 10-1, 10-2, and 10-3** for monitoring well locations; and Worksheet #18 for specifics regarding analyses for samples from individual wells.

LAND USE INSPECTIONS AND MONITORING

17.9 Annual monitoring and maintenance of LUCs, including institutional controls, land use restrictions, and engineering controls and land use is required for 42 sites at the Former Seneca Army Depot as described in **Table 18-3** and applicable design documents and RODs. LUC checklists (**Appendix B**) and land use monitoring forms will be used to document that LUC objectives for each site are being met. Annual inspections include land use evaluations, observations of intrusive activities, vegetative stress and cover, unwanted vegetation, penetration caused by animal pests, construction activities, signs of erosion, and appropriate posting of signage. In addition, photographs of each site and recent publicly available aerial imagery will be collected and cataloged to document current conditions.

MONITORING WELL INSTALLATION AND ABANDONMENT

17.10 Based on the results of LTM monitoring and in consultation with USACE and NYSDEC, monitoring wells may be installed or abandoned following the procedures presented in Worksheet #14 and #16.

17.11 The sampling design and rationale in terms of what matrices will be sampled and what analytical groups will be analyzed is described in **Table 17-1**.

Table 17-1. LTM & LUC Data Needs

Sample matrix	**Parameter**	**Equipment and/or Method**	**Rationale for Analysis and Data Use**
LTM			
Groundwater	Monitoring well conditions	Inspections	Ensure that the wells remain usable for future monitoring, if required.
	Groundwater elevations	Electronic water level meter	Generate groundwater contour maps, determine groundwater flow directions, and calculate hydraulic gradients
	Water quality parameters (pH, temperature, specific conductivity, ORP, DO, turbidity)	Low-flow groundwater Horiba U-22 (or equivalent) with flow-thru cell	Groundwater stabilization parameters and indicators of water quality. Evaluate the effectiveness of the permeable reactive barrier.
	VOCs	SW8260D	Monitoring VOC contamination in groundwater and evaluate the effectiveness of the permeable reactive barrier.
	TOC	SW9060A	
	Anions (nitrate, sulfate, chloride)	SW9056A	
	Dissolved gases (methane/ethane/ethene)	RSK-175	
	Metals and Mercury	SW6020B and 7470A	Monitoring metals contamination in groundwater.
	Ferrous Fe and Mn	HACH 8146 and 8034	Evaluate site conditions for Monitored Natural Attenuation (MNA) parameters.
LUC Inspections			
Site Inspections	N/A	N/A	Ensure LUC objectives and criteria are met, and that specific site RAs have not been disturbed.

This page intentionally left blank

Worksheet #18 Sampling Locations and Methods

18.1 This worksheet documents the samples planned for collection under this project and will serve as a completeness check for field personnel and QA/QC auditors. There are three tables included in this worksheet. The first table (**Table 18-1**) provides specifics about existing site monitoring wells networks. The second table (**Table 18-2**) includes analytes for each groundwater sample as well as sampling frequency. The third table (**Table 18-3**) includes specific about LUCs located on-site.

Table 18-1. Well Specifications

Sample Locations	Northing	Easting	Screen Top (ft bgs)	Screen Bottom (ft bgs)	Well Depth (ft bgs)	Top of Riser Elevation (ft amsl)
SEAD-16						
MW16-1	998717.8800	749854.6300	3.3	5.3	7.8	735.53
MW16-2	998613.8100	749592.5000	1.4	3.4	5.8	734.86
MW16-4	998713.3000	749703.2800	2.3	4.3	6.8	734.51
MW16-5	998512.4700	749560.8700	2.5	4.5	5.3	735.36
MW16-6	998709.5500	749602.3500	1.3	3.3	6.6	734.25
MW16-7	998489.9900	749752.8700	2.6	4.6	6.9	734.96
SEAD-25						
MW25-1	998030.6600	751123.9300	-	-	7.77	743.00
MW25-2	998024.3000	750974.6100	3.4	7.4	11.31	746.36
MW25-3	998079.4300	750926.4900	4.0	6.0	9.58	746.34
MW25-6	998277.0000	751007.5600	-	-	14.27	744.44
MW25-8	998077.3100	750855.5500	-	-	5.47	742.46
MW25-9	998004.1500	750898.1400	3.2	4.0	5.42	742.36
MW25-10	997966.2600	750999.2600	3.2	5.2	6.20	743.01
MW25-13	997864.8100	750869.3800	-	-	5.70	739.64
MW25-15	997972.6100	750764.5400	-	-	7.20	741.00
MW25-17	998188.4200	750964.1900	4.6	9.1	11.60	743.94
MW25-18	998116.3600	751083.1500	-	-	11.00	744.35
MW25-19	998136.6700	750763.1800	-	-	12.10	741.95

Table 18-1. Well Specifications

Sample Locations	Northing	Easting	Screen Top (ft bgs)	Screen Bottom (ft bgs)	Well Depth (ft bgs)	Top of Riser Elevation (ft amsl)
MW25-20	998381.8924	750817.9462	-	-	-	740.78
MW25-21	997965.7028	750289.2539	-	-	-	732.44
MW25-22	997729.8327	750616.9306	-	-	-	733.70
MW25-22D	997725.0400	750609.3097	-	-	-	735.61
MW25-23	997618.2497	751122.6723	-	-	-	738.54
MW25-25	998499.1234	751510.4381	-	-	-	743.74
MW25-30	998536.2023	750274.5465	-	-	-	736.13
MW25-31	998015.8040	750939.5777	-	-	-	745.34
MW25-31D	998025.1338	750937.9433	-	-	-	744.63
Ash Landfill						
PT-16	995521.1910	739682.3080	-	-	-	-
PT-17	994661.3460	739932.5010	-	-	7.46	640.14
PT-18A	994882.7640	740601.5180	4.8	9.8	12.79	659.05
PT-19	994555.6860	740294.3030	-	-	-	-
PT-20	994732.3250	740194.0640	-	-	-	-
PT-22	994934.0790	740207.0680	-	-	11.79	648.61
PT-24	994969.0960	739668.0460	-	-	11.83	636.40
MW-27	995172.6891	739813.5181	-	-	-	-
MW-29	994820.6080	739744.9300	-	-	-	-
MW-32	994545.9320	740034.3050	-	-	-	-
MW-39	995627.1800	740842.3350	-	-	-	-
MW-40	994893.4210	740771.7510	-	-	-	-
MW-44A	995187.3990	740556.5240	-	-	-	-
MW-46	995168.0320	740326.0250	-	-	-	-
MW-48	995347.6310	740154.2890	-	-	-	-
MW-56R	994766.0020	739439.4270	-	-	12	-

Table 18-1. Well Specifications

Sample Locations	Northing	Easting	Screen Top (ft bgs)	Screen Bottom (ft bgs)	Well Depth (ft bgs)	Top of Riser Elevation (ft amsl)
MW-60	994145.8640	740899.6190	-	-	-	-
MWT-7	994721.0163	739767.3105	-	-	13.64	638.34
MWT-10	995252.6375	739655.6651	-	-	-	-
MWT-22	994935.8895	740350.8689	7.5	12.5	14.86	650.66
MWT-23	994949.0210	740052.3120	-	-	13.65	646.77
MWT-24	994959.7980	739892.7760	-	-	12.74	641.56
MWT-25	994908.1090	740488.8770	-	-	13.14	654.51
MWT-26	994907.4560	740419.2360	-	-	13.11	652.19
MWT-27	994908.3340	740406.6870	-	-	12.46	652.99
MWT-28	994907.2437	740389.6710	-	-	12.81	652.69
MWT-29	994906.2020	740347.7439	-	-	13.06	651.82

Notes:
Coordinates are in NAD83 New York East State Plane (ft).
- Value unknown

Table 18-2. Monitoring Wells, Sampling Frequency, and Applicable Analytes/Methods

Sample Locations	Sampling Frequency	Sample ID	Analytes/Methods						
			Dissolved Gases (RSK-175)	TOC (9060A)	Anions (9056A)	Mercury (7470A)	Metals (6020B)	HACH Fe and Mn (8146 and 8034)	VOCs (8260D)
SEAD-16									
MW16-1	Every 5 years during the Spring beginning in 2025	SEAD-16-MW16-1-YYYYMMDD				X	X		
MW16-2		SEAD-16-MW16-2-YYYYMMDD				X	X		
MW16-4		SEAD-16-MW16-4-YYYYMMDD				X	X		
MW16-5		SEAD-16-MW16-5-YYYYMMDD				X	X		
MW16-6		SEAD-16-MW16-6-YYYYMMDD				X	X		
MW16-7		SEAD-16-MW16-7-YYYYMMDD				X	X		
SEAD-25									
MW25-2	Every 5 years during the Spring beginning in 2025	SEAD-25-MW25-2-YYYYMMDD							X
MW25-31	Annually during the Spring for 5 Years	SEAD-25-MW25-31-YYYYMMDD							X
Ash Landfill									
PT-17	Annual during the Spring	SEAD-AL-PT-17-YYYYMMDD	X	X	X			X	X
PT-18A		SEAD-AL-PT-18A-YYYYMMDD							X
PT-22		SEAD-AL-PT-22-YYYYMMDD							X
PT-24		SEAD-AL-PT-24-YYYYMMDD	X	X	X			X	X
MW-56R		SEAD-AL-MW-56-YYYYMMDD							X

Table 18-2. Monitoring Wells, Sampling Frequency, and Applicable Analytes/Methods

Sample Locations	Sampling Frequency	Sample ID			Analytes/Methods				
			Dissolved Gases (RSK-175)	TOC (9060A)	Anions (9056A)	Mercury (7470A)	Metals (6020B)	HACH Fe and Mn (8146 and 8034)	VOCs (8260D)
MWT-7		SEAD-AL-MWT-7-YYYYMMDD	X	X	X			X	X
MWT-22		SEAD-AL-MWT-22-YYYYMMDD							X
MWT-23		SEAD-AL-MWT-23-YYYYMMDD	X	X	X			X	X
MWT-24		SEAD-AL-MWT-24-YYYYMMDD							X
MWT-25		SEAD-AL-MWT-25-YYYYMMDD							X
MWT-26		SEAD-AL-MWT-26-YYYYMMDD	X	X	X			X	X
MWT-27		SEAD-AL-MWT-27-YYYYMMDD	X	X	X			X	X
MWT-28		SEAD-AL-MWT-28-YYYYMMDD	X	X	X			X	X
MWT-29		SEAD-AL-MW-29-YYYYMMDD	X	X	X			X	X

18.2 LUC inspections will be conducted through visual observation to evaluate whether the LUC objectives identified in **Table 18-3** are being met and whether any remedies are needed. To conduct these inspections, a LUC inspection form (**Appendix B**) will be filled out during site visits, and then reviewed to determine adherence to applicable LUCs. For example, at SEADs 1 and 2, if no residential housing, schooling, or childcare facilities are observed on the property, and if there are no signs that groundwater has been accessed, then the LUC objectives will be considered met.

Table 18-3. Land Use Control Inspections

SEAD	Northing	Easting	Site Inspection Frequency	LUC Objectives
1	996946.8936	750976.9145	Annual	• Prohibit the development and use of property for residential housing, elementary and secondary schools, childcare facilities and playground activities. • Prevent access to or use of the groundwater until NYS Class GA Groundwater Standards are met.
2	997074.4978	747718.2339	Annual	
5	998708.2515	750559.2152	Annual	• Prohibit the development and use of property for residential housing, elementary and secondary schools, childcare facilities and playground activities. • Prevent access to or use of the groundwater until New York State Class GA Groundwater Standards are met. • Prohibit unauthorized excavation or other activities that could compromise the integrity of the engineered cover at SEAD-5.
12	1014020.3951	744773.3099	Annual	• Implementation, monitoring, and maintenance of an environmental LUC restricting access to and use of the existing vacant Buildings 813/814 and the construction of inhabitable structures (temporary or permanent) above the area and within a 50-ft perimeter of Buildings 813/814 and 50-ft radius from MW12-37 where trichloroethene-contaminated soil was previously identified, and where contaminated groundwater may exist. • Implementation, monitoring, and maintenance of a LUC that prohibits access to and use of groundwater in the vicinity of Buildings 813/814. • Prohibit the development and use of the property for residential housing, elementary and secondary schools, childcare facilities and playgrounds until soil and groundwater standards for unrestricted use and unlimited exposure are achieved.

Table 18-3. Land Use Control Inspections

SEAD	Northing	Easting	Site Inspection Frequency	LUC Objectives
13	1007528.8793	747831.2392	Annual	• Prevent access to or use of groundwater until New York State Class GA Groundwater Standards are met (SEAD-13 and SEAD-64D) • Restriction on unauthorized excavation or digging within SEAD-64B and SEAD-64D
	1007610.8658	748747.5510	Annual	
16	998700.5325	749636.9071	Annual	• Prohibit the development and use of property for residential housing, elementary and secondary schools, childcare facilities and playground activities. • Prevent access to or use of the groundwater until New York State Class GA Groundwater Standards are met.
17	998118.3252	749274.6490	Annual	
23	1011870.2649	738863.0527	Annual	• Visually inspect vegetative compacted soils to assure the long-term integrity of the soil cover and to check for erosion. • Visually inspect Reeder Creek to ensure no mobilization and migration of contaminated soil has occurred into the creek. Inspect for erosion of the creek embankment adjacent to the Open Burning (OB) grounds/accumulation of sediment along the stream bed.
25	998126.5099	750799.0276	Annual	• Prohibit the development and use of property for residential housing, elementary and secondary schools, childcare facilities and playground activities. • Prevent access to or use of the groundwater until New York State Class GA Groundwater Standards are met. • Maintain the integrity of any current or future remedial or monitoring system at SEAD-25.
26	992291.8019	751171.7873	Annual	• Prohibit the development and use of property for residential housing, elementary and secondary schools, childcare facilities and playground activities. • Prevent access to or use of the groundwater until New York State Class GA Groundwater Standards are met.
27	997133.5256	750087.1576	Annual	
39	999312.9037	751429.5495	Annual	
40	997219.2836	750707.3682	Annual	
41	1015465.6307	741663.0063	Annual	Prohibit access to or use of groundwater at SEAD 41 until concentrations of hazardous substances contained are reduced to levels that allow UU.
43	987502.9907	753915.7035	Annual	• Continued restricted use as a state maximum security correctional facility.
44A	985287.1958	753237.5472	Annual	

Table 18-3. Land Use Control Inspections

SEAD	Northing	Easting	Site Inspection Frequency	LUC Objectives
44B	987893.0503	751458.2297	Annual	
46	1006439.9736	749677.3103	Annual	
52	986339.7019	751741.1568	Annual	
56	987502.9907	753915.7035	Annual	
59	998809.9521	750043.0683	Annual	• Prohibit the development and use of property for residential housing, elementary and secondary schools, childcare facilities and playground activities. • Prevent access to or use of the groundwater until New York State Class GA Groundwater Standards are met.
62	986568.6829	752787.4325	Annual	• Continued restricted use as a state maximum security correctional facility.
64A	992391.0308	750730.5297	Annual	• Prohibit the development and use of property for residential housing, elementary and secondary schools, childcare facilities and playground activities. • Prevent access to or use of the groundwater until New York State Class GA Groundwater Standards are met. • Prevent unauthorized excavation at the SEAD-64A Controlled Property. • No digging or excavation shall be permitted on the SEAD-64A Controlled Property without prior written approval of the Army, EPA Region II, and NYSDEC.
64B	985908.8181	748434.3813	Annual	• Prevent access to or use of groundwater until New York State Class GA Groundwater Standards are met (SEAD-13 and SEAD-64D) • Restriction on unauthorized excavation or digging within SEAD-64B and SEAD-64D
64C	984464.8307	753819.1176	Annual	• Continued restricted use as a state maximum security correctional facility.
64D	991335.1944	740694.4300	Annual	• Prevent access to or use of groundwater until New York State Class GA Groundwater Standards are met (SEAD-13 and SEAD-64D) • Restriction on unauthorized excavation or digging within SEAD-64B and SEAD-64D
66	1001829.706	747886.6367	Annual	

Table 18-3. Land Use Control Inspections

SEAD	Northing	Easting	Site Inspection Frequency	LUC Objectives
	1001343.595	747903.9978	Annual	• Prohibit the development and use of property for residential housing, elementary and secondary schools, childcare facilities and playground activities. • Prevent access to or use of the groundwater until New York State Class GA Groundwater Standards are met.
67	1002201.555	748822.9719	Annual	
69	987502.9907	753915.7035	Annual	• Continued restricted use as a state maximum security correctional facility.
71	999222.6451	750514.0516	Annual	• Prohibit the development and use of property for residential housing, elementary and secondary schools, childcare facilities and playground activities. • Prevent access to or use of the groundwater until New York Class GA Groundwater Standards are met.
121C	997107.5481	749770.2185	Annual	• Prohibit the development and use of property for residential housing, elementary and secondary schools, childcare facilities and playground activities. • Prevent access to or use of the groundwater until New York State Class GA Groundwater Standards are met.
121I	994301.4346	751464.1780	Annual	
122B	986834.7437	739521.3875	Annual	• Prohibit the development and use of property for residential housing, elementary or secondary schools, childcare facilities, and playgrounds.
122E	991480.8753	738634.5078	Annual	
	988956.7933	739166.1187	Annual	
	987132.1022	740789.1934	Annual	
002-R-01	1007545.1828	747545.4406	Annual	• Continue LUC inspections due to material potentially presenting an explosive hazard
	1007642.8057	749434.5370	Annual	
003-R-01	1009413.6989	738919.0588	Annual	
007-R-01	1008195.7597	737315.6495	Annual	
Ash Landfill (SEADs 3, 6, 8, 14, and 15)				
3	994793.9529	740537.8937	Annual	• Prevent access to or use of groundwater until cleanup levels are met. • Maintain the integrity of any current or future remedial or monitoring system such as monitoring wells and permeable reactive barriers.
6	994989.8616	740638.6679	Annual	
8	994389.1627	741095.5673	Annual	
14	995552.3759	740547.5363	Annual	

Table 18-3. Land Use Control Inspections

SEAD	Northing	Easting	Site Inspection Frequency	LUC Objectives
15	994747.9040	740433.4566	Annual	• Prohibit excavation of the soil or construction of inhabitable structures (temporary or permanent) above the area of the existing groundwater plume. • Maintain the vegetative soil layer over the ash fill areas and the NCFL to limit ecological contact.

Notes:
Coordinates are in NAD83 New York East State Plane (ft).

Worksheet #19 and #30 Sample Containers, Preservation, and Hold Times

19/30.1 Field teams will coordinate with the laboratory prior to mobilization for sample containers and preservatives. It is possible that sample volume for certain analytical methods may be efficiently combined into single sample containers than what is listed in this worksheet. A standard turn-around-time of 10 business days is anticipated for receipt of analytical results.

Laboratory Name:	SGS Orlando
Laboratory Sample Receipt Address:	4405 Vineland Rd, Orlando, Florida 32811
Laboratory POC:	Kevin Gibbons
Laboratory POC Email:	Kevin.Gibbons@sgs.com
Laboratory POC Phone Number:	732-406-1471
Matrix:	Aqueous
Accreditations/Certifications:	DoD ELAP (expires 15 December 2024) NYSDOH (expires 1 April 2024) (**Appendix A** for documentation of accreditation)
Sample Delivery Method:	Overnight shipping (Expedited courier, i.e., Federal Express)

Analyte/ Analyte Group	Analytical/ Preparation Method SOP Reference[1]	Accreditation Expiration Date	Container(s) (number, size, and type per sample)	Preservation Requirements (Chemical, Temperature, Light Protected)	Preparation Holding Time	Analytical Holding Time
Dissolved Gases	RSK-175 SGS Orlando SOPs GC019 OP025	DoD ELAP Expiration December 15, 2024	3 – 40 mL VOC vials with Teflon lined caps	HCl to pH < 2 Cool to ≤ 6ºC	1NA	14 days
TOC	SW-846 9060A SGS Orlando SOP GN215	DoD ELAP Expiration December 15, 2024	2 – 40 mL amber VOC vials	HCl to pH < 2 Cool to ≤ 6ºC	NA	28 days
Anions	SW-846 9056A SGS Orlando SOP GN237	DoD ELAP Expiration December 15, 2024	1 – 500 mL plastic bottle	Cool to ≤ 6ºC	NA	Cl, SO^4 - 28 days NO_3 – 48 hours

Analyte/ Analyte Group	Analytical/ Preparation Method SOP Reference[1]	Accreditation Expiration Date	Container(s) (number, size, and type per sample)	Preservation Requirements (Chemical, Temperature, Light Protected)	Preparation Holding Time	Analytical Holding Time
Mercury	SW-846 7470A SGS Orlando SOPs MET106	DoD ELAP Expiration December 15, 2024	1 – 500 mL plastic bottle	HNO_3 to pH < 2 Cool to ≤ 6ºC	NA	28 days
Metals	SW-846 6020B SGS Orlando SOPs MET107 MET103	DoD ELAP Expiration December 15, 2024	1 – 500 mL plastic bottle	HNO_3 to pH < 2, Cool to ≤ 6ºC	NA	6 months
VOCs	SW-846 8260D SGS Orlando SOP OP021 SOP MS020	DoD ELAP Expiration December 15, 2024	3 – 40 mL VOC vials with Teflon lined caps	HCl to pH < 2 Cool to ≤ 6ºC	NA	14 days

Notes:
1) Refer to the Analytical SOP References table (Worksheet #23).
2) Maximum holding time is calculated from the time the sample is collected to the time the sample is prepared/extracted.
H_2SO_4 = Sulfuric acid
HCl = Hydrochloric acid
HNO_3 = Nitric acid
L = Liter
NO_3 = Nitrate
Triple volume is required for MS/MSD as well as primary sample to be spiked

Worksheet #20 Field Quality Control Sample Summary

20.1 This worksheet summarizes the number of field QC samples that will be collected and submitted to the laboratory for each matrix and analytical group per event.

Matrix	Analyte/ Analytical Method	Number of Field Samples[1]	Field Duplicates[2]	MS/MSD[3]	Trip Blanks[4]	Field Blanks[5]	Total Number of Analyses
SEAD-16							
			1 per 20 samples (5%); minimum 1 per event	1 set per 20 samples (5%); minimum 1 per event	1 per cooler/shipment with samples for analysis of VOCs	1 per event; when non-dedicated field equipment is used	
Aqueous	Total Metals (SW-846 6020B)	6	1	2	0	1	10
Aqueous	Mercury (SW7470A)	6	1	2	0	1	10
SEAD-25							
Aqueous	VOCs (SW8260D)	1 (2)[6]	1	2	1	1	6(7)[6]
Ash Landfill (SEADs 3, 6, 8, 14, 15)							
Aqueous	VOCs (SW8260D)	14	1	2	1	1	19
Aqueous	TOC (SW9060A)	8	1	2	0	1	12
Aqueous	Anions (SW9056A)	8	1	2	0	1	12
Aqueous	Dissolved Gases (RSK-175)	8	1	2	0	1	12
Aqueous	HACH Field Screening - Ferrous Fe (8146)	8	0	0	0	0	8
Aqueous	HACH Field Screening – Mn (8034)	8	0	0	0	0	8

Notes:

1) Standard, non-QC samples.
2) Duplicates are collected at a rate of 5% (1 per 20 standard samples). The number of duplicates may increase if additional standard samples are collected.

3) MS/MSDs are collected at a minimum rate of 5% (1 set per 20 standard samples). MS/MSD pairs require extra volume. These will be collected in separate containers. The number of MS/MSD pairs may increase if additional standard samples are collected.
4) Trip blanks will be shipped at a rate of 1 per cooler (1 in each cooler) that contains aqueous VOC.
5) Field blanks will be collected at a minimum rate of one per event when non-dedicated field equipment is used.
6) 2 samples will be collected for SEAD-25 every 5 years to include MW25-2.

Worksheet #21 Field Standard Operating Procedures

21.1 Provisions of the field SOPs listed below are superseded by specific activities outlined in the UFP-QAPP. There are no project-specific modifications to the SOPs listed below. Field SOPs that will be used in support of field sampling are provided in Appendix D.

SOP Reference Number	Title, Revision Date, and/or Number	Organizing Organization	Equipment Type
MRS SOP 001	Anomaly Avoidance	Contractor	Magnetometer
SOP 001	SOP for Sample Labels, Revision 1, November 2018	Contractor	Supplies, indelible ink pen, and documents
SOP 002	SOP for CoC Form, Revision 1, November 2018	Contractor	Supplies, indelible ink pen, and documents
SOP 003	SOP for Subsurface Utility Clearance, Revision 1, July 2018	Contractor	Supplies, indelible ink pen, and documents
SOP 004	SOP for Sampling Packing and Shipping, Revision 1, September 2018	Contractor	Supplies, coolers, and documents
SOP 005	SOP for Field Decontamination, Revision 2, September 2018	Contractor	Supplies, distilled water, non-phosphate laboratory detergent, scrub brushes, buckets, drums, and tubs
SOP 008	SOP for Trimble Geo 7X Global Positioning System Units, Revision 00, September 2021	Contractor	GPS unit
SOP 010	SOP for Water Level and Well Depth Measurements, Revision 2, March 2021	Contractor	Water level meter and interface probe
SOP 011	SOP for Photoionization detector Revision 1, May 2020	Contractor	Photoionization detector
SOP 013	SOP for Collection of Monitoring Well Samples, Revision 1, January 2019	Contractor	Filters, water quality instrument, turbidity instrument, generator or batter, logbook, peristaltic pump, applicable tubing, Photo Ionization Detector, plastic sheeting, buckets or drums, sample bottles, bailers, submersible pumps, and water level indicator.
SOP 016	SOP for Groundwater/Soil Field Logbooks, Revision 1, July 2019	Contractor	Logbooks and appropriate field forms
SOP 019	SOP for Monitoring Well Installation, Revision 1, October 2019	Contractor	Drilling equipment, water level meter, photoionization detector, plastic sheeting, buckets or drums, logbook
SOP 028	Well and Boring Abandonment, Revision 1, January 2021	Contractor	Drilling equipment, bentonite pellets, filter pack material, cement, bentonite grout, water

SOP Reference Number	Title, Revision Date, and/or Number	Organizing Organization	Equipment Type
SOP 039	SOP for Sample Preservation and Container Requirements, Revision 2, September 2018	Contractor	Ice, ice chests, sulfuric acid, nitric acid, hydrochloric acid, sodium hydroxide, containers, plastic bags.
SOP 042	SOP for Disposal of Investigation-Derived Material, December 2014	Contractor	Hazardous waste labels, bar codes permanent marker, CoC forms, field logbook (bound), department of transportation 17C specification metal containers, and waste ID labels
SOP 043	SOP for Multi-Probe Water Quality Monitoring Instruments, Revision 2, June 2020	Contractor	Water quality instrument, calibration standards, and accessories (batteries, chargers, case, etc.)
SOP 048	SOP for Low-Flow Sampling, Revision 0, December 2014	Contractor	Filters, water quality instrument, turbidity instrument, generator or batter, logbook, peristaltic pump, applicable tubing, photoionization detector, plastic sheeting, buckets or drums, sample bottles, bailers, submersible pumps, water level indicator, flow measuring device, flow-through cell, and sample tags
SOP A1	HACH Method 8146: Iron, Ferrous	HACH Company	HACH test kit
SOP A2	HACH Method 8034: Manganese	HACH Company	HACH test kit

Worksheet #22 Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
MiniRAE Lite photoionization detector (or equivalent)	Calibrate in accordance with the manual	Protect in hard case	Field test in accordance with the manual	Inspect for external damage	Daily, before use and when unstable readings occur	Within calibration standard(s) range	Recalibration	Field personnel	SOP 011, Equipment manual
Water Level Indicator	N/A	N/A	Daily Before Use	Visual Inspection	Daily Before Use	Manufacturer Specifics	Obtain New Water Level Indicator	Field personnel	SOP 010, Equipment manual
Peristaltic Pump	None	Charge battery	Field checks per manual	Visual Inspection	Daily	Pumping at required flow pressure and rate for sample recovery	Operator correction or return to manufacturer	Field personnel	SOP 013 and 048, Equipment manual
Submersible Pump	N/A	N/A	Field checks per manual	Visual Inspection	Daily	Pumping at required flow pressure and rate for sample recovery	Operator correction or return to manufacturer	Field Personnel	SOP 013 and 048, Equipment manual
Water Quality Meter	Calibrate in accordance with the manual	Protect in hard case	Field test in accordance with the manual	Inspect for external damage	Daily	Within calibration standard(s) range	Recalibration	Field personnel	SOP 043, Equipment manual
HACH spectrophotometer	In accordance with HACH method instructions	In accordance with instrument manual	Analyze standard solution	In accordance with instrument manual	In accordance with instrument manual	75-125% actual value of standard solution	In accordance with instrument manual	Field personnel	SOP A1 (Ferrous Iron) and SOP A2 (Manganese)

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
Global Positioning System (GPS) Equipment	Calibrate in accordance with the manual	Protect in hard case. Keep instrument clean, see manufacturer's specifications, and keep battery charged for operation.	Field test in accordance with the manual	Inspect for external damage	Daily check shots 'pre' and 'post' use	Field checks: horizontal: meter; 1.0 vertical; 2.0 meters between known and measured points. For post-processed data: horizontal quality – 0.15 meter; vertical quality – 0.15 meter.	If daily QC checks do not meet acceptance criteria, return equipment to vendor for repair or work with the vendor to rectify the issue.	Field personnel	Equipment Manual, EA-SOP-008

Notes:
1) Field SOPs that will be used in support of field sampling activities are provided in **Appendix D**.

Worksheet #23 Analytical Standard Operating Procedures

23.1 A subcontracted commercial laboratory will perform the fixed laboratory analyses under this UFP-QAPP. The SOPs listed in the following table may be used for the fixed laboratory analyses for this UFP-QAPP. SOPs are found in **Appendix C**.

SOP No.	Title, Revision Date and/or Number	Organization Performing Analysis	Definitive or Screening Data	Matrix	Analytical Group	Instrument	Modified for Project Work
GC019	Analysis of Dissolved Gases by Gas Chromatography, Flame Ionization Detector, Revised 02/21; Reviewed 08/22	SGS Orlando	Definitive	Aqueous	Dissolved Gases	GC/FID	No
GN215	Total Organic Carbon in Aqueous Samples, Revised 12/20; Reviewed 12/21	SGS Orlando	Definitive	Aqueous	TOC	TOC Analyzer	No
GN237	Determination of Inorganic Anions by Ion Chromatography (IC), Revised 04/23	SGS Orlando	Definitive	Aqueous	Anions	IC	No
MET103	Digestion of Water Samples for Inductively Coupled Plasma (ICP)/ICP-MS Analysis, Revised 04/22	SGS Orlando	Not applicable	Aqueous	Metals	Hot Block	No
MET106	Cold Vapor Analysis of Mercury for Water Samples, Revised 04/22	SGS Orlando	Definitive	Aqueous	Mercury	Atomic Absorption Spectrophotometer	No
MET107	Metals by ICP-MS, Revised 04/22	SGS Orlando	Definitive	Aqueous	Metals	ICP-MS	No
MS020	Analysis of Volatile Organics by GC/MS, Revised 03/22	SGS Orlando	Definitive	Aqueous	Volatile Organics	GC/MS	No
OP021	Standard Operating Procedure for the Introduction of Volatile Organics Analytes using Purge and Trap, Revised 05/20; Reviewed 08/22	SGS Orlando	Not Applicable	Aqueous	Volatile Organics	Purge and Trap	No
OP025	Standard Operating Procedure for Sample Preparation for Dissolved Gases in Aqueous Samples, Revised 06/20	SGS Orlando	Not Applicable	Aqueous	Dissolved Gases	NA	No

Notes:
GC/MS = Gas chromatograph/mass spectrometer

This page intentionally left blank

Worksheet #24 Analytical Instrument Calibration

24.1 Field equipment calibration is detailed in Worksheet #22. Laboratories will be required to follow their own policies and documented procedures in accordance with their certification requirements of the methods, SOPs, and support of the project objectives.

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action	Title/Position Responsible for Corrective Action	SOP Reference
GC/FID: Agilent 6890	Initial Calibration (ICAL) – A minimum of 5 point calibration	Various	As needed when Continuing Calibration Verification (CCV) fails	Percent relative standard deviation (%RSD) ≤ 20% or correlation coefficient r ≥ 0.995	Repeat ICAL and/or perform necessary equipment maintenance; check calibration standards; reanalyze affected data	Analyst, Department Manager	SGS Orlando SOP GC019
	Initial Calibration Blank (ICB)	NA	Before beginning a sample sequence.	No analytes detected ≥ ½ LOQ	Correct the problem, re-prepare and reanalyze	Analyst, Department Manager	
	Initial calibration verification (ICV)	Mid-range	1 per ICAL, analyzed after ICAL, before field samples	Percent difference (%D) ≤ 15%	If the acceptance criteria were not met, prepare fresh ICV, If fails, re-calibration is performed before any samples may be analyzed.	Analyst, Department Manager	

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action	Title/Position Responsible for Corrective Action	SOP Reference
	CCV	Various	Analyze standard at beginning and end of sequence and after every 10 field samples	%D ≤ 15%	If the criterion has not achieved corrective action, re-calibration is performed before any samples may be analyzed. Corrective action may include re-analysis of the samples.	Analyst, Department Manager	
TOC Analyzer: Shimadzu 5000 Combustion analyzer	ICAL - the instrument is calibrated by a minimum 5-point curve and a blank	1.0 – 33 mg/L TOC	At beginning of each day, or if QC is out of criteria	If multiple calibration standards are used, r must be ≥ 0.995.	Recalibrate and/or perform necessary equipment maintenance; check calibration standards; reanalyze affected data	Analyst, Department Manager	SGS Orlando SOP GN215
	ICB	NA	Before beginning a sample sequence.	No analytes detected ≥ ½ LOQ	Correct the problem, re-prepare and reanalyze	Analyst, Department Manager	
	ICV – Second Source	Mid-range	Following ICAL, prior to sample analysis	%R must be within 90-110% of the true value.	Investigate reasons for failure, reanalyze once; if still unacceptable, repeat ICAL	Analyst, Department Manager	
	CCV – second source to the curve	Mid-range	At beginning and end of sequence and after every 10 samples	%R must be within 90–110% of true value.	Recalibrate and/or perform necessary equipment maintenance; check calibration standards; reanalyze affected data.	Analyst, Department Manager	

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action	Title/Position Responsible for Corrective Action	SOP Reference
	Continuing Calibration Blank (CCB)	NA	After the initial CCV, after every 10 field samples; and at end of sequence	No analytes detected ≥ ½ LOQ.	Correct the problem, then re-prepare and reanalyze calibration blank and previous 10 samples.	Analyst, Department Manager	
IC: Metrohm 930	ICAL - the instrument is calibrated by a minimum 5-point curve and a blank	Various	Minimum quarterly, or if QC is out of criteria	$r^2 \geq 0.99$.	Recalibrate and/or perform necessary equipment maintenance; check calibration standards; reanalyze affected data	Analyst, Department Manager	SGS Orlando SOP GN237
	ICB	NA	Before beginning a sample sequence.	No analytes detected ≥ ½ LOQ	Correct the problem, re-prepare and reanalyze	Analyst, Department Manager	
	ICV – Second Source	Mid-range	Following ICAL, prior to sample analysis	%R must be within 90–110% of the true value.	Investigate reasons for failure, reanalyze once; if still unacceptable, repeat ICAL	Analyst, Department Manager	
	CCV	Various	At beginning and end of sequence and after every 10 samples	%R must be within 90–110% of true value.	Recalibrate and/or perform necessary equipment maintenance; check calibration standards; reanalyze affected data.	Analyst, Department Manager	

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action	Title/Position Responsible for Corrective Action	SOP Reference
	CCV2	Low level	One per calibration	%R must be within 50–150% of the true value.	Reanalyze standards, and/or recalibrate instrument and reanalyze all samples associated with CCV2	Analyst, Department Manager	
	CCB	NA	After the initial CCV, after every 10 field samples; and at end of sequence	No analytes detected ≥ ½ LOQ.	Correct the problem, then re-prepare and reanalyze calibration blank and previous 10 samples.	Analyst, Department Manager	
	Retention time (RT) window position establishment	NA	Once per multipoint calibration.	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.	NA	Analyst, Department Manager	
	RT window width	NA	At method set-up and after major maintenance (e.g., column change).	RT width is ± 3 times standard deviation for each analyte RT over a 24-hour period.	NA	Analyst, Department Manager	
Atomic Absorption Spectrophotometer: Leeman Hydra II	ICAL - the instrument is calibrated by 5-point series of standards and a calibration blank	0.20 – 6.0 µg/L	Daily prior to sample analysis	$r^2 \geq 0.99$	Recalibrate and/or perform necessary equipment maintenance; check calibration standards; reanalyze affected data	Analyst, Department Manager	SGS Orlando SOPs MET106

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action	Title/Position Responsible for Corrective Action	SOP Reference
	ICV Second Source	3.0 µg/L	Following ICAL, prior to samples analysis	%R must be within 90–110% of the true value.	Investigate reasons for failure, reanalyze once; if still unacceptable, repeat ICAL	Analyst, Department Manager	
	ICB	NA	Before beginning a sample sequence.	No analytes detected ≥ ½ LOQ.	Correct the problem, re-digest and reanalyze	Analyst, Department Manager	
	CCV	3.0 µg/L	At beginning and end of sequence and after every 10 samples	%R must be within 90–110% of true value.	Recalibrate and/or perform necessary equipment maintenance; check calibration standards; reanalyze affected data.	Analyst, Department Manager	
	CCB	NA	After the initial CCV, after every 10 field samples; and at end of sequence	No analytes detected ≥ ½ LOQ	Correct the problem, then re-prepare and reanalyze calibration blank and previous 10 samples.	Analyst, Department Manager	
	Low-Level Check Standard	0.20 µg/L	Daily after ICAL and before samples.	The %R must be within 80–120% of true value.	Investigate and perform necessary equipment maintenance; recalibrate and reanalyze all affected samples	Analyst, Department Manager	

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action	Title/Position Responsible for Corrective Action	SOP Reference
ICP-MS: Agilent 7700x	Tuning	Prior to ICAL	Mass calibration ≤ 0.1 atomic mass units from the true value; Resolution < 0.9 atomic mass units full width at 10% peak height	Flagging not appropriate, no samples should be analyzed w/o valid tune	Retune instrument and verify	Analyst, Department Manager	SGS Orlando SOP MET107
	ICAL –daily prior to sample analysis.	Various	At beginning of each day, or if QC is out of criteria	If multiple calibration standards are used, r must be ≥ 0.998	Recalibrate and/or perform necessary equipment maintenance; check calibration standards; reanalyze affected data	Analyst, Department Manager	
	ICV Second Source	Various	Following ICAL, prior to samples analysis	%R must be within 90–110% of the true value	Investigate reasons for failure, reanalyze once; if still unacceptable, repeat ICAL	Analyst, Department Manager	
	ICB	NA	Before beginning a sample sequence.	No analytes detected ≥ ½ LOQ, or < 1/10 of the amount measured in the sample	Correct the problem, re-prepare and reanalyze; if fails, rerun ICAL.	Analyst, Department Manager	
	CCV	Various	At beginning and end of sequence and after every 10 samples	%R must be within 90–110% of true value	Recalibrate and/or perform necessary equipment maintenance; check calibration standards; reanalyze affected data.	Analyst, Department Manager	

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action	Title/Position Responsible for Corrective Action	SOP Reference
	CCB	NA	After the initial CCV, after every 10 field samples; and at end of sequence	No analytes detected ≥ ½ LOQ, or < 1/10 of the amount measured in the sample	Correct the problem, then re-prepare and reanalyze calibration blank and previous 10 samples and a CCV.	Analyst, Department Manager	
	Low-Level Check Standard	Various	Daily after ICAL and before samples.	The %R must be within 80–120% of true value	Investigate and perform necessary equipment maintenance; recalibrate and reanalyze all affected samples	Analyst, Department Manager	
	Interference Check Standards (ICS – ICS A and ICS B)	Various	After ICAL and prior to sample analysis.	ICS A recoveries must be within the absolute value of the LOD; and ICS B recoveries must be within 80–120 %R of the true value	Terminate analysis; locate and correct problem; reanalyze ICS, reanalyze all samples	Analyst, Department Manager	
GC/MS: Agilent 6890 or 7890 with Agilent 5973 or 5975	ICAL – Minimum of a 5-point calibration curve is prepared (6-point curve for quadratic)	Various	After major instrument maintenance and upon second consecutive CCV failure	Relative standard deviation (RSD) for each analyte must be ≤ 15%, or the linear or non-linear r^2 must be ≥ 0.99 for each analyte.	Repeat calibration if criterion is not met	Analyst, Department Manager	SGS Orlando SOP MS020
	ICV – second source	Various	Once after each ICAL, prior to beginning a sample run	%R of all analytes must be within 80–120% of true value.	Correct problem and verify second source standard; reanalyze ICAL	Analyst, Department Manager	

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action	Title/Position Responsible for Corrective Action	SOP Reference
	Establish RT Window Position	Various	Once per ICAL for each analyte and surrogate	Position shall be set by midpoint standard of the ICAL curve during ICAL. When ICAL not performed, use initial CCV.	NA	Analyst, Department Manager	
	Evaluation of Relative Retention Times (RRTs)	Various	With each sample	RRT of each target analyte must be within ± 0.06 RRT units.	Correct problem then rerun ICAL	Analyst, Department Manager	
	CCV	Various	One per 12-hour analysis period after tune and before sample analysis One at the end of each run.	The %Dor percent drift must be ≤ 20% for all analytes and surrogates	Repeat ICAL and reanalyze all samples analyzed since the last successful CCV	Analyst, Department Manager	
	Tune Verification – 4-Bromofluorobenzene (BFB)	NA	Prior to ICAL and at the beginning of each 12-hour analytical sequence	Must meet ion abundance criteria required by the method. No samples may be accepted without a valid tune.	Retune and/or clean source	Analyst, Department Manager	

Worksheet #25 Analytical Instrument and Equipment Maintenance, Testing, and Inspection

25.1 Laboratories will be required to follow their own policies and documented procedures in accordance with their certification requirements of the methods, SOPs, and support of the project objectives.

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	Lab SOP No.
Agilent 6890 (GC/FID)	Injector port, column maintenance	RSK-175 Dissolved Gases	Leak test, column and injector port inspection	Need for maintenance determined by passing calibration and chromatography	Passing Calibration	Column clipping, seals and liners replacement, recalibrate and reanalyze affected samples	Laboratory Analyst	SGS Orlando SOP GC019
Shimadzu 5000 (TOC Analyzer)	Cleaning and maintenance of heating modules	SW-846 9060A Total Organic Carbon	Tubing inspection for build-up, catalyst inspection	As needed	Passing Calibration	Clean or replace tubing, replace Pt catalyst, replace Air/Oxygen tanks	Laboratory Analyst	SGS Orlando SOP GN215
Metrohm 930 (IC)	Pump maintenance, guard column cleaning	SW-846 9056A Anions	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	SGS Orlando SOP GN237
Leeman HYDRA AA II	Pump tubing, absorption cell, and lens cleaning.	SW-846 7470A Mercury (AQ)	Check connections, flush sample lines	Frequency determined by instrument remaining in calibration and free of interference	Passing calibration	Reconnect sample pathways, recalibrate, reanalyze affected samples	Laboratory Analyst	SGS Orlando SOP MET106

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	Lab SOP No.
Agilent 7700x (ICP-MS)	Clean torch assembly and spray chamber when discolored or when degradation in data quality is observed. Clean nebulizer, check argon, replace peristaltic pump tubing as needed.	SW-846 6020B Metals	Torch, nebulizer chamber, pump, pump tubing	Prior to ICAL and as necessary	Acceptable ICAL or CCV	Correct the problem and repeat ICAL or CCV	Laboratory Analyst	SGS Orlando SOP MET107
Agilent 6890 or 7890 with Agilent 5973 or 5975 (GC/MS)	Injector port, column maintenance, source cleaning	SW-846 8260D Volatile Organic Compounds	Leak test, column and injector port inspection, source insulator integrity	Need for maintenance determined by passing calibration and BFB	Passing BFB and CCV, passing Internal Standard response	Column clipping and/or reconditioning, seal and liners replacement, filaments and insulators as needed	Laboratory Analyst	SGS Orlando SOP MS020

Worksheet #26 and #27 Sample Handling, Custody, and Disposal

26/27.1 To ensure sample authenticity and data defensibility, a proper sample handing system will be followed from the time of sample collection to final sample disposal.

Sampling Organization:	Contractor
Laboratory:	SGS Orlando 4405 Vineland Rd, Orlando, Florida 32811
Point-of-Contact:	Kevin Gibbons
Email:	Kevin.Gibbons@sgs.com
Telephone:	732-406-1471
Sample Delivery Method:	Overnight shipping via Federal Express or United Parcel Service

Activity	Organization and Title or Position of Person Responsible for the Activity	SOP Reference[1]
Sample labeling	Field lead or designee	SOP 001
CoC record completion	Field lead or designee	SOP 002
Packaging	Field lead or designee	SOP 004
Shipping coordination	Field lead or designee	SOP 004
Sample receipt, inspection, and log-in	DoD ELAP-accredited laboratory sample log-in staff and laboratory PM	Laboratory SOP
Sample custody and storage	DoD ELAP-accredited Laboratory PM	Laboratory SOP
Sample disposal	DoD ELAP-accredited Laboratory Waste Manager	Laboratory SOP

Notes: Field SOPs are included in **Appendix D.**

SAMPLE COLLECTION

26/27.2 Analytical samples will be collected using clean nitrile gloves and placed in bottleware as defined in Worksheet #19 and #30. The laboratory will supply sample containers and appropriate preservation additives. On-site personnel will be responsible for ensuring that adequate sample containers are available for the work scheduled at the sample collection points.

26/27.3 QA/QC samples (duplicates, MS/MSD sample sets, trip blanks, and field blanks) will be collected as detailed in Worksheet #20.

SAMPLE IDENTIFICATION

26/27.4 Weatherproof sample labels with sample identification numbers will be affixed to each sample container and entered on the CoC record. Each sample will be assigned a unique alpha-numeric code to assist in the tracking of samples and to facilitate retrieval of analytical results. The sampling code will be used on sample labels, sample tracking forms, CoC forms, field logs, and any other applicable documentation. The alpha-numeric code will be as follows:

- Site Name-Location Identifier-Date Code
    - Site Name = SEAD for Former Seneca Army Depot and the assigned number or identifier

  - Location Identifier = Well ID
  - Date Code (YYYYMMDD) = Correspond to season and year

26/27.5 For example, sample IDs for groundwater collected from MW16-1 on 8 July 2023 at SEAD 16would be labeled as:

- SEAD16-MW16-1-20230708

26/27.6 Field QA/QC samples will include trip blanks for VOC and dissolved gas samples, field duplicates, MS/MSDs, and field blanks. Sample ID number naming conventions will be as follows:

- Duplicate samples will follow a similar naming convention to the parent samples, to be blind to the laboratory. Samples will be assigned a false location, starting with MW-943 for groundwater, with the location number increasing for each subsequent field duplicate collected per media at the SEAD site. For example, the first groundwater duplicate sample collected at SEAD-25 on 8 July 2023 would be labeled as follows:

  - SEAD25-MW-943-20230708

- MS/MSD sample ID numbers will consist of the same alpha-numeric code (sample number) as parent samples, with a note on the CoC that extra volume was collected for MS/MSD.

- Groundwater trip blank sample ID numbers will be labeled using the following convention: Site Name-TB-#-date code. For example, the trip blank submitted on 8 July 2023 will be labeled SEAD-TB-01-20230708.

- Groundwater field blank sample ID numbers will be labeled using the following convention: Site Name-EB-date code. For example, the field blank collected on 8 July 2022 will be labeled SEAD-EB-20230708.

SAMPLE DOCUMENTATION

26/27.7 Sampling information will be recorded in a permanently bound field logbook and on sample collection logs provided in **Appendix B**. The entries will be legible and recorded in indelible ink.

SAMPLE CUSTODY

26/27.8 Sample custody must be traceable from the time of collection until results are verified, reported by the contracted laboratory, and the samples are disposed of. Sample custody will be documented on CoC records. A CoC record will be completed before sample release or shipment. CoC documentation is required for each sample to track collection, shipments, laboratory receipt, custody, and disposal. The CoC record is preprinted with appropriate space for the applicable data to be entered.

26/27.9 Upon completion of sample collection, logging, and preservation, each sample identification number will be entered on the CoC record. Additional information contained on the CoC record will include the sampler's initials, analytical method(s), sample matrix, preservative, request for QC analysis, signatures of those relinquishing and receiving samples, time of relinquishment and receiving, and any additional notes for special conditions or requests. If the samples are transported to an off-site laboratory by a courier service, the courier's name and/or airbill number will be noted on the CoC record. The CoC record, sample labels, and field documentation will be crosschecked to verify sample identification, date of collection, time of collection, number of bottles, sample volume, and sample preservative prior to sample shipment.

26/27.10 The CoC record will accompany the samples throughout the shipping and analytical process. This record will document transfer of custody of samples from the sampler to another person or to the laboratory. Each individual who has the samples in their possession will sign the CoC record. A sample is considered to be in custody under the following conditions:

- It is in actual possession or in view of the person who collected the sample
- It is locked in a secure area
- It is placed in an area restricted to authorized personnel.

26/27.11 When transferring possession of samples, the individuals relinquishing and receiving the samples will sign, date, and note the time on the CoC record.

SAMPLE HANDLING, PACKAGING AND SHIPPING

26/27.12 After the appropriate labels are applied, the sample containers will be placed in coolers and cooled to less than 6ºC for transport to the laboratory. Completion of sample CoC records and sample packing for sample shipment will be performed in a project sample management staging area.

26/27.13 Designated sample control and/or field staff will complete and crosscheck CoC records and pack samples for shipment at the end of each sampling day or as necessary by project requirements. When shipping samples, outside packaging (cooler) will have two custody seals affixed to the container; one on the front and one on the back or side. These seals help identify if the container was opened between relinquishment and receiving.

26/27.14 Environmental samples from this project will be packaged and shipped in a manner that will ensure the safety and accountability of each sample, and all procedures will be in accordance with applicable federal and local requirements. The persons packing and shipping environmental samples will review and be aware of state, federal, Department of Transportation, and International Air Transport Association regulations governing environmental and hazardous sample packaging. The person(s) shipping the samples is responsible for compliance with applicable packaging, labeling, and shipping requirements.

26/27.15 The following procedures will be followed when packing sample coolers:

- Sample containers will be sealed in a plastic bag with a locking seal (e.g., Ziploc®), as applicable
- Each cooler will be cleaned and lined with bubble wrap
- Samples will be shipped in appropriate containers
- Each cooler containing samples will have its own CoC record
- A large plastic bag and/or cardboard will be used to segregate sample containers from the ice in the coolers used for transport
- Double-bagged ice will be packed on top of sample containers
- The original CoC record will be contained within the shipping container
- The shipping containers will have two signed custody seals affixed to the lid and will be taped shut.

26/27.16 Environmental samples will be shipped to the laboratory via overnight delivery service. Samples will be packaged and shipped in a manner that will ensure the safety and accountability of each sample, and the procedures implemented will be in accordance with applicable federal and local requirements. The persons packing and shipping environmental samples should review and be aware of state, federal, and International Air Transport Association regulations governing environmental and hazardous sample packaging. The person(s) shipping the samples is responsible for being in compliance with applicable packaging, labeling, and shipping requirements.

26/27.17 Upon arrival at the laboratory, the samples in the cooler are checked against the CoC record by laboratory personnel. If discrepancies are noted, the samples in question will be segregated and field personnel will be immediately notified. The person accepting the delivery will sign and date the CoC record.

26/27.18 A cooler receipt form will be prepared for each cooler of samples received by the laboratory sample receiving staff. The laboratory staff will inspect each cooler to ensure that proper packaging, labeling, and preservation were followed. Discrepancies will be documented on the cooler receipt form. The laboratory will email a copy of the cooler receipt form and the CoC record to the Project Chemist within 24 hours of delivery of each sample delivery group (SDG). A copy of cooler receipt forms will be provided in the final laboratory analytical report.

Worksheet #28 Analytical Quality Control and Corrective Action

28.1 The laboratory will be required to follow their own documented procedures in accordance with their QA/QC requirements, SOPs, and quality manual.

Table 28-1. Summary of QC Procedures for GC/FID Method (SGS Orlando)

Matrix	Aqueous
Analytical Group	Dissolved Gases
Analytical Method/ SOP Reference	RSK-175 SGS Orlando SOP GC019

QC Sample	Number/ Frequency	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Project-Specific Measurement Performance Criteria
Helium Blank	One per preparation batch of 20 or fewer samples of similar matrix	Analytes must be ≤ ½ LOQ and ≤ 1/10 the amount measured in any sample (whichever is greater)	Investigate source of contamination. Undertake Corrective action to remove contamination, up to and including replacing Helium cylinder	Analyst, Laboratory Department Manager	System integrity and freedom of interferences.

QC Sample	Number/ Frequency	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Project-Specific Measurement Performance Criteria
Method Blank (MB)	One per preparation batch of 20 or fewer samples of similar matrix	Analytes must be ≤ ½ LOQ and ≤ 1/10 the amount measured in any sample (whichever is greater)	Investigate source of contamination. Evaluate the samples and associated QC: e.g., if the blank results are above the LOQ, report sample results that are <LOQ or > 10x the blank concentration. Otherwise, re-prepare a blank and samples >LOQ and <10x LOQ.	Analyst, Laboratory Department Manager, and Data Validator	System integrity and freedom of interferences.
Field Duplicate	One per 20 samples of similar matrix	RPD ≤30%	If the limits exceed limits for the field duplicate, this will be addressed by the data reviewer.	Data Validator	Same as QC Acceptance Limits
LCS/ LCSD	One for each batch of up to 20 samples	%R must be within the DoD QSM v5.4 limits RPD ≤30%	Evaluate and reanalyze if possible. If LCS recoveries are high but the sample results are < LOQ, narrate. Otherwise, re-prepare and reanalyze.	Analyst, Laboratory Department Manager	Performance in ideal matrix

QC Sample	Number/ Frequency	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Project-Specific Measurement Performance Criteria
MS/MSD	One per 20 samples of similar matrix	%R should be within LCS limits RPD ≤30%	CA not taken for samples when %Rs are outside limits and surrogate and LCS criteria are met. If both LCS and MS/MSD are unacceptable, re-prepare the samples and QC.	Analyst, Laboratory Department Manager	Performance and reproducibility in real matrix

This page intentionally left blank

Table 28-2. Summary of QC Procedures for Total Organic Carbon Methods (SGS Orlando)

Matrix	Aqueous
Analytical Group	TOC
Analytical Method/ SOP Reference	SW9060A SOP GN215

QC Sample	Number/ Frequency	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Project-Specific Measurement Performance Criteria
MB	One per digestion batch of 20 or fewer samples	≤ ½ LOQ or ≤ 1/10 the amount measured in any sample	Reanalyze, and/or stop the run and determine the source of contamination, or document why the data are acceptable.	Analyst, Laboratory Department Manager	System integrity and freedom of interferences.
LCS	One for each batch of up to 20 samples	90-110%R	Evaluate and reanalyze if possible. If LCS recoveries are high but the sample results are < LOQ, narrate. Otherwise, re-prepare and reanalyze.	Analyst, Laboratory Department Manager	Performance in ideal matrix
Field Duplicate	One per 20 samples of similar matrix	RPD ≤30%	If the limits exceed limits for the field duplicate, this will be addressed by the data reviewer.	Data Validator	Same as QC Acceptance Limits
MS/MSD	10% of samples for each matrix	%R 90-110 RPD ≤ 20%	Determine and correct the problem, reanalyze samples and MS/MSD, or document why data are acceptable	Analyst, Department Manager	Performance and reproducibility in real matrix

Table 28-3. Summary of QC Procedures for IC Methods (SGS Orlando)

Matrix	Aqueous
Analytical Group	Anions
Analytical Method/ SOP Reference	SW9056A, SGS Orlando SOP GN237

QC Sample	Number/ Frequency	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Project-Specific Measurement Performance Criteria
MB	One per preparation batch of 20 or fewer samples	Analytes must be ≤ ½ LOQ or ≤ 1/10 the amount measured in any sample or 1/10 the regulatory limit	Reanalyze, and/or stop the run and determine the source of contamination, or document why the data are acceptable.	Analyst, Laboratory Department Manager	System integrity and freedom of interferences.
LCS	One for each batch of up to 20 samples	%R within DoD QSM v5.4 Appendix C Tables	Determine and correct the problem, reanalyze samples, if necessary, or document why data are acceptable.	Analyst, Laboratory Department Manager	Performance in ideal matrix
Field Duplicate	One per 20 samples of similar matrix	RPD ≤30%	If the limits exceed limits for the field duplicate, this will be addressed by the data reviewer.	Data Validator	Same as QC Acceptance Limits
MS/MSD	One per preparation batch of 20 samples of similar matrix	%R within LCS limits RPD ≤ 15%	Determine and correct the problem, reanalyze samples and MS/MSD, or document why data are acceptable	Analyst, Laboratory Department Manager	Performance and reproducibility in real matrix

Table 28-4. Summary of QC Procedures for Metals (Mercury) Methods (SGS Orlando)

Matrix	Aqueous
Analytical Group	Mercury
Analytical Method/ SOP Reference	SW7470A SGS Orlando SOPs MET106

QC Sample	Number/ Frequency	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Project-Specific Measurement Performance Criteria
MB	One per digestion batch of 20 or fewer samples	≤ ½ LOQ or ≤ 1/10 the amount measured in any sample or 1/10 the regulatory limit	Reanalyze, and/or stop the run and determine the source of contamination, or document why the data are acceptable.	Analyst, Laboratory Department Manager	System integrity and freedom of interferences.
LCS	One for each batch of up to 20 samples	%R within DoD QSM v5.4 Appendix C limits (82-119%)	Evaluate and reanalyze if possible. If LCS recoveries are high but the sample results are < LOQ, narrate. Otherwise, re-digest and reanalyze.	Analyst, Laboratory Department Manager	Performance in ideal matrix
Field Duplicate	One per 20 samples of similar matrix	RPD ≤30%	If the limits exceed limits for the field duplicate, this will be addressed by the data reviewer.	Data Validator	Same as QC Acceptance Limits
MS/MSD	One per preparation batch of 20 samples of similar matrix	Within LCS limits RPD ≤ 20%	Qualify results for affected analytes for all associated samples. Perform post-digestion spike to assess matrix effect.	Analyst, Laboratory Department Manager	Performance Reproducibility in real matrix

Table 28-5. Summary of QC Procedures for Metals Methods (SGS Orlando)

Matrix	Aqueous, Soil
Analytical Group	Metals
Analytical Method/ SOP Reference	SW-8466020B SGS Orlando SOP MET108

QC Sample	Number/ Frequency	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Project-Specific Measurement Performance Criteria
MB	One per digestion batch of 20 or fewer samples	Analytes must be ≤ ½ LOQ or ≤ 1/10 the amount measured in any sample or 1/10 the regulatory limit	Reanalyze, and/or stop the run and determine the source of contamination, or document why the data are acceptable.	Analyst, Laboratory Department Manager	System integrity and freedom of interferences.
LCS	One for each batch of up to 20 samples	Within DoD QSM v5.4 Appendix C limits Statistical limits if not listed in DoD QSM	Evaluate and reanalyze if possible. If LCS recoveries are high but the sample results are < LOQ, narrate. Otherwise, re-digest and reanalyze.	Analyst, Laboratory Department Manager	Performance in ideal matrix
Field Duplicate	One per 20 samples of similar matrix	RPD ≤30%	If the limits exceed limits for the field duplicate, this will be addressed by the data reviewer.	Data Validator	Same as QC Acceptance Limits
MS/MSD	One per preparation batch of 20 samples of similar matrix	Within LCS limits RPD ≤ 20%	Qualify results for affected analytes for associated samples. Perform post-digestion spike to assess matrix effect.	Analyst, Laboratory Department Manager	Performance Reproducibility in real matrix

QC Sample	Number/ Frequency	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Project-Specific Measurement Performance Criteria
Serial Dilution	One for each preparation batch with sample concentration(s) > 50x LOQ	The results of the 1:5 dilution shall agree within 10% of the original measurement as long as the analyte concentration is within the linear range of the instrument and sufficiently high (minimally, a factor of 25 times greater than the RL).	If the results are outside these criteria then matrix interference should be suspected, and the proper footnote entered into LIMS.	Analyst, Laboratory Department Manager	Matrix effect
Internal Standard (IS)	All samples and standards	70-120 %R referenced against ICB	Dilute sample until internal standard is within range. Footnote data accordingly.	Analyst, Department Manager	Instrument sensitivity

Table 28-6. Summary of QC Procedures for Volatile Organic Compounds Methods (SGS Orlando)

Matrix	Aqueous, Solid
Analytical Group	VOCs
Analytical Method/ SOP Reference	SW8260D SGS Orlando SOP MS020

QC Sample	Number/ Frequency	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Project-Specific Measurement Performance Criteria
MB	One per preparation batch of 20 or fewer samples of similar matrix	Analytes must be ≤ ½ LOQ or ≤ 1/10 the amount measured in any sample or 1/10 the regulatory limit	(1) Investigate contamination source. (2) Re-prepare and analyze method blank and all samples processed with the contaminated blank.	Analyst, Laboratory Department Manager	System integrity and freedom of interferences

QC Sample	Number/ Frequency	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Project-Specific Measurement Performance Criteria
Surrogates (Surr.)	Every sample, standard and QC	Within DoD QSM v5.4 Appendix C limits Statistical limits if alternate surrogates are used	(1) Check chromatogram for interference; if found, flag the data. (2) If not found, then check instrument performance; if problem is found, correct and reanalyze. (3) If still out, re-extract and analyze sample. (4) If reanalysis is out, flag the data.	Analyst, Laboratory Department Manager	Individual sample efficiency control
Laboratory Control Sample (LCS) or Blank Spike (BS)	One for each batch of up to 20 samples	Within DoD QSM 5-series Appendix C Tables Statistical limits if not listed in DoD QSM	Evaluate and reanalyze if possible. If LCS recoveries are high but the sample results are < LOQ, narrate. Otherwise, re-prepare and reanalyze.	Analyst, Department Manager	Performance in ideal matrix
Internal Standard (IS)	Every sample	Retention times for ISs must be within ± 30 seconds and response areas must be within – 50% to + 100% of the ICAL midpoint standard or sequence CCV	Reanalyze affected samples.	Analyst, Laboratory Department Manager	Instrument response and retention time

QC Sample	Number/ Frequency	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Project-Specific Measurement Performance Criteria
MS/MSD	One per 20 samples of similar matrix	Within LCS limits RPD ≤ 20%	CA not taken for samples when %Rs are outside limits and surrogate and LCS criteria are met. If both LCS and MS/MSD are unacceptable, re-prepare the samples and QC.	Analyst, Laboratory Department Manager	Performance and reproducibility in real matrix
Field Duplicate	One per 20 samples of similar matrix	RPD ≤30%	If the limits exceed limits for the field duplicate, this will be addressed by the data reviewer.	Data Validator	Same as QC Acceptance Limits

Worksheet #29 Project Documents and Records Table

Planning Documents	Sample Collection Documents and Records	On-site Analysis Documents and Records	Off-Site Analysis Documents and Records	Data Assessment Documents and Records	Other
• Project Management Plan • UFP-QAPP • APP • Site Management Plan	• Field forms • Field logbooks • Data collection documents and records • CoC records • Location data (GPS) • Sample tracking forms • Photographs • Air bills	• CoC records • Communications regarding corrective action or deviation from methods • Calibration logs • Sampling notes • Well inspection checklists • Synoptic gauging logs • Well purge logs • Sample collection logs • IDW inventory logs • Field logbook • ID of QC samples • Daily chemical QC reports • Photographs • Air bills • LUC inspection forms	• SOPs • Case narrative • Definitions of laboratory qualifiers • Documentation of corrective action results • Documentation of laboratory method deviations • Electronic data deliverables • ID of QC samples • Laboratory name • Laboratory sample ID numbers • Reporting forms, completed with actual results • Sample chronology (time of receipt, extraction, and analysis) • Tabulated data summary forms and raw data for field samples, standards, QC checks, and QC samples • Cooler receipt forms • Site-specific file geo-database	• Data Validation Reports • Chemical QC Summary Report • Data usability evaluation • Periodic Review Report	• H&S Sign-off Sheets • Daily field reports • Weekly reports • Monthly project status reports • Quarterly project review reports • Accident and/or injury reports • Corrective Action Reports • Data generated will be archived following contractual requirements.

This page intentionally left blank

Worksheet #31, #32, and #33 Assessments and Corrective Actions

ASSESSMENT				
Assessment Type	**Responsible Party and Organization**	**Frequency**	**Assessment Deliverable**	**Deliverable Due Date**
QA Oversight	USACE per Quality Assurance Surveillance Plan (**Appendix F**)	As required by USACE	QC Report	30 days after review
Field Sampling Audit	QA/QC Manager or designee	As required by USACE	Audit Memorandum	7 days after assessment
Independent Technical Review	Senior Technical Experts	As needed, at critical points in development and performance	Independent Technical Review Report	7 days after assessment
Field Documentation Audit	QA/QC Manager or designee	As required by USACE	Audit Memorandum	7 days after assessment
Deliverable Checks	Qualified individual from the appropriate discipline	Prior to document submission	Email or written documentation	Immediate correction
Interdisciplinary Checks	Project development team members	Daily, as needed	Email or written documentation; sign-off sheet	Immediate correction
Laboratory Technical Systems Audit (may be documentation review)	Laboratory QA; Project Chemist	As required by USACE	Audit Memorandum	Immediate correction – written documentation within 7 days
Performance Evaluation Sample	Field QC Manager	As required by USACE	Audit Memorandum	7 days after assessment
H&S Compliance Audit	SSHO	During each Definable Feature of Work (DFW), upon arrival of new crew, and as required by USACE	Project Review Summary Report	Immediate correction – written documentation due within 1 week
Management Systems Review	Field QC Manager	As necessary or requested	Project Review Summary Report	Immediate correction – written documentation due within 1 week
Subcontract Laboratory Technical Systems/ Performance Audits	Laboratory PM	Per Laboratory QA Manual	Audit Memorandum	30 days after review

Assessment Response and Corrective Action

Assessment Type	Responsibility for Responding to Assessment Findings	Assessment Response Documentation	Timeframe for Response	Responsibility for Implementing Corrective Action	Responsible for Monitoring Corrective Action Implementation
Field Sampling Audit	EA PM, Field Task Leader	Corrective Action Response (email or memorandum)	Immediate correction – written documentation due within 1 week	Field Task Leader	EA PM or designee
Independent Technical Review	Appropriate persons depending on the area of the findings, EA Project Chemist	Corrections to plans, documents as indicated	In accordance with project schedule	Appropriate persons depending on the area of the findings, EA Project Chemist	EA PM or designee
Field Documentation Audit	EA PM, Field Task Leader	Corrective Action Response (email or memorandum)	Immediate correction – written documentation due within 1 week	Field Task Leader	EA PM or designee
Deliverable Checks	Appropriate persons depending on the area of the findings, EA Project Chemist	Corrections to deliverables as indicated	In accordance with project schedule	Appropriate persons depending on the area of the findings, EA Project Chemist	EA PM or designee
Interdisciplinary Checks	Appropriate persons depending on the area of the findings, EA Project Chemist	Email to file	As necessary for progress of project	Appropriate persons depending on the area of the findings, EA Project Chemist	EA PM or designee
Laboratory Technical Systems Audit (may be documentation review)	Laboratory QA Manager	Corrective Action Response (email or memorandum)	Immediate correction- written documentation within 7 days of receipt of memorandum	Laboratory Manager	EA Project Chemist
Performance Evaluation Sample	Laboratory QA Manager	Corrective Action Response	7 days from receipt of memorandum	Laboratory Technical Director	EA Project Chemist
H&S Inspection	SSHO	Corrective Action Response (email or memorandum)	Immediate correction- written documentation within 7 days of receipt of memorandum	SSHO	Health and Safety Manager
Management Systems Review	EA PM or designee	Corrective Action Response	7 days from receipt of memorandum	As assigned in response	Contractor QA/QC Manager or designee
Laboratory Data Assessment	Laboratory QA Manager	E-mail to file	Immediate correction – written documentation due within 1 week	Laboratory PM	EA Project Chemist

Worksheet #34 Data Verification and Validation Inputs

34.1 This worksheet is used to list the inputs that will be used during data verification and validation. Inputs include planning documents, field records, and laboratory records. To ensure that scientifically-sound data of known and documented quality are used in making environmental decisions, the following three-step data review will be performed:

- Step I (verification) will confirm that the sampling and analytical requirements have been met.
- Step II (validation) will assess whether the sampling and analytical processes comply with the contract-specific and project-specific requirements.
- Step III (usability assessment) will determine whether the resulting data are suitable as a basis for the decision being made.

34.2 Records subject to verification and validation are listed below.

Item	Record/Document	Description	Verification (completeness)	Validation (conformance to specifications)
Planning Documents/Records				
1	Approved planning documents	All planning documents will be available to reviewers to allow reconciliation with planned activities and objectives.	X	
2	Contract		X	
3	Field SOPs		X	
4	Laboratory SOPs		X	
Field Records				
5	Tailgate safety meeting record	Tailgate safety meetings and associated H&S forms will be completed by the designated H&S officer.	X	X
6	Field logbooks/field sheets	Field notes will be prepared daily by the Field Team and will be complete, appropriate to the project tasks, and legible. The Technical Manager will review logbooks and records for accuracy and completeness. Upon completion of field work, logbooks and records will be placed in the project files. Field reports will be verified to ensure correct reporting of information. Review will be conducted prior to completion of each report.	X	X
7	Equipment calibration records		X	X

Item	Record/Document	Description	Verification (completeness)	Validation (conformance to specifications)
8	CoC records	Technical Manager, or designee will review the CoC forms against the samples packed in each cooler prior to shipment. CoCs will be sent with the samples to the laboratory and copies retained for the project files. Analytical data will be reviewed upon completion of analytical activities and verified against the laboratory report.	X	X
9	Sampling drawings/surveys	Data user will review during evaluation and completion of data report.	X	X
10	Relevant correspondence	Relevant correspondence will be used to reconcile field records and data.	X	X
11	Change orders/deviations	Field changes will be communicated as presented in Worksheet #6. Unanticipated field changes may require a UFP-QAPP addendum, amendment, and/or revision. This requirement will be determined in consultation with the USACE Technical Lead following notification of the proposed change. If required, any UFP-QAPP addendum, amendment, and/or revision will be submitted to the USACE PM and USACE Technical Manager, and regulators /stakeholders (as applicable) for review, comment, and approval.	X	X
12	Field audit reports	The Contractor PM and/or Technical Manager will evaluate whether field sampling procedures were followed with respect to equipment and proper sampling support and verify that planned audits were conducted and examine audit reports. For any deficiencies noted, the Technical Manager will verify that corrective action was implemented according to plan. The audit reports will indicate whether samples were collected, field measurements performed, and field equipment calibrated according to the UFP-QAPP. During verification, any necessary corrective actions will be reviewed.	X	X
13	Field corrective action reports		X	X

Item	Record/Document	Description	Verification (completeness)	Validation (conformance to specifications)
Analytical Data Package				
14	Cover sheet (laboratory identifying information)	Laboratory analyst and QA Manager will review/verify internally the completeness and technical accuracy of data prior to submittal. Laboratory data will be verified by the project chemist who will review data packages for content and sample information upon receipt. Data packages will be evaluated for completeness and compliance. Relevant correspondence will be used to reconcile analytical data. Analytical data will be validated using stage 2b validation. The data will be evaluated against project DQOs and measurement performance criteria, such as completeness.	X	X
15	Case narrative		X	X
16	Internal laboratory CoC		X	X
17	Sample receipt records		X	X
18	Sample chronology (i.e., dates and times of receipt, preparation, and analysis)		X	X
19	Communication records		X	X
20	Project-specific proficiency testing/sample results (if applicable)		X	X
21	LOD/LOQ establishment and verification		X	X
22	Standards traceability		X	X
23	Instrument calibration records		X	X
24	Definition of laboratory qualifiers		X	X
25	Results reporting forms		X	X
26	QA/QC sample results		X	X
27	Corrective action reports		X	X
28	Raw data		X	
29	Electronic data deliverable		X	X

This page intentionally left blank

Worksheet #35 Data Verification Procedures

35.1 This worksheet establishes the procedures that will be followed to verify project data. Data verification is a completeness check to confirm that the required activities were conducted, the specified records are present, and the contents of the records are complete.

Records Reviewed	Process Description	Responsible Person, Organization
CoC records and shipping forms	CoC forms and shipping documentation will be reviewed internally upon their completion and verified against the packed sample coolers that they represent to verify their completeness, accuracy, and consistency with the field logbook. The review will include verification of appropriate analytical methods, preservation, sufficient volume for analyses and necessary QC samples (i.e., MS/MSD), and required signatures and dates. A check for transcription errors will occur. A copy of the CoC will be retained in the project file, with the original and remaining copies taped inside the cooler for shipment.	Daily – EA Field team lead; at the conclusion of field activities – EA Project Chemist or designee.
Field notes/logbook/field forms	Field notes will be reviewed daily internally for completeness, accuracy, and comparability between sample locations and field samplers. The review will include verification that records are present and complete for each day of field activities, the planned samples including field QC samples were collected, sample collection locations are documented, and meteorological data were provided for each day of field activities. Review will also include verification that changes/exceptions are documented and were reported in accordance with requirements. If field data are collected, review will verify that results are documented. Any required corrective actions will be addressed with the field samplers prior to further site work.	Daily – EA Field team lead; at the conclusion of field activities – EA Field QCM or designee.
Audit reports, Corrective Action Reports	The Field QCM will verify that planned audits were conducted and examine audit reports. For any deficiencies noted, the Field QCM will verify that corrective action was implemented according to plan. The audit reports will indicate whether samples were collected, field measurements performed, and field equipment calibrated according to the UFP-QAPP. During verification, any necessary corrective actions will be reviewed.	EA Field QCM, EA PM, or designee
Laboratory deliverables	The laboratory deliverable will be reviewed to verify that content contains the records specified in the planning documents. Verification will include check of sample receipt records to ensure sample condition upon receipt was noted, and that missing/broken sample containers were noted and reported according to planning documents. The data package will be compared to CoC records to verify that results were provided for the collected samples. The narrative will be reviewed to ensure that QC exceptions are described. The review will verify that necessary signatures and dates are present.	Before release of data package – Laboratory QA Manager; Upon receipt – EA Project Chemist or designee

This page intentionally left blank

Worksheet #36 Data Validation Procedures

36.1 This worksheet documents procedures that will be used to validate project data. Data validation is an analyte and sample-specific process for evaluating compliance with contract requirements, methods/SOPs, and method performance criteria. The validation to be performed for each data type is summarized in this worksheet. Data validation will be performed by a third-party validator, Environmental Data Services, Ltd.

Data Validation

Analytical Group/Method	VOCs by SW8260D, TOC by 9060A, anions by SW9056A, dissolved gases by RSK-175, Mercury by 7470A, and Metals by SW-846 6020B
Data deliverable requirements	Level 4 PDF data package; NYSDEC EQuIS and ERIS or HQAES EDD
Analytical specifications	Worksheet #28
Measurement performance criteria	Worksheet #12
Percent of data packages to be validated	100%
Percent of raw data reviewed	0%
Percent of results to be recalculated	0%
Validation procedure	DoD Data Validation Guidelines (DoD 2019a) and associated modules 1 and 2; DoD Quality System Manual Version 5.4 (DoD 2021)
Validation Level	S2bVM
Electronic validation program/version	Not applicable

Validation Code and Label Identifier Table

Validation Code	Validation Label	Description/Reference
S1VE	Stage 1 Validation Electronic	EPA 540-R-08-005
S1VM	Stage 1 Validation Manual	
S1VEM	Stage 1 Validation Electronic and Manual	
S2aVE	Stage 2a Validation Electronic	
S2aVM	Stage 2a Validation Manual	
S2aVEM	Stage 2a Validation Electronic and Manual	
S2bVE	Stage 2b Validation Electronic	
S2bVM	Stage 2b Validation Manual	
S2bVEM	Stage 2b Validation Electronic and Manual	
S3VE	Stage 3 Validation Electronic	
S3VM	Stage 3 Validation Manual	
S3VEM	Stage 3 Validation Electronic and Manual	
S4VE	Stage 4 Validation Electronic	
S4VM	Stage 4 Validation Manual	
S4VEM	Stage 4 Validation Electronic and Manual	
NV	Not validated	

36.2 The data validation will provide a discussion of the QC parameters evaluated, the acceptance criteria used to evaluate each QC parameter, a list of QC exceedances and the extent of the exceedance, the samples associated with each exceedance, and the qualifiers applied.

36.3 Data validation is an analyte and sample-specific process for evaluating compliance with contract requirements, methods/SOPs, and method performance criteria. The validation criteria that will be used to evaluate project data include this UFP-QAPP, General Data Validation Guidelines (DoD 2019a), DoD QSM Version 5.4 (DoD 2021) (or more recent version used by the laboratory for the analyses), Environmental Data Quality Workgroup data validation guidance for GC/MS (DoD 2020a) or ICP (DoD 2020b) analyses, and method criteria.

36.4 The validation will consist of a review of the reported results and associated raw data as necessary and will be conducted by a qualified third-party validator. The Project Chemist will review the validation reports.

36.5 The objective of the data validation is to assess the performance associated with the analysis in order to determine the quality of the data. This objective will be accomplished by evaluating whether the collected data comply with the pre-defined requirements of the project, including method, procedural, or contractual requirements, and by comparing the collected data with established criteria.

DATA REVIEW REQUIREMENTS FOR DEFINITIVE DATA

36.6 Scientifically sound data of known and documented quality that meet established criteria are essential for use in the decision-making process. Data review is the process whereby data are examined and evaluated 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. There must be persuasive records that document data review activities to afford effective assessment of the data for quality and usability. The data can then move forward with associated qualifiers indicating the overall usability of the data.

36.7 Data verification is the first step in data review, as described in Worksheet #35. Data verification is to confirm that the specified requirements have been performed.

36.8 Data validation extends data verification and is used to confirm that the requirements for a specific intended use are fulfilled. Data validation is the systematic process of evaluating the compliance of the data with the pre-defined requirements of the project, including method, procedural, or contractual requirements and the comparison of the data with criteria based on the quality objectives documented in the project planning documents. The purpose of data validation is to assess the performance associated with the analysis in order to determine the quality of the data. Data validation includes a determination, to the extent possible, of the reasons for any failure to meet performance requirements, and an evaluation of the impact of such failures on the usability of the data.

36.9 Data usability assessment is an evaluation based on the results of data validation and verification in the context of the overall project decisions or objectives as described in Worksheet #37. Both the sampling and analytical activities must be considered, with the ultimate goal of assessing whether the final, qualified results support the decisions to be made with the data.

LABORATORY REQUIREMENTS

36.10 The analytical data package must contain adequate information and be presented in a clear and concise manner. The minimum requirements are presented in the most current version of the DoD QSM, Version 5.4 (DoD 2021). The complete laboratory data report will be submitted as an Adobe Acrobat™ PDF file in the format defined in Appendix A of the DoD QSM Version 5.4 (2021). The PDF file shall be searchable. A table of contents is required in the PDF file; bookmarks will be created such that there is a logical organization/presentation of the analytical data. Data will be organized at least by analytical method, and preferably also by laboratory batch.

36.11 A reviewer should be able to determine the precision, accuracy, representativeness, comparability, completeness, and sensitivity of the data, based on the information contained in the data package. Additional information may be required, depending on the detail of the data review performed.

Data Verification

36.12 Prior to validating the data, laboratory reports will be verified for completeness to ensure that the data requested are present in the data deliverable format that is presented above, and that the results are complete. The items to be verified are listed under Stage 1 validation below.

36.13 Data verification may include, but is not limited to, review of the following:

- Sampling documentation (such as the CoC record)
- Preservation summary and holding times
- Presence of the analyses and analytes requested
- Use of required sample preparation and analysis procedures
- DLs, LODs, LOQs
- Correctness of concentration units
- Case narrative

Data Validation Level

36.14 After data have been verified, they can be validated. Data validation consists of evaluating the documented sample receipt conditions and comparing sample-related analytical QC results to acceptance criteria. Note that review of instrument-related QC is not required unless discrepancies are noted in the case narrative.

36.15 The levels of data review (defined in the 2019 DoD General Data Validation Guidelines) that will be employed for chemical data generated are as follows:

- Stage 1 Validation: Sample results forms, CoC, laboratory receipt checklist
- Stage 2A validation: Sample results forms, CoC, laboratory receipt checklist, method QC forms
- Stage 2B Validation: Instrument QC forms and preparation logs.

Stage 1 Validation

36.16 A Stage 1 validation is based only on a review of completeness and compliance of sample receipt condition checks.

36.17 The Stage 1 validation includes the review of CoC records, sample receipt forms, and the laboratory report in general to ensure that the sample holding times were met and that the samples were labeled correctly and were in good condition and properly preserved upon receipt at the laboratory. The cover letter/case narrative will be reviewed to determine if there are significant data quality issues identified at the laboratory and verify that the laboratory data are not adversely impacted to the point of rejection.

36.18 The Stage 1 validation of the laboratory analytical data package consists of verification and validation checks for the compliance of sample receipt conditions, sample characteristics (e.g., percent moisture), and analytical results. The following items will be verified in the laboratory analytical data package as part of the Stage 1 validation:

- Verify that the laboratory report is complete
- Verify that sample documentation is adequate and that the CoC is unbroken
- Verify that requested analytical methods were performed as described in the approved planning document
- Verify that sample dates, date and time of laboratory receipt of samples, and sample condition upon receipt at the laboratory (including preservation, pH, and temperature) are documented, and that holding time and sample condition are acceptable
- Verify that requested analytical results are reported, and that the results are reported at or below the required RLs
- Verify that sample characteristics are representative

Stage 2A Validation

36.19 The Stage 2A validation includes verification and validation based on completeness and compliance checks of sample receipt condition and sample-related QC results. The Stage 2A validation does not include review of instrument level QC unless discrepancies are identified in the case narrative. If instrument level QC discrepancies are noted, the validator shall document potential impacts to project data.

36.20 The Stage 2A validation involves checking analytical parameters at the preparatory batch level (method blanks, LCSs, MS, and surrogate spikes) and field QC samples (field replicates, field blanks, field blanks, and trip blanks).

36.21 Data qualifiers (flags) will be applied to results that have the potential to be affected by QC failures or other anomalies identified that may impact results.

Stage 2B Validation

36.22 The following items will be verified in the laboratory analytical data package as part of the Stage 2B validation:

- Initial calibration summaries detailing the following: calibration type, individual standard concentrations, individual response factors, individual abundances, average response factors, correlation coefficients, and linear dynamic range results
- Initial and continuing calibration verification summaries along with associated concentrations and percent recoveries or percent differences
- Method specific forms such as tune and interference check summaries and IS summaries
- All summary forms listed above for second column or detector including percent difference between the two analytical results
- Preparation logs, including records supporting special techniques applied by the laboratory (included to allow evaluation of applicable QC checks as detailed in the UFP-QAPP).

Data Qualifiers

36.23 Data qualifiers applied during the data review will be included in tables, figures, and elsewhere in project reports wherever these results are referenced. The following data qualifiers will be applied during data validation. Potential impacts on project specific DQOs will be discussed in the data validation report.

- NM – Measurement Performance Criteria contained in Worksheet #12 were not met.
- J – The result is an estimated value. The nature of the bias will be discussed in the data validation report.
- J- – The result is an estimated value with a potential low bias.
- J+ – The result is an estimated value with a potential high bias.

- X – The sample results were affected by serious deficiencies. The analyte may or may not be present in the sample. Exclusion of the data is recommended.

- U – The analyte was analyzed for but was not detected above the level of the associated value. The associated value is the LOD.

- UJ – The analyte was analyzed for but was not detected above the level of the associated value. The associated value is an estimate and may be inaccurate or imprecise.

36.24 The J and X flags are added to the results by the data reviewer to signify that the result is potentially impacted and may be biased and/or appropriate for rejection. If X flagged data are determined by the project team to be appropriate for rejection, then the data will not be used for any project purpose. Note that recommended data qualification criteria may be revised based on the reviewer's professional judgement; however, revisions to qualification require a written explanation.

Worksheet #37 Data Usability Assessment

37.1 This worksheet documents procedures that will be used to perform the data usability assessment. Once the data have been verified and the quality of the data set has been validated and results have been qualified, the usability of the data may be assessed. Data usability is the process of determining whether the data can be used to support project decision making and involves both a detailed knowledge of the implications of data verification and validation failures, as well as broad knowledge of a project's objectives. The assessment involves evaluating data verification and validation findings in the context of broader project data quality objectives and determining whether the data are usable for purposes of project decision-making.

37.2 The usability assessment will consider whether data meet DQOs as they relate to the decision(s) to be made and evaluates whether data are suitable for making that decision. The usability assessment is a data review and will be performed only on data of known and documented quality (i.e., verified, and validated data collected as part of the investigation). The results of the data usability assessment will be included as a section in each report that presents project data.
To accomplish this step of data review, the project team will do the following:

- Perform data validation as described in Worksheet #36
- Summarize the usability assessment process and the usability assessment procedures, including interim steps and any statistics, equations, and computer algorithms that will be used to assess data.
- Describe the documentation that will be generated during usability assessment
- Identify the personnel (by title and organizational affiliation) responsible for performing the usability assessment
- Describe how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies
- Describe the evaluative procedures used to assess overall measurement error associated with the project and include the data quality indicators

SUMMARY OF DATA QUALITY INDICATORS

37.3 Precision, accuracy/bias, representativeness, comparability, completeness, and sensitivity are the data quality indicators used to assess the data produced during the project. Each data quality indicator is described below, including a definition of the terminology, the referenced process for calculating the indicator, and the referenced measurement performance criteria for this project. A description of how the data quality indicators will be incorporated into the usability section is found under each parameter heading.

Precision

37.4 Precision is 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, %D, or range, in either absolute or relative terms. The QC measures for precision include field duplicates, laboratory duplicates, MS/MSDs, and analytical replicates.

37.5 Precision may be the result of one or more of the following: field instrument variation, analytical measurement variation, poor sampling technique, sample transport problems, or spatial variation (heterogeneous sample matrices). To identify the cause of imprecision, the field sampling design rationale and sampling techniques will be evaluated by the reviewer, and both field and analytical duplicate/replicate sample results will be reviewed. The process for calculating precision is detailed in and will be in accordance with the UFP-QAPP Manual, Section 2.6.2.1 (EPA 2005). If poor precision is indicated in both the field and analytical duplicates/replicates, then the laboratory may be the source of error. If poor precision is limited to the field duplicate/replicate results, then the sampling technique, field instrument variation, sample transport, and/or spatial variability may be the source of error. Validation will be performed on the definitive data packages.

37.6 The usability report will:

- Discuss and compare overall field duplicate/replicate precision data from data collected for the project for each matrix, analytical group, and concentration level

- Discuss and describe the limitations on the use of project data when overall precision is poor or when poor precision is limited to a specific sampling or laboratory (analytical) group, data set or sample delivery group (SDG), matrix, analytical group, or concentration level

Accuracy/Bias

37.7 Accuracy is 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) that are due to sampling and analytical operations. Examples of QC measures for accuracy include MSs, LCSs, surrogates, and field blanks. In order to meet the needs of the data users, project data must meet the measurement performance criteria for accuracy/bias. The process for calculating accuracy/bias is detailed in, and will be in accordance with, the UFP-QAPP Manual, Section 2.6.2.2 (EPA 2005).

37.8 The usability report will:

- Discuss and compare overall contamination and accuracy/bias for data collected for the project for each matrix, analytical group, and concentration level

- Describe the limitations on the use of project data if extensive contamination and/or inaccuracy or bias exists, or when inaccuracy is limited to a specific sampling or laboratory group, data set or SDG, matrix, analytical group, or concentration level

- Discuss the impact of qualitative and quantitative trends in bias on the sample data

Representativeness

37.9 Representativeness is the 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. The process for calculating representativeness is detailed in, and will be in accordance with, the UFP-QAPP Manual, Section 2.6.2.4 (EPA 2005).

37.10 If field duplicate precision checks indicate potential spatial variability, additional scoping meetings and subsequent re-sampling may be needed in order to collect data that are more representative of a non-homogeneous site.

37.11 The usability report will:

- Discuss and compare overall sample representativeness for each matrix, analytical group, and concentration level

- Describe the limitations on the use of project data when overall non-representative sampling has occurred, or when non-representative sampling is limited to a specific sampling, group, data set or SDG, matrix, analytical group, or concentration level

Comparability

37.12 Comparability is the degree to which different methods, data sets, and decisions agree or can be represented as similar. Comparability describes the confidence (expressed qualitatively or quantitatively) that two data sets can contribute to a common analysis and interpolation.

37.13 Additional detail regarding the process of assessing comparability is detailed in, and will be in accordance with, UFP-QAPP Manual, Section 2.6.2.5 (EPA 2005). Different situations require different assessments of comparability, as in the following:

- If two or more sampling procedures or sampling teams will be used to collect samples, describe how comparability will be assessed for each matrix, analytical group, and concentration level

- If two or more analytical methods or SOPs will be used to analyze samples of the same matrix and concentration level for the same analytical group, the comparability will be assessed between the two data sets and discussed

- If replicate samples are analyzed, the specific method and %D formula that will be used to assess replicate sample comparability for individual data points will be discussed.

37.14 The usability report will:

- Discuss and compare overall comparability for the project for each matrix, analytical group, and concentration level
- Discuss if screening data will be confirmed by definitive methods and document the specific method and %D formula that will be used to assess comparability for individual data points
- Document overall comparability, and describe the procedures used to perform overall assessment of comparability and include mathematical and statistical formulas for evaluating screening and confirmatory data comparability
- Discuss if the project is LTM; project data should be compared with previously generated data to ascertain the possibility of false positives and false negatives, and positive and negative trends in bias. Data comparability is extremely important in these situations
- Discuss anomalies detected in the data that may reflect a changing environment or indicate sampling and/or analytical error. Comparability criteria should be established to evaluate these data sets to identify outliers and the need for re-sampling as warranted
- Describe the limitations on the use of project data when project-required data comparability is not achieved for the overall project or when comparability is limited to a specific sampling or laboratory group, data set or SDG, matrix, analytical group, or concentration level
- Document the failure to meet screening/confirmatory (on-site and off-site data) comparability criteria and discuss the impact on usability
- Document the failure to meet replicate sampling comparability criteria and discuss the impact on usability
- If data are not usable to adequately address environmental questions or support project decision-making, address how this problem will be resolved and discuss the potential need for re-sampling.

Sensitivity and Quantitation Limits

37.15 Sensitivity is 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, DL, LOD, and LOQ studies, and low-level calibration standards. The process for assessing sensitivity is detailed in the UFP-QAPP Manual, Section 2.6.2.3 (EPA 2005).

36.16 The laboratory will establish a DL using a scientifically valid and documented procedure. The DL is the minimum concentration of a substance that can be measured and reported with 99%

confidence that the analyte concentration is greater than zero. The DL is the laboratory's "best case" sensitivity for a given analytical method. The laboratory may establish DLs for each method, matrix, and analyte for each instrument the laboratory plans to use for the project using the statistical method presented in the 40 Code of Federal Regulations Part 136, Appendix D.

37.17 The DL, LOD, and LOQ will be established in accordance with DoD requirements.

37.18 A general summary of the relationship between the DL terms used above is presented below:

$$\text{DL} < \text{LOD} < \text{LOQ} \leq \text{RL}$$

37.19 The following requirements apply to the determination of DL, LOD, and LOQ:

- The apparent signal to noise ratio at the LOD must be at least three and in the results, must meet all method requirements for analyte ID (e.g., ion abundance, second column confirmation, or pattern recognition). If no measurement of noise is available for a given method, then the LOD must yield a result that is at least three standard deviations greater than the mean blank concentration.

- If multiple instruments are used, the lab must verify the DL, LOD, and LOQ on each.

- If the LOD verification fails, then the laboratory must repeat the DL and LOD determinations at higher concentrations.

- The laboratory will maintain documentation of the DL, LOD, and LOQ studies and these measures of instrument sensitivity will be performed at least quarterly.

- A non-detectable result will be reported as less than the LOD. The "J" flag will be applied to the detectable results that fall between the DL and the LOQ, indicating the variability associated with the result. No detectable results will be reported below the DL.

37.20 The usability report will:

- Discuss and compare overall sensitivity from multiple data sets collected for the project for each matrix, analytical group, and concentration level

- Discuss the impact of that lack of sensitivity or higher DLs on data usability; if information is available, indicate that sensitivity or project-specific DLs were not achieved.

- Describe the limitations on the use of project data if project-required sensitivity and DLs are not achieved for the project data, or when sensitivity is limited to a specific sampling or laboratory group, data set or SDG, matrix, analytical group, or concentration level.

- The laboratory's LODs are capable of meeting sensitivity requirements, and the compounds of potential concern can be detected below the project evaluation criteria unless otherwise noted in Worksheet #15.

Completeness

37.21 Completeness is 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 circumstances. Completeness will be calculated and reported for each analyte in each well, because each well at this site represents a decision unit. The number of valid results divided by the number of possible individual analyte results, expressed as a percentage, determines the completeness of the data set. The completeness target is 95%. Completeness measures the effectiveness in sample collection, analysis, and result reporting of the entire investigation, and will calculated on a per-well, per-analyte basis by the following equation:

$$\%\ Completeness = \frac{Number\ of\ valid\ measurements}{Number\ of\ possible\ measurements}\ x\ 100$$

37.22 For instances of samples that could not be analyzed for any reason (holding time violations in which resampling, and analysis were not possible, samples spilled or broken, etc.), the numerator of this calculation becomes the number of possible results minus the number of possible results not reported.

37.23 A completeness check will be done on the data generated by the laboratory. For each analyte, completeness will be calculated as the number of data points for each analyte that meets the measurement performance criteria for precision, accuracy/bias, and sensitivity, divided by the total number of data points for each analyte. A discussion will follow summarizing the calculation of data completeness. Any conclusions about the completeness of the data for each analyte will be drawn and any limitations on the use of the data will be described.

37.24 For this project, 95% of usable sample data for each COC in each well is considered the minimal acceptance criteria for completeness.

37.25 The usability report will:

- Discuss and compare overall completeness for each matrix, analytical group, and concentration level

- Describe the limitations on the use of project data if project-required completeness is not achieved for the overall project, or when completeness is limited to a specific sampling or laboratory group, data set or SDG, matrix, analytical group, or concentration level.

Activities

37.26 The entire project team will reconvene to perform the usability assessment to ensure that the DQOs are understood, and the full scope is considered. If, for whatever reason, measurement performance criteria (e.g., precision, accuracy/bias, comparability, sensitivity, completeness) are not achieved and it has been determined that certain project data are not usable, then the project team will determine if it is necessary to take further action, such as, resampling, to ensure that DQOs have been met.

37.27 The items listed below are examples of specific items that will be considered during the project under the usability assessment.

Evaluative Procedures used to Assess Overall Measurement Error with the Project:

- ***Precision***—The precision of the data will be determined by a comparison to other similar data, as well as, with field duplicates, lab duplicates/replicates and MSDs. Note that field duplicates and MSDs do not measure total precision, as only two duplicate samples are analyzed in each case.

- ***Accuracy/Bias***—The analytical accuracy of data will be assessed by comparing observed values with reference value through the use of MSs, LCSs, and field blanks.

- ***Representativeness***—Samples will be considered to be representative of the groundwater at each well location if sampling procedures conform to currently accepted (low-flow) methods.

- ***Comparability***—The results of this study will be used as a benchmark for determining comparability for data collected during any future sampling events using the same or similar sampling and analytical SOPs.

- ***Completeness***—A completeness check will be done on all the data generated by the laboratory. For each analyte at each monitoring well, completeness will be calculated as the number of data points for each analyte that meets the measurement performance criteria for precision, accuracy/bias, and sensitivity, divided by the total number of data points for each analyte. A discussion will follow summarizing the calculation of data completeness. Any conclusions about the completeness of the data for each analyte will be drawn and any limitations on the use of the data will be described.

- ***Reconciliation***—Each of the DQOs presented in Worksheet #11 will be examined to determine if the objective was met. This examination will include a combined overall assessment of the results of each analysis pertinent to an objective. Each analysis will first be evaluated separately in terms of the major impacts observed from the data quality indicators, and measurement performance criteria assessments. Based on the results of these assessments, the quality of the data will be determined. Based on the quality determined, the usability of the data for each analysis will be determined. Based on the combined usability of the data from all analyses, it will be determined if the DQO was met and whether PALs were exceeded. Reports will include a summary of the points that went into the reconciliation of each objective. As part of the reconciliation of each objective, conclusions will be drawn and any limitations on the usability of any of the data will be described.

37.28 The Contractor PM, Project Chemist, Field QCM, Corporate QA/QC Manager, and others as appropriate will participate in this activity.

Assessment Documentation

37.29 A usability section will be provided in subsequent reports that discusses precision, accuracy/bias, representativeness, comparability, and completeness as detailed within this worksheet. This narrative report will include worksheets and supporting documentation to assess the DQOs and any conclusions and limitations of the associated data. The specific details of each section of the usability assessment documentation can be found above under the individual data quality indicators.

Considerations for Usability Assessment:

- **Data Deliverables and UFP-QAPP, Deviation—**Ensure that the necessary information was provided.

- **Deviations—**Determine the impact of deviations on the usability of data.

- **Sampling Locations—**Determine if any implemented alterations to groundwater sample locations continue to satisfy the project objectives.

- **CoC Record—**Establish that problems with documentation or custody procedures do not prevent the data from being used for the intended purpose.

- **Holding Times—**Determine the acceptability of data if holding times were exceeded.

- **Damaged Samples—**Determine whether the data from damaged samples are usable. If the data cannot be used, determine whether resampling is necessary.

- **SOPs and Methods—**Evaluate the impact of deviations from SOPs and specified methods on data.

- **QC Samples—**Evaluate the implications of unacceptable QC sample results on the data usability for the associated samples. For example, consider the effects of observed blank contamination.

- **Matrix—**Evaluate matrix effects (interference or bias). For example, consider the effects of observed MS recoveries.

- **Meteorological Data and Site Conditions—**Evaluate the possible effects of meteorological (e.g., wind, rain, temperature) and site conditions on sample results. Review field reports to identify whether any unusual conditions were present and how the sampling was executed.

- **Comparability—**Ensure that results from different data collection activities achieve an acceptable level of agreement.

- **Completeness—** Evaluate the impact of missing information. Ensure that enough information was obtained for the data to be usable (completeness as defined in project quality objectives documented in the UFP-QAPP).

- **Background—**Determine if background levels have been adequately established (if appropriate).

- **Critical Samples—**Establish that critical samples and critical target analytes, as defined in the UFP-QAPP, were collected and analyzed. Determine if the results meet criteria specified in the UFP-QAPP.

- **Data Restrictions—**Describe the exact process for handling data that do not meet project quality objectives (i.e., when measurement performance criteria are not met). Depending on how those data will be used, specify the restrictions on use of those data for environmental decision making.

- **Usability Decision—**Determine if the data can be used to make a specific decision considering the implications of all deviations and corrective actions.

- **Usability Report—**Discuss and compare overall precision, accuracy/bias, representativeness, comparability, completeness, and sensitivity for each matrix, analytical group, and concentration level. Describe limitations on the use of project data if criteria for data quality indicators are not met.

This page intentionally left blank

REFERENCES

Department of Defense (DoD). 2019a. *General Data Validation Guidelines.* May.

———. 2020a. *Data Validation Guidelines Module 1: Data Validation Procedure for Organic Analysis by GC/MS.* Environmental Data Quality Workgroup. May.

———. 2020b. *Data Validation Guidelines Module 2: Data Validation Procedure for Metals by ICP-OES.* Environmental Data Quality Workgroup. May.

———. 2021. *Consolidated Quality Systems Manual (QSM) for Environmental Laboratories Version 5.4*. Environmental Data Quality Workgroup. October.

Groundwater Monitoring & Remediation. 1992. Merin, I.S. *Conceptual Model of Ground Water Flow in Fractured Siltstone Based on Analysis of Rock Cores, Borehole Geophysics, and Thin Sections.* Vol. 12. 118-125.

New York State Department of Environmental Conservation Basin Planning Report ORB-5, 1974. *Crain, L.J. Ground-water resources of the Western Oswego River Basin, New York.*

New York State Department of Health (NYSDOH). 2006. *Individual Water Supply Wells – Fact Sheet #2 Water Storage.* March.

New York State Water Power and Control Commission. Mozola, A.J. *The ground-water resources of Seneca County, New York.*

U.S. Environmental Protection Agency (EPA). 1993 EPA, Army, and NYSDEC. *Federal Facility Agreement Under CERCLA Section 120, Docket Number: II-CERCLA-FFA-00202.* January.

———. 1998. *Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater.* September.

———. 2001. *EPA Requirements for Quality Assurance Project Plans EPA QA/R-5 (reissued 2006).*

———. 2005. *Intergovernmental Data Quality Task Force Uniform Federal Policy for Quality Assurance Project Plans, Part 1: Uniform Federal Policy-Quality Assurance Project Plan Manual.* March.

————. 2006. *Guidance on Systematic Planning Using the Data Quality Objectives Process EPA QA/G-4*. February.

———. 2012. *Intergovernmental Data Quality Task Force Uniform Federal Policy for Quality Assurance Project Plans, Part 2A: Uniform Federal Policy-Quality Assurance Project Plan Workbook. Revision 1.* March.

Parsons. 1994a. *Final SWMU Classification Report, Seneca Army Depot Activity.* September.

———. 1995. *Expanded Site Inspection (ESI) – Seven High Priority SWMUs SEADs 4, 16, 17, 24, 25, 26, and 45.* December

———. 1999. *ROD Former Open Burning (OB) Grounds Site.* January.

———. 2002. *Decision Document - Mini Risk Assessment SEAD 9, 27, 28, 32, 33, 34, 43, 44A, 44B, 52, 56, 58, 62, 64A, 64B, 64C, 64D, 66, 68, 69, 70, and 120B.* May.

———. 2003. *ROD for Twenty No Action SWMUs (SEADs 7, 9, 10, 18, 19, 20, 21, 22, 33, 35, 36, 37, 42, 47, 49, 51, 53, 55, 65, and 68) and Eight No Further Action SWMUs (SEADs 28, 29, 30, 31, 32, 34, 60, and 61).* September.

———. 2004a. *ROD for Sites Requiring Institutional Controls in the Planned Industrial/Office Development or Warehousing Areas.* September.

———. 2004b. *ROD The Fire Training and Demonstration Pad (SEAD 25) and the Fire Training Pit and Area (SEAD 26).* September.

———.2004c. Decision Document, Mini Risk Assessment, SEAD-13, IRFNA Disposal Area. July.

———. 2005a. *ROD The Ash Landfill Operable Unit.* January.

———. 2005b. *ROD No Further Action SWMUs (SEAD-50/54).* September.

———.2006. *ROD The Abandoned Deactivation Furnace (SEAD-16) and the Active Deactivation Furnace (SEAD-17).* March.

———. 2007. *ROD for Seventeen SWMUs Requiring Land Use Controls (SEADs 13, 39, 40, 41, 43/56/69, 44A, 44B, 52, 62, 64B, 64C, 64D, 67, 122B, and 122E).* March.

———. 2008. *ROD for the Defense Reutilization and Marketing Office Yard (SEAD-121C) and the Rumored Cosmoline Oil Disposal Area (SEAD-121I).* June.

———. 2009a. *ROD for the fill area west of Building 135 (SEAD-59) and the Alleged Paint Disposal Area (SEAD-71).* March.

———. 2009b. *ROD for the Old Construction Debris Landfill (SEAD-11).* September.

———. 2009c. *ROD for Five Former SWMUs SEAD-1, 2, 5, 24, & 48.* April.

———. 2015. *ROD The Radioactive Waste Burial Sites (SEAD-12) and the Mixed Waste Storage Facility (SEAD-72).* March.

———. 2016a. *Draft 2016 Annual Long-Term Monitoring Report, Fire Training and Demonstration Pad (SEAD-25), Seneca Army Depot Activity.* October.

———. 2017a. *Final UFP-QAPP Seneca Army Depot Activity Long-Term Monitoring.* May.

———. 2017b. *ROD SEAD-46, SEAD 003-R-01 (SEAD-57), SEAD 002-R-01 and SEAD 007-R-01 (Seneca AD Munitions Response Sites) and SEAD-70.* March.

———. 2018. *2017 Land Use Controls Inspection Report*. March

———. 2021a. *Final Five-Year Review Seneca Army Depot Activity.* August.

———. 2021b. *Final 2019 Year 9 Annual Report for the former Abandoned Deactivation Furnace (SEAD-16) and the former Active Deactivation Furnace (SEAD-17).* February.

Woodward-Clyde Federal Services. 1997. *Environmental Baseline Survey Report. Final, U.S. Army Base Realignment and Closure 95 Program.* March.

This page intentionally left blank

Appendix A

Laboratory Certifications

This page intentionally left blank

ANSI *National Accreditation Board*

CERTIFICATE OF ACCREDITATION

The ANSI National Accreditation Board

Hereby attests that

SGS North America Inc. - Orlando
4405 Vineland Road, Suite C-15
Orlando, FL 32811

Fulfills the requirements of

ISO/IEC 17025:2017

and

U.S. Department of Defense (DoD) Quality Systems Manual for Environmental Laboratories (DoD QSM V 5.4)

In the field of

TESTING

This certificate is valid only when accompanied by a current scope of accreditation document.
The current scope of accreditation can be verified at www.anab.org.

R. Douglas Leonard Jr., VP, PILR SBU

Expiry Date: 15 December 2024
Certificate Number: L2229

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. 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 April 2017).

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017
AND
U.S. DEPARTMENT OF DEFENSE (DOD) QUALITY SYSTEMS MANUAL FOR ENVIRONMENTAL LABORATORIES (DOD QSM V 5.4)

SGS North America Inc. - Orlando
4405 Vineland Road, Suite C-15
Orlando, FL 32811
Svetlana Izosimova, Ph. D., QA Officer
407-425-6700

TESTING

Valid to: **December 15, 2024** Certificate Number: **L2229**

Environmental

Drinking Water		
Technology	**Method**	**Analyte**
LC/MS/MS	EPA 537 rev. 1.1	Perfluorohexanoic Acid
LC/MS/MS	EPA 537 rev. 1.1	Perfluoroheptanoic Acid
LC/MS/MS	EPA 537 rev. 1.1	Perfluorooctanoic Acid
LC/MS/MS	EPA 537 rev. 1.1	Perfluorononanoic Acid
LC/MS/MS	EPA 537 rev. 1.1	Perfluorodecanoic Acid
LC/MS/MS	EPA 537 rev. 1.1	Perfluoroundecanoic Acid
LC/MS/MS	EPA 537 rev. 1.1	Perfluorododecanoic Acid
LC/MS/MS	EPA 537 rev. 1.1	Perfluorotridecanoic Acid
LC/MS/MS	EPA 537 rev. 1.1	Perfluorotetradecanoic Acid
LC/MS/MS	EPA 537 rev. 1.1	Perfluorobutanesulfonic Acid
LC/MS/MS	EPA 537 rev. 1.1	Perfluorohexanesulfonic Acid
LC/MS/MS	EPA 537 rev. 1.1	Perfluorooctanesulfonic Acid
LC/MS/MS	EPA 537 rev. 1.1	N-Methyl perfluorooctanesulfonamidoacetic acid
LC/MS/MS	EPA 537 rev. 1.1	N-Ethyl perfluorooctanesulfonamidoacetic acid

Drinking Water		
Technology	**Method**	**Analyte**
LC/MS/MS	EPA 537.1	Perfluorohexanoic Acid
LC/MS/MS	EPA 537.1	Perfluoroheptanoic Acid
LC/MS/MS	EPA 537.1	Perfluorooctanoic Acid
LC/MS/MS	EPA 537.1	Perfluorononanoic Acid
LC/MS/MS	EPA 537.1	Perfluorodecanoic Acid
LC/MS/MS	EPA 537.1	Perfluoroundecanoic Acid
LC/MS/MS	EPA 537.1	Perfluorododecanoic Acid
LC/MS/MS	EPA 537.1	Perfluorotridecanoic Acid
LC/MS/MS	EPA 537.1	Perfluorotetradecanoic Acid
LC/MS/MS	EPA 537.1	Perfluorobutanesulfonic Acid
LC/MS/MS	EPA 537.1	Perfluorohexanesulfonic Acid
LC/MS/MS	EPA 537.1	Perfluorooctanesulfonic Acid
LC/MS/MS	EPA 537.1	N-Methyl perfluorooctanesulfonamidoacetic acid
LC/MS/MS	EPA 537.1	N-Ethyl perfluorooctanesulfonamidoacetic acid
LC/MS/MS	EPA 537.1	ADONA
LC/MS/MS	EPA 537.1	2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA; GenX)
LC/MS/MS	EPA 537.1	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS; F53B minor)
LC/MS/MS	EPA 537.1	9-Chlorohexadecafluoro-3-oxanone-1-sulfonic acid (9Cl-PF3ONS; F53B major)
LC/MS/MS	EPA 533	Perfluorobutanoic acid
LC/MS/MS	EPA 533	Perfluoropentanoic acid
LC/MS/MS	EPA 533	Perfluorohexanoic acid
LC/MS/MS	EPA 533	Perfluoroheptanoic acid
LC/MS/MS	EPA 533	Perfluorooctanoic acid
LC/MS/MS	EPA 533	Perfluorononanoic acid

Drinking Water

Technology	Method	Analyte
LC/MS/MS	EPA 533	Perfluorodecanoic acid
LC/MS/MS	EPA 533	Perfluoroundecanoic acid
LC/MS/MS	EPA 533	Perfluorododecanoic acid
LC/MS/MS	EPA 533	Perfluorobutanesulfonic acid
LC/MS/MS	EPA 533	Perfluoropentanesulfonic acid
LC/MS/MS	EPA 533	Perfluorohexanesulfonic acid
LC/MS/MS	EPA 533	Perfluoroheptanesulfonic acid
LC/MS/MS	EPA 533	Perfluorooctanesulfonic acid
LC/MS/MS	EPA 533	4:2 Fluorotelomer sulfonate
LC/MS/MS	EPA 533	6:2 Fluorotelomer sulfonate
LC/MS/MS	EPA 533	8:2 Fluorotelomer sulfonate
LC/MS/MS	EPA 533	Perfluoro-3-methoxypropanoic acid
LC/MS/MS	EPA 533	Perfluoro-4-methoxybutanoic acid
LC/MS/MS	EPA 533	Nonafluoro-3,6-dioxaheptanoic acid
LC/MS/MS	EPA 533	Perfluoro(2-ethoxyethane)sulfonic acid
LC/MS/MS	EPA 533	Hexafluoropropylene oxide dimer acid
LC/MS/MS	EPA 533	4,8-Dioxa-3H-perfluorononanoic acid
LC/MS/MS	EPA 533	9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid
LC/MS/MS	EPA 533	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid

Non-Potable Water

Technology	Method	Analyte
GC/ECD	EPA 8011	1,2-Dibromoethane (EDB)
GC/ECD	EPA 8011	1,2-Dibromo-3-Chloropropane (DBCP)
GC/ECD	EPA 504.1	1,2-Dibromoethane (EDB)
GC/ECD	EPA 504.1	1,2-Dibromo-3-Chloropropane (DBCP)
GC/ECD	EPA 504.1	1,2,3-Trichloropropane (1,2,3-TCP)
GC/FID	EPA 8015C/D	Diesel range organics (DRO)

Non-Potable Water

Technology	Method	Analyte
GC/FID	EPA 8015C/D	Oil Range Organics (ORO)
GC/FID	EPA 8015C/D	Gasoline range organics (GRO)
GC/ECD	EPA 608.3; EPA 8081B	4,4`-DDD
GC/ECD	EPA 608.3; EPA 8081B	4,4`-DDE
GC/ECD	EPA 608.3; EPA 8081B	4,4`-DDT
GC/ECD	EPA 608.3; EPA 8081B	Aldrin
GC/ECD	EPA 608.3; EPA 8081B	alpha-BHC (alpha-Hexachlorocyclohexane)
GC/ECD	EPA 608.3; EPA 8081B	beta-BHC (beta-Hexachlorocyclohexane)
GC/ECD	EPA 608.3; EPA 8081B	delta-BHC
GC/ECD	EPA 608.3; EPA 8081B	gamma-BHC (Lindane gamma-Hexachlorocyclohexane)
GC/ECD	EPA 608.3; EPA 8081B	Chlordane (tech.)
GC/ECD	EPA 608.3; EPA 8081B	alpha-Chlordane
GC/ECD	EPA 608.3; EPA 8081B	gamma-Chlordane
GC/ECD	EPA 608.3; EPA 8081B	Dieldrin
GC/ECD	EPA 608.3; EPA 8081B	Endosulfan I
GC/ECD	EPA 608.3; EPA 8081B	Endosulfan II
GC/ECD	EPA 608.3; EPA 8081B	Endosulfan sulfate
GC/ECD	EPA 608.3; EPA 8081B	Endrin
GC/ECD	EPA 608.3; EPA 8081B	Endrin aldehyde
GC/ECD	EPA 608.3; EPA 8081B	Endrin ketone
GC/ECD	EPA 608.3; EPA 8081B	Heptachlor
GC/ECD	EPA 608.3; EPA 8081B	Heptachlor epoxide
GC/ECD	EPA 608.3; EPA 8081B	Methoxychlor
GC/ECD	EPA 608.3; EPA 8081B	Toxaphene (Chlorinated camphene)
GC/ECD	EPA 608.3; EPA 8082A	Aroclor-1016 (PCB-1016)
GC/ECD	EPA 608.3; EPA 8082A	Aroclor-1221 (PCB-1221)
GC/ECD	EPA 608.3; EPA 8082A	Aroclor-1232 (PCB-1232)
GC/ECD	EPA 608.3; EPA 8082A	Aroclor-1242 (PCB-1242)
GC/ECD	EPA 608.3; EPA 8082A	Aroclor-1248 (PCB-1248)
GC/ECD	EPA 608.3; EPA 8082A	Aroclor-1254 (PCB-1254)
GC/ECD	EPA 608.3; EPA 8082A	Aroclor-1260 (PCB-1260)
GC/ECD	EPA 8082A	Aroclor-1262 (PCB-1262)
GC/ECD	EPA 8082A	Aroclor-1268 (PCB-1268)
GC/ECD	EPA 8082A	Total PCB

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/FPD	EPA 8141B	Azinphos-methyl (Guthion)
GC/FPD	EPA 8141B	Bolstar (Sulprofos)
GC/FPD	EPA 8141B	Carbophenothion
GC/FPD	EPA 8141B	Chlorpyrifos
GC/FPD	EPA 8141B	Coumaphos
GC/FPD	EPA 8141B	Demeton-o
GC/FPD	EPA 8141B	Demeton-s
GC/FPD	EPA 8141B	Demeton
GC/FPD	EPA 8141B	Diazinon
GC/FPD	EPA 8141B	Dichlorovos (DDVP Dichlorvos)
GC/FPD	EPA 8141B	Dimethoate
GC/FPD	EPA 8141B	Disulfoton
GC/FPD	EPA 8141B	EPN
GC/FPD	EPA 8141B	Ethion
GC/FPD	EPA 8141B	Ethoprop
GC/FPD	EPA 8141B	Famphur
GC/FPD	EPA 8141B	Fensulfothion
GC/FPD	EPA 8141B	Fenthion
GC/FPD	EPA 8141B	Malathion
GC/FPD	EPA 8141B	Merphos
GC/FPD	EPA 8141B	Methyl parathion (Parathion methyl)
GC/FPD	EPA 8141B	Mevinphos
GC/FPD	EPA 8141B	Monocrotophos
GC/FPD	EPA 8141B	Naled
GC/FPD	EPA 8141B	Parathion ethyl
GC/FPD	EPA 8141B	Phorate
GC/FPD	EPA 8141B	Ronnel
GC/FPD	EPA 8141B	Stirofos
GC/FPD	EPA 8141B	Sulfotepp
GC/FPD	EPA 8141B	Tetraethyl pyrophosphate (TEPP)
GC/FPD	EPA 8141B	Thionazin (Zinophos)
GC/FPD	EPA 8141B	Tokuthion (Prothiophos)
GC/FPD	EPA 8141B	Trichloronate
GC/FPD	EPA 8141B	O,O,O-Triethyl phosphorothioate
GC/ECD	EPA 8151A	2,4,5-T
GC/ECD	EPA 8151A	2,4-D

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/ECD	EPA 8151A	2,4-DB
GC/ECD	EPA 8151A	Dalapon
GC/ECD	EPA 8151A	Dicamba
GC/ECD	EPA 8151A	Dichloroprop (Dichlorprop)
GC/ECD	EPA 8151A	Dinoseb (2-sec-butyl-4,6-dinitrophenol DNBP)
GC/ECD	EPA 8151A	MCPA
GC/ECD	EPA 8151A	MCPP
GC/ECD	EPA 8151A	Pentachlorophenol
GC/ECD	EPA 8151A	Silvex (2,4,5-TP)
GC/FID	RSK-175	Acetylene
GC/FID	RSK-175	Methane
GC/FID	RSK-175	Ethane
GC/FID	RSK-175	Ethene
GC/FID	RSK-175	Propane
GC/FID	FL-PRO	Total Petroleum Hydrocarbons (TPH)
GC/FID	MA-VPH	Volatile petroleum range organics (VPH)
GC/FID	MA-EPH	Extractable petroleum range organics (EPH)
GC/FID	IA-OA1	Gasoline range organics (GRO)
GC/FID	IA-OA2	Diesel range organics (DRO)
GC/FID	TN-GRO	Gasoline range organics (GRO)
GC/FID	TN-EPH	Extractable petroleum range organics (EPH)
GC/FID	WI-DRO	Diesel range organics (DRO)
GC/FID	KS LRH	Low-Range Hydrocarbons (LRH)
GC/FID	KS MRH	Mid-Range Hydrocarbons (MRH)
GC/FID	KS HRH	High-Range Hydrocarbons (HRH)
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	1,1,1,2-Tetrachloroethane
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	1,1,1-Trichloroethane
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	1,1,2,2-Tetrachloroethane
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	1,1,2-Trichloroethane
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	1,1-Dichloroethane

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	1,1-Dichloroethylene
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	1,1-Dichloropropene
GC/MS	EPA 624.1; EPA 8260B/C/D	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	1,2,3-Trichlorobenzene
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	1,2,3-Trichloropropane
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	1,2,4-Trichlorobenzene
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	1,2,4-Trimethylbenzene
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	1,2-Dibromo-3-chloropropane (DBCP)
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	1,2-Dibromoethane (EDB Ethylene dibromide)
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	1,2-Dichlorobenzene (o-Dichlorobenzene)
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	1,2-Dichloroethane
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	1,2-Dichloroethene (total)
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	1,2-Dichloropropane
GC/MS	EPA 8260B/C/D	1,2-Dichlorotrifluoroethane (Freon 123)
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	1,3,5-Trimethylbenzene
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	1,3-Dichlorobenzene (m-Dichlorobenzene)
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	1,3-Dichloropropane
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	1,4-Dichlorobenzene (p-Dichlorobenzene)
GC/MS	EPA 8260B/C	1-Chlorohexane
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	2,2-Dichloropropane
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	2-Butanone (Methyl ethyl ketone MEK)

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 624.1; EPA 8260B/C/D	2-Chloroethyl vinyl ether
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	2-Chlorotoluene
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	2-Hexanone
GC/MS	EPA 8260B/C	2-Nitropropane
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	4-Chlorotoluene
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	4-Methyl-2-pentanone (MIBK)
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	Acetone
GC/MS	EPA 8260B/C/D	Acetonitrile
GC/MS	EPA 624.1; EPA 8260B/C/D	Acrolein (Propenal)
GC/MS	EPA 624.1; EPA 8260B/C/D	Acrylonitrile
GC/MS	EPA 8260B/C/D	Allyl chloride (3-Chloropropene)
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	Benzene
GC/MS	EPA 8260B/C/D	Benzyl Chloride
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	Bromobenzene
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	Bromochloromethane
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	Bromodichloromethane
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	Bromoform
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	n-Butylbenzene
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	sec-Butylbenzene
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	tert-Butylbenzene
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	Carbon disulfide
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	Carbon tetrachloride
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	Chlorobenzene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	Chloroethane
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	Chloroform
GC/MS	EPA 8260B/C/D	Chloroprene
GC/MS	EPA 624.1; EPA 8260B/C/D	Cyclohexane
GC/MS	EPA 8260B/C/D	Cyclohexanone
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	cis-1,2-Dichloroethylene
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	trans-1,2-Dichloroethylene
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	cis-1,3-Dichloropropene
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	trans-1,3-Dichloropropylene
GC/MS	EPA 8260B/C/D	cis-1,4-Dichloro-2-butene
GC/MS	EPA 8260B/C/D	trans-1,4-Dichloro-2-butene
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	Di-isopropylether (DIPE)
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	Dibromochloromethane
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	Dibromomethane (Methylene Bromide)
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	Dichlorodifluoromethane
GC/MS	EPA 8260B/C/D	Diethyl ether
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D SIM	p-Dioxane (1,4-Dioxane)
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	Ethanol (Ethyl Alcohol)
GC/MS	EPA 8260B/C/D	Ethyl acetate
GC/MS	EPA 8260B/C/D	Ethyl methacrylate
GC/MS	EPA 8260B/C	Ethyl tert-butyl alcohol (ETBA)
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	Ethyl tert-butyl ether (ETBE)
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	Ethylbenzene
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	Hexachlorobutadiene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B/C/D	Hexane
GC/MS	EPA 8260B/C/D	Iodomethane (Methyl iodide)
GC/MS	EPA 8260B/C/D	Isobutyl alcohol (2-Methyl-1-propanol)
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	p-Isopropyltoluene
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	Isopropylbenzene
GC/MS	EPA 8260B/C/D	Methacrylonitrile
GC/MS	EPA 624.1; EPA 8260B/C/D	Methyl Acetate
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	Methyl bromide (Bromomethane)
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	Methyl chloride (Chloromethane)
GC/MS	EPA 624.1; EPA 8260B/C/D	Methylcyclohexane
GC/MS	EPA 8260B/C/D	Methyl methacrylate
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	Methyl tert-butyl ether (MTBE)
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	Methylene chloride
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	Naphthalene
GC/MS	EPA 8260B/C/D	Pentachloroethane
GC/MS	EPA 8260B/C/D	Propionitrile (Ethyl cyanide)
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	n-Propylbenzene
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	Styrene
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	tert-Amyl alcohol (TAA)
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	tert-Amyl methyl ether (TAME)
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	tert-Butyl alcohol (TBA)
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	tert-Butyl formate (TBF)
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	Tetrachloroethylene (Perchloroethylene)
GC/MS	EPA 8260B/C/D	Tetrahydrofuran

Non-Potable Water

Technology	Method	Analyte
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	Toluene
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	Trichloroethene (Trichloroethylene)
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	Trichlorofluoromethane
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	Vinyl acetate
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	Vinyl chloride
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	Xylene (total)
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	m,p-Xylene
GC/MS	EPA 624.1; SM 6200B-11; EPA 8260B/C/D	o-Xylene
GC/MS	EPA 625.1; EPA 8270D/E	1,2,4,5-Tetrachlorobenzene
GC/MS	EPA 625.1; EPA 8270D/E	1,2,4-Trichlorobenzene
GC/MS	EPA 625.1; EPA 8270D/E	1,2-Dichlorobenzene (o-Dichlorobenzene)
GC/MS	EPA 625.1; EPA 8270D/E	1,2-Diphenylhydrazine
GC/MS	EPA 8270D/E	1,3,5-Trinitrobenzene (1,3,5-TNB)
GC/MS	EPA 625.1; EPA 8270D/E	1,3-Dichlorobenzene (m-Dichlorobenzene)
GC/MS	EPA 8270D/E	1,3-Dinitrobenzene (1,3-DNB)
GC/MS	EPA 625.1; EPA 8270D/E	1,4-Dichlorobenzene (p-Dichlorobenzene)
GC/MS	EPA 8270D/E	1,4-Naphthoquinone
GC/MS	EPA 8270D/E	1,4-Phenylenediamine
GC/MS	EPA 8270D/E	1-Chloronaphthalene
GC/MS	EPA 625.1; EPA 8270D/E; EPA 8270D/E SIM	1-Methylnaphthalene
GC/MS	EPA 8270D/E	1-Naphthylamine
GC/MS	EPA 625.1; EPA 8270D/E	2,3,4,6-Tetrachlorophenol
GC/MS	EPA 625.1; EPA 8270D/E	2,4,5-Trichlorophenol
GC/MS	EPA 625.1; EPA 8270D/E	2,4,6-Trichlorophenol
GC/MS	EPA 625.1; EPA 8270D/E	2,4-Dichlorophenol
GC/MS	EPA 625.1; EPA 8270D/E	2,4-Dimethylphenol
GC/MS	EPA 625.1; EPA 8270D/E	2,4-Dinitrophenol
GC/MS	EPA 625.1; EPA 8270D/E	2,4-Dinitrotoluene (2,4-DNT)
GC/MS	EPA 8270D/E	2,6-Dichlorophenol

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 625.1; EPA 8270D/E	2,6-Dinitrotoluene (2,6-DNT)
GC/MS	EPA 8270D/E	2-Acetylaminofluorene
GC/MS	EPA 625.1; EPA 8270D/E	2-Chloronaphthalene
GC/MS	EPA 625.1; EPA 8270D/E	2-Chlorophenol
GC/MS	EPA 625.1; EPA 8270D/E	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-o-cresol)
GC/MS	EPA 625.1; EPA 8270D/E; EPA 8270D/E SIM	2-Methylnaphthalene
GC/MS	EPA 625.1; EPA 8270D/E	2-Methylphenol (o-Cresol)
GC/MS	EPA 8270D/E	2-Naphthylamine
GC/MS	EPA 625.1; EPA 8270D/E	2-Nitroaniline
GC/MS	EPA 625.1; EPA 8270D/E	2-Nitrophenol
GC/MS	EPA 8270D/E	2-Picoline (2-Methylpyridine)
GC/MS	EPA 625.1; EPA 8270D/E	3,3`-Dichlorobenzidine
GC/MS	EPA 8270D/E	3,3`-Dimethylbenzidine
GC/MS	EPA 8270D/E	3-Methylcholanthrene
GC/MS	EPA 625.1; EPA 8270D/E	3&4-Methylphenol (m,p-Cresol)
GC/MS	EPA 625.1; EPA 8270D/E	3-Nitroaniline
GC/MS	EPA 8270D/E	4-Aminobiphenyl
GC/MS	EPA 625.1; EPA 8270D/E	4-Bromophenyl phenyl ether
GC/MS	EPA 625.1; EPA 8270D/E	4-Chloro-3-methylphenol
GC/MS	EPA 625.1; EPA 8270D/E	4-Chloroaniline
GC/MS	EPA 625.1; EPA 8270D/E	4-Chlorophenyl phenylether
GC/MS	EPA 8270D/E	4-Dimethyl aminoazobenzene
GC/MS	EPA 625.1; EPA 8270D/E	4-Nitroaniline
GC/MS	EPA 625.1; EPA 8270D/E	4-Nitrophenol
GC/MS	EPA 8270D/E	5-Nitro-o-toluidine
GC/MS	EPA 8270D/E	7,12-Dimethylbenz(a) anthracene
GC/MS	EPA 625.1; EPA 8270D/E; EPA 8270D/E SIM	Acenaphthene
GC/MS	EPA 625.1; EPA 8270D/E; EPA 8270D/E SIM	Acenaphthylene
GC/MS	EPA 625.1; EPA 8270D/E	Acetophenone
GC/MS	EPA 625.1; EPA 8270D/E	Aniline
GC/MS	EPA 625.1; EPA 8270D/E; EPA 8270D/E SIM	Anthracene
GC/MS	EPA 8270D/E	Aramite

Non-Potable Water

Technology	Method	Analyte
GC/MS	EPA 625.1; EPA 8270D/E	Atrazine
GC/MS	EPA 625.1; EPA 8270D/E	Benzaldehyde
GC/MS	EPA 625.1; EPA 8270D/E	Benzidine
GC/MS	EPA 625.1; EPA 8270D/E; EPA 8270D/E SIM	Benzo(a)anthracene
GC/MS	EPA 625.1; EPA 8270D/E; EPA 8270D/E SIM	Benzo(a)pyrene
GC/MS	EPA 625.1; EPA 8270D/E; EPA 8270D/E SIM	Benzo(b)fluoranthene
GC/MS	EPA 625.1; EPA 8270D/E; EPA 8270D/E SIM	Benzo(g,h,i)perylene
GC/MS	EPA 625.1; EPA 8270D/E; EPA 8270D/E SIM	Benzo(k)fluoranthene
GC/MS	EPA 625.1; EPA 8270D/E	Benzoic acid
GC/MS	EPA 625.1; EPA 8270D/E	Benzyl alcohol
GC/MS	EPA 625.1; EPA 8270D/E	Biphenyl(1,1’-Biphenyl)
GC/MS	EPA 625.1; EPA 8270D/E	bis(2-Chloroethoxy)methane
GC/MS	EPA 625.1; EPA 8270D/E	bis(2-Chloroethyl) ether
GC/MS	EPA 625.1; EPA 8270D/E	bis(2-Chloroisopropyl) ether (2,2`-Oxybis(1-chloropropane))
GC/MS	EPA 625.1; EPA 8270D/E	bis(2-Ethylhexyl) phthalate (DEHP)
GC/MS	EPA 625.1; EPA 8270D/E	Butyl benzyl phthalate
GC/MS	EPA 625.1; EPA 8270D/E	Carbazole
GC/MS	EPA 625.1; EPA 8270D/E	Caprolactam
GC/MS	EPA 8270D/E	Chlorobenzilate
GC/MS	EPA 625.1; EPA 8270D/E; EPA 8270D/E SIM	Chrysene
GC/MS	EPA 8270D/E	Diallate
GC/MS	EPA 625.1; EPA 8270D/E	Di-n-butyl phthalate
GC/MS	EPA 625.1; EPA 8270D/E	Di-n-octyl phthalate
GC/MS	EPA 625.1; EPA 8270D/E; EPA 8270D/E SIM	Dibenz(a,h)anthracene
GC/MS	EPA 8270D/E	Dibenz(a,j)acridine
GC/MS	EPA 625.1; EPA 8270D/E	Dibenzofuran
GC/MS	EPA 625.1; EPA 8270D/E	Diethyl phthalate
GC/MS	EPA 625.1; EPA 8270D/E	Dimethyl phthalate
GC/MS	EPA 8270D/E	a,a-Dimethylphenethylamine

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270D/E	Diphenyl Ether
GC/MS	EPA 8270D/E	p-Dioxane (1,4-Dioxane)
GC/MS	EPA 8270D/E	Ethyl methanesulfonate
GC/MS	EPA 625.1; EPA 8270D/E; EPA 8270D/E SIM	Fluoranthene
GC/MS	EPA 625.1; EPA 8270D/E; EPA 8270D/E SIM	Fluorene
GC/MS	EPA 625.1; EPA 8270D/E	Hexachlorobenzene
GC/MS	EPA 625.1; EPA 8270D/E	Hexachlorobutadiene
GC/MS	EPA 625.1; EPA 8270D/E	Hexachlorocyclopentadiene
GC/MS	EPA 625.1; EPA 8270D/E	Hexachloroethane
GC/MS	EPA 8270D/E	Hexachlorophene
GC/MS	EPA 8270D/E	Hexachloropropene
GC/MS	EPA 625.1; EPA 8270D/E; EPA 8270D/E SIM	Indeno(1,2,3-cd)pyrene
GC/MS	EPA 8270D	Isodrin
GC/MS	EPA 625.1; EPA 8270D/E	Isophorone
GC/MS	EPA 8270D/E	Isosafrole
GC/MS	EPA 8270D/E	Kepone
GC/MS	EPA 8270D/E	Methapyrilene
GC/MS	EPA 8270D/E	Methyl methanesulfonate
GC/MS	EPA 625.1; EPA 8270D/E; EPA 8270D/E SIM	Naphthalene
GC/MS	EPA 625.1; EPA 8270D/E	Nitrobenzene
GC/MS	EPA 8270D/E	Nitroquinoline-1-oxide
GC/MS	EPA 8270D/E	n-Nitroso-di-n-butylamine
GC/MS	EPA 625.1; EPA 8270D/E	n-Nitrosodi-n-propylamine
GC/MS	EPA 8270D/E	n-Nitrosodiethylamine
GC/MS	EPA 625.1; EPA 8270D/E	n-Nitrosodimethylamine
GC/MS	EPA 625.1; EPA 8270D/E	n-Nitrosodiphenylamine
GC/MS	EPA 8270D/E	n-Nitrosodiphenylamine/Diphenylamine (analyte pair)
GC/MS	EPA 8270D/E	n-Nitrosomethylethylamine
GC/MS	EPA 8270D/E	n-Nitrosomorpholine
GC/MS	EPA 8270D/E	n-Nitrosopiperidine
GC/MS	EPA 8270D/E	n-Nitrosopyrrolidine
GC/MS	EPA 8270D/E	Pentachlorobenzene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270D/E	Pentachloroethane
GC/MS	EPA 8270D/E	Pentachloronitrobenzene
GC/MS	EPA 625.1; EPA 8270D/E; EPA 8270D/E SIM	Pentachlorophenol
GC/MS	EPA 8270D/E	Phenacetin
GC/MS	EPA 625.1; EPA 8270D/E; EPA 8270D/E SIM	Phenanthrene
GC/MS	EPA 625.1; EPA 8270D/E	Phenol
GC/MS	EPA 8270D/E	Pronamide (Kerb)
GC/MS	EPA 625.1; EPA 8270D/E; EPA 8270D/E SIM	Pyrene
GC/MS	EPA 625.1; EPA 8270D/E	Pyridine
GC/MS	EPA 8270D/E	Safrole
GC/MS	EPA 8270D/E	Simazine
GC/MS	EPA 8270D/E	Thionazin (Zinophos)
GC/MS	EPA 8270D/E	o-Toluidine
GC/MS	EPA 8270D/E	Dimethoate
GC/MS	EPA 8270D/E	Disulfoton
GC/MS	EPA 8270D/E	Famphur
GC/MS	EPA 8270D/E	Methyl parathion (Parathion methyl)
GC/MS	EPA 8270D/E	Parathion ethyl
GC/MS	EPA 8270D/E	Phorate
GC/MS	EPA 8270D/E	O,O,O-Triethyl phosphorothioate
HPLC	EPA 8330A/B	1,3,5-Trinitrobenzene (1,3,5-TNB)
HPLC	EPA 8330A/B	1,3-Dinitrobenzene (1,3-DNB)
HPLC	EPA 8330A/B	2,4,6-Trinitrotoluene (2,4,6-TNT)
HPLC	EPA 8330A/B	2,4-Dinitrotoluene (2,4-DNT)
HPLC	EPA 8330A/B	2,6-Dinitrotoluene (2,6-DNT)
HPLC	EPA 8330A/B	2-Amino-4,6-dinitrotoluene (2-am-dnt)
HPLC	EPA 8330A/B	2-Nitrotoluene
HPLC	EPA 8330A/B	3,5-Dinitroaniline
HPLC	EPA 8330A/B	3-Nitrotoluene
HPLC	EPA 8330A/B	4-Amino-2,6-dinitrotoluene (4-am-dnt)
HPLC	EPA 8330A/B	4-Nitrotoluene
HPLC	EPA 8330A/B	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)
HPLC	EPA 8330A/B	Nitrobenzene

Non-Potable Water		
Technology	**Method**	**Analyte**
HPLC	EPA 8330A/B	Nitroglycerin
HPLC	EPA 8330A/B	Methyl-2,4,6-trinitrophenylnitramine (Tetryl)
HPLC	EPA 8330A/B	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)
HPLC	EPA 8330A/B	Pentaerythritoltetranitrate (PETN)
HPLC	EPA 8330A/B	2,4-diamino-6-Nitrotoluene
HPLC	EPA 8330A/B	2,6-diamino-4-Nitrotoluene
HPLC	EPA 8330A/B	DNX
HPLC	EPA 8330A/B	MNX
HPLC	EPA 8330A/B	TNX
LC/MS/MS	EPA 6850	Perchlorate
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorobutanoic Acid (PFBA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoropentanoic Acid (PFPeA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorohexanoic Acid (PFHxA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoroheptanoic Acid (PFHpA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorooctanoic Acid (PFOA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorononanoic Acid (PFNA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorodecanoic Acid (PFDA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoroundecanoic Acid (PFUnA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorododecanoic Acid (PFDoA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorotridecanoic Acid (PFTrDA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorotetradecanoic Acid (PFTA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorobutanesulfonic Acid (PFBS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorohexanesulfonic Acid (PFHxS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorooctanesulfonic Acid (PFOS)

Non-Potable Water		
Technology	**Method**	**Analyte**
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorononanesulfonic Acid (PFNS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorodecanesulfonic Acid (PFDS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoroheptanesulfonic Acid (PFHpS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoropentanesulfonic Acid (PFPeS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorooctane sulfonamide (PFOSA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	N-Methyl perfluorooctanesulfonamidoacetic acid (MeFOSAA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	N-Ethyl perfluorooctanesulfonamidoacetic acid (EtFOSAA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	4:2 Fluorotelomer Sulfonate (FTS 4:2)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	6:2 Fluorotelomer Sulfonate (FTS 6:2)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	8:2 Fluorotelomer Sulfonate (FTS 8:2)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	ADONA
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA; GenX)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS; F53B minor)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	9-Chlorohexadecafluoro-3-oxanone-1-sulfonic acid (9Cl-PF3ONS; F53B major)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	3:3 Fluorotelomer carboxylate
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	5:3 Fluorotelomer carboxylate
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	7:3 Fluorotelomer carboxylate
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	10:2 Fluorotelomer sulfonate
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorododecanesulfonic acid

Non-Potable Water		
Technology	**Method**	**Analyte**
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro-3-methoxypropanoic acid (PFMPA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro-4-methoxybutanoic acid (PFMBA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro (2-ethoxyethane) sulfonic acid (PFEESA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorohexadecanoic acid (PFHxDA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorooctadecanoic acid (PFOcDA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	4-PFecHS (Perfluoro-4-ethylcyclohexanesulfonate)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	N-Methyl perfluorooctane sulfonamide
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	N-Ethyl perfluorooctane sulfonamide
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	N-Methyl perfluorooctane sulfonamidoethanol
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	N-Ethyl perfluorooctane sulfonamidoethanol
LC/MS/MS	Draft EPA Method 1633	Perfluorobutanoic Acid (PFBA)
LC/MS/MS	Draft EPA Method 1633	Perfluoropentanoic Acid (PFPeA)
LC/MS/MS	Draft EPA Method 1633	Perfluorohexanoic Acid (PFHxA)
LC/MS/MS	Draft EPA Method 1633	Perfluoroheptanoic Acid (PFHpA)
LC/MS/MS	Draft EPA Method 1633	Perfluorooctanoic Acid (PFOA)
LC/MS/MS	Draft EPA Method 1633	Perfluorononanoic Acid (PFNA)
LC/MS/MS	Draft EPA Method 1633	Perfluorodecanoic Acid (PFDA)
LC/MS/MS	Draft EPA Method 1633	Perfluoroundecanoic Acid (PFUnA)
LC/MS/MS	Draft EPA Method 1633	Perfluorododecanoic Acid (PFDoA)
LC/MS/MS	Draft EPA Method 1633	Perfluorotridecanoic Acid (PFTrDA)
LC/MS/MS	Draft EPA Method 1633	Perfluorotetradecanoic Acid (PFTA)
LC/MS/MS	Draft EPA Method 1633	Perfluorobutanesulfonic Acid (PFBS)
LC/MS/MS	Draft EPA Method 1633	Perfluorohexanesulfonic Acid (PFHxS)
LC/MS/MS	Draft EPA Method 1633	Perfluorooctanesulfonic Acid (PFOS)
LC/MS/MS	Draft EPA Method 1633	Perfluorononanesulfonic Acid (PFNS)
LC/MS/MS	Draft EPA Method 1633	Perfluorodecanesulfonic Acid (PFDS)
LC/MS/MS	Draft EPA Method 1633	Perfluoroheptanesulfonic acid (PFHpS)

Non-Potable Water		
Technology	**Method**	**Analyte**
LC/MS/MS	Draft EPA Method 1633	Perfluoropentanesulfonic Acid (PFPeS)
LC/MS/MS	Draft EPA Method 1633	Perfluorododecanesulfonic Acid (PFDoS)
LC/MS/MS	Draft EPA Method 1633	4:2 Fluorotelomer Sulfonate (FTS 4:2)
LC/MS/MS	Draft EPA Method 1633	6:2 Fluorotelomer Sulfonate (FTS 6:2)
LC/MS/MS	Draft EPA Method 1633	8:2 Fluorotelomer Sulfonate (FTS 8:2)
LC/MS/MS	Draft EPA Method 1633	3:3 Fluorotelomer carboxylate (3:3 FTCA)
LC/MS/MS	Draft EPA Method 1633	5:3 Fluorotelomer carboxylate (5:3 FTCA)
LC/MS/MS	Draft EPA Method 1633	7:3 Fluorotelomer carboxylate (7:3 FTCA)
LC/MS/MS	Draft EPA Method 1633	Perfluorooctane sulfonamide (PFOSA)
LC/MS/MS	Draft EPA Method 1633	N-Methyl perfluorooctane sulfonamide (NMeFOSA)
LC/MS/MS	Draft EPA Method 1633	N-Ethyl perfluorooctane sulfonamide (NEtFOSA)
LC/MS/MS	Draft EPA Method 1633	N-Methyl perfluorooctanesulfonamidoacetic acid (MeFOSAA)
LC/MS/MS	Draft EPA Method 1633	N-Ethyl perfluorooctanesulfonamidoacetic acid (EtFOSAA)
LC/MS/MS	Draft EPA Method 1633	N-Methyl perfluorooctane sulfonamidoethanol (NMeFOSE)
LC/MS/MS	Draft EPA Method 1633	N-Ethyl perfluorooctane sulfonamidoethanol (NEtFOSE)
LC/MS/MS	Draft EPA Method 1633	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS; F53B minor)
LC/MS/MS	Draft EPA Method 1633	9-Chlorohexadecafluoro-3-oxanone-1-sulfonic acid (9Cl-PF3ONS; F53B major)
LC/MS/MS	Draft EPA Method 1633	4,8-Dioxa-3H-perfluorononanoic acid (ADONA)
LC/MS/MS	Draft EPA Method 1633	2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA; GenX)
LC/MS/MS	Draft EPA Method 1633	Perfluoro-3-methoxypropanoic acid (PFMPA)
LC/MS/MS	Draft EPA Method 1633	Perfluoro-4-methoxybutanoic acid (PFMBA)
LC/MS/MS	Draft EPA Method 1633	Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)
LC/MS/MS	Draft EPA Method 1633	Perfluoro (2-ethoxyethane) sulfonic acid (PFEESA)

Non-Potable Water		
Technology	**Method**	**Analyte**
ICP	EPA 200.7; EPA 6010C/D	Aluminum
ICP	EPA 200.7; EPA 6010C/D	Antimony
ICP	EPA 200.7; EPA 6010C/D	Arsenic
ICP	EPA 200.7; EPA 6010C/D	Barium
ICP	EPA 200.7; EPA 6010C/D	Beryllium
ICP	EPA 200.7; EPA 6010C/D	Cadmium
ICP	EPA 200.7; EPA 6010C/D	Calcium
ICP	EPA 200.7; EPA 6010C/D	Chromium
ICP	EPA 200.7; EPA 6010C/D	Cobalt
ICP	EPA 200.7; EPA 6010C/D	Copper
ICP	EPA 200.7; EPA 6010C/D	Iron
ICP	EPA 200.7; EPA 6010C/D	Lead
ICP	EPA 200.7; EPA 6010C/D	Magnesium
ICP	EPA 200.7; EPA 6010C/D	Manganese
ICP	EPA 200.7; EPA 6010C/D	Molybdenum
ICP	EPA 200.7; EPA 6010C/D	Nickel
ICP	EPA 200.7; EPA 6010C/D	Potassium
ICP	EPA 200.7; EPA 6010C/D	Selenium
ICP	EPA 200.7; EPA 6010C/D	Silver
ICP	EPA 200.7; EPA 6010C/D	Sodium
ICP	EPA 200.7; EPA 6010C/D	Strontium
ICP	EPA 200.7; EPA 6010C/D	Thallium
ICP	EPA 200.7; EPA 6010C/D	Tin
ICP	EPA 200.7; EPA 6010C/D	Titanium
ICP	EPA 200.7; EPA 6010C/D	Vanadium
ICP	EPA 200.7; EPA 6010C/D	Zinc
ICP/MS	EPA 200.8; EPA 6020A/B	Aluminum
ICP/MS	EPA 200.8; EPA 6020A/B	Antimony
ICP/MS	EPA 200.8; EPA 6020A/B	Arsenic
ICP/MS	EPA 200.8; EPA 6020A/B	Barium
ICP/MS	EPA 200.8; EPA 6020A/B	Beryllium
ICP/MS	EPA 200.8; EPA 6020A/B	Cadmium
ICP/MS	EPA 200.8; EPA 6020A/B	Calcium
ICP/MS	EPA 200.8; EPA 6020A/B	Chromium
ICP/MS	EPA 200.8; EPA 6020A/B	Cobalt
ICP/MS	EPA 200.8; EPA 6020A/B	Copper

Non-Potable Water		
Technology	**Method**	**Analyte**
ICP/MS	EPA 200.8; EPA 6020A/B	Iron
ICP/MS	EPA 200.8; EPA 6020A/B	Lead
ICP/MS	EPA 200.8; EPA 6020A/B	Magnesium
ICP/MS	EPA 200.8; EPA 6020A/B	Manganese
ICP/MS	EPA 200.8; EPA 6020A/B	Molybdenum
ICP/MS	EPA 200.8; EPA 6020A/B	Nickel
ICP/MS	EPA 200.8; EPA 6020A/B	Potassium
ICP/MS	EPA 200.8; EPA 6020A/B	Selenium
ICP/MS	EPA 200.8; EPA 6020A/B	Silver
ICP/MS	EPA 200.8; EPA 6020A/B	Sodium
ICP/MS	EPA 200.8; EPA 6020A/B	Strontium
ICP/MS	EPA 200.8; EPA 6020A/B	Thallium
ICP/MS	EPA 200.8; EPA 6020A/B	Tin
ICP/MS	EPA 200.8; EPA 6020A/B	Titanium
ICP/MS	EPA 200.8; EPA 6020A/B	Vanadium
ICP/MS	EPA 200.8; EPA 6020A/B	Zinc
CVAA	EPA 7470A	Mercury
CVAA	EPA 245.1	Mercury
UV/VIS	EPA 7196A	Hexavalent Chromium (Cr6+)
UV/VIS	EPA 9012B	Cyanide (Total)
IC	EPA 300; EPA 9056A	Bromide
IC	EPA 300; EPA 9056A	Chloride
IC	EPA 300; EPA 9056A	Fluoride
IC	EPA 300; EPA 9056A	Nitrate
IC	EPA 300; EPA 9056A	Nitrite
IC	EPA 300; EPA 9056A	Sulfate
IC	EPA 300; EPA 9056A	Total nitrate-nitrite
IC	EPA 300; EPA 9056A	Orthophosphate
Automated Colorimetry	EPA 350.1	Ammonia
Automated Colorimetry	EPA 350.1	Ammonia, Gas Diffusion Option
Automated Colorimetry	EPA 351.2	Total Kjeldahl Nitrogen
Automated Colorimetry	EPA 420.4	Total Phenolics
Manual Colorimetry	EPA 365.3	Orthophosphate
Automated Colorimetry	EPA 365.1	Orthophosphate

Non-Potable Water		
Technology	**Method**	**Analyte**
Automated Colorimetry	EPA 365.1	Total Phosphorus
Manual Colorimetry	EPA 365.3	Total Phosphorus
Titrimetric	SM 2320B-11	Alkalinity, Total
Titrimetric	SM 4500-S2 F-11	Sulfide, Iodometric
Gravimetric Methods	EPA 1664A; EPA 1664B; EPA 9070A	Oil and Grease
Gravimetric Methods	SM 2540B-11	Total Residue (Total Solids)
Gravimetric Methods	SM 2540C-11	Filterable Residue (Total Dissolved Solids)
Gravimetric Methods	SM 2540D-11	Non-Filterable Residue (Total Suspended Solids)
Electrometric Methods	SM 4500H+B-11; EPA 9040C	Hydrogen Ion (Ph)
Electrometric Methods	EPA 120.1	Specific conductivity
Combustion	EPA 9060A	Total Organic Carbon
Combustion	SM 5310B-11	Total Organic Carbon
Ignitability	EPA 1010A	Flash Point
Ignitability	EPA 1020B/ASTM D3278-78	Flash Point
Waste Characterization	EPA Ch.7	Reactive Cyanide and Reactive Sulfide
Waste Characterization	EPA Section 7.3	Reactive Cyanide
Waste Characterization	EPA Section 7.3	Reactive Sulfide
Preparation	**Method**	**Type**
Organic Preparation	EPA 3510C	Separatory Funnel Liquid-Liquid Extraction
Organic Preparation	EPA 3511	Micro-extraction
Organic Preparation	EPA 3535A; EPA 3535A MOD	Solid Phase Extraction
Organic Preparation	EPA 8015C/D	Non-Halogenated Organics (Alcohols), direct injection
Organic Preparation	EPA 8151A	Chlorinated Herbicides, Liquid-Liquid Extraction
Organic Preparation	EPA 608; EPA 625	Separatory Funnel Liquid-Liquid Extraction
Volatile Organic Preparation	SW836 5030B	Closed System Purge and Trap
Volatile Organic Preparation	EPA 624	Closed System Purge and Trap
Volatile Organic Preparation	SM 6200B-11	Closed System Purge and Trap
Lachat MicroDistillation	EPA 9012B	Cyanide MicroDistillation; proprietary method
Inorganic Preparation	EPA 3010A	Metals Acid Digestion by Hotblock

Non-Potable Water		
Technology	**Method**	**Analyte**
Inorganic Preparation	EPA 7470A	CVAA Digestion by Hotblock
Organics Cleanup	EPA 3660B	Sulfur Cleanup
Organics Cleanup	EPA 3665A	Sulfuric Acid Cleanup

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/ECD	EPA 8011	1,2-Dibromoethane (EDB)
GC/ECD	EPA 8011	1,2-Dibromo-3-Chloropropane (DBCP)
GC/FID	EPA 8015C/D	Diesel range organics (DRO)
GC/FID	EPA 8015C/D	Oil Range Organics (ORO)
GC/FID	EPA 8015C/D	Gasoline range organics (GRO)
GC/FID	EPA 8015C/D	Ethanol
GC/FID	EPA 8015C/D	2-Ethoxyethanol
GC/FID	EPA 8015C/D	Isobutyl alcohol (2-Methyl-1-propanol)
GC/FID	EPA 8015C/D	Isopropyl alcohol (2-Propanol)
GC/FID	EPA 8015C/D	Methanol
GC/FID	EPA 8015C/D	n-Butyl alcohol
GC/FID	EPA 8015C/D	n-Propanol
GC/ECD	EPA 8081B	4,4`-DDD
GC/ECD	EPA 8081B	4,4`-DDE
GC/ECD	EPA 8081B	4,4`-DDT
GC/ECD	EPA 8081B	Aldrin
GC/ECD	EPA 8081B	alpha-BHC (alpha-Hexachlorocyclohexane)
GC/ECD	EPA 8081B	beta-BHC (beta-Hexachlorocyclohexane)
GC/ECD	EPA 8081B	delta-BHC
GC/ECD	EPA 8081B	gamma-BHC (Lindane gamma-Hexachlorocyclohexane)
GC/ECD	EPA 8081B	Chlordane (tech.)
GC/ECD	EPA 8081B	alpha-Chlordane
GC/ECD	EPA 8081B	gamma-Chlordane
GC/ECD	EPA 8081B	Dieldrin
GC/ECD	EPA 8081B	Endosulfan I
GC/ECD	EPA 8081B	Endosulfan II
GC/ECD	EPA 8081B	Endosulfan sulfate

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/ECD	EPA 8081B	Endrin
GC/ECD	EPA 8081B	Endrin aldehyde
GC/ECD	EPA 8081B	Endrin ketone
GC/ECD	EPA 8081B	Heptachlor
GC/ECD	EPA 8081B	Heptachlor epoxide
GC/ECD	EPA 8081B	Methoxychlor
GC/ECD	EPA 8081B	Toxaphene (Chlorinated camphene)
GC/ECD	EPA 8082A	Aroclor-1016 (PCB-1016)
GC/ECD	EPA 8082A	Aroclor-1221 (PCB-1221)
GC/ECD	EPA 8082A	Aroclor-1232 (PCB-1232)
GC/ECD	EPA 8082A	Aroclor-1242 (PCB-1242)
GC/ECD	EPA 8082A	Aroclor-1248 (PCB-1248)
GC/ECD	EPA 8082A	Aroclor-1254 (PCB-1254)
GC/ECD	EPA 8082A	Aroclor-1260 (PCB-1260)
GC/ECD	EPA 8082A	Aroclor-1262 (PCB-1262)
GC/ECD	EPA 8082A	Aroclor-1268 (PCB-1268)
GC/ECD	EPA 8082A	Total PCB
GC/FPD	EPA 8141B	Azinphos-methyl (Guthion)
GC/FPD	EPA 8141B	Bolstar (Sulprofos)
GC/FPD	EPA 8141B	Carbophenothion
GC/FPD	EPA 8141B	Chlorpyrifos
GC/FPD	EPA 8141B	Coumaphos
GC/FPD	EPA 8141B	Demeton-o
GC/FPD	EPA 8141B	Demeton-s
GC/FPD	EPA 8141B	Demeton
GC/FPD	EPA 8141B	Diazinon
GC/FPD	EPA 8141B	Dichlorovos (DDVP Dichlorvos)
GC/FPD	EPA 8141B	Dimethoate
GC/FPD	EPA 8141B	Disulfoton
GC/FPD	EPA 8141B	EPN
GC/FPD	EPA 8141B	Ethion
GC/FPD	EPA 8141B	Ethoprop
GC/FPD	EPA 8141B	Famphur
GC/FPD	EPA 8141B	Fensulfothion
GC/FPD	EPA 8141B	Fenthion
GC/FPD	EPA 8141B	Malathion

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/FPD	EPA 8141B	Merphos
GC/FPD	EPA 8141B	Methyl parathion (Parathion methyl)
GC/FPD	EPA 8141B	Mevinphos
GC/FPD	EPA 8141B	Monocrotophos
GC/FPD	EPA 8141B	Naled
GC/FPD	EPA 8141B	Parathion ethyl
GC/FPD	EPA 8141B	Phorate
GC/FPD	EPA 8141B	Ronnel
GC/FPD	EPA 8141B	Stirofos
GC/FPD	EPA 8141B	Sulfotepp
GC/FPD	EPA 8141B	Tetraethyl pyrophosphate (TEPP)
GC/FPD	EPA 8141B	Thionazin (Zinophos)
GC/FPD	EPA 8141B	Tokuthion (Prothiophos)
GC/FPD	EPA 8141B	Trichloronate
GC/FPD	EPA 8141B	O,O,O-Triethyl phosphorothioate
GC/ECD	EPA 8151A	2,4,5-T
GC/ECD	EPA 8151A	2,4-D
GC/ECD	EPA 8151A	2,4-DB
GC/ECD	EPA 8151A	Dalapon
GC/ECD	EPA 8151A	Dicamba
GC/ECD	EPA 8151A	Dichloroprop (Dichlorprop)
GC/ECD	EPA 8151A	Dinoseb (2-sec-butyl-4,6-dinitrophenol DNBP)
GC/ECD	EPA 8151A	MCPA
GC/ECD	EPA 8151A	MCPP
GC/ECD	EPA 8151A	Pentachlorophenol
GC/ECD	EPA 8151A	Silvex (2,4,5-TP)
GC/FID	FL-PRO	Total Petroleum Hydrocarbons (TPH)
GC/FID	MA-VPH	Volatile petroleum range organics (VPH)
GC/FID	MA-EPH	Extractable petroleum range organics (EPH)
GC/FID	IA-OA1	Gasoline range organics (GRO)
GC/FID	IA-OA2	Diesel range organics (DRO)
GC/FID	TN-GRO	Gasoline range organics (GRO)
GC/FID	TN-EPH	Extractable petroleum range organics (EPH)

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/FID	KS LRH	Low-range Hydrocarbons (LRH)
GC/FID	KS MRH	Mid-Range Hydrocarbons (MRH)
GC/FID	KS HRH	High-Range Hydrocarbons (HRH)
GC/MS	EPA 8260B/C/D	1,1,1,2-Tetrachloroethane
GC/MS	EPA 8260B/C/D	1,1,1-Trichloroethane
GC/MS	EPA 8260B/C/D	1,1,2,2-Tetrachloroethane
GC/MS	EPA 8260B/C/D	1,1,2-Trichloroethane
GC/MS	EPA 8260B/C/D	1,1-Dichloroethane
GC/MS	EPA 8260B/C/D	1,1-Dichloroethylene
GC/MS	EPA 8260B/C/D	1,1-Dichloropropene
GC/MS	EPA 8260B/C/D	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)
GC/MS	EPA 8260B/C/D	1,2,3-Trichlorobenzene
GC/MS	EPA 8260B/C/D	1,2,3-Trichloropropane
GC/MS	EPA 8260B/C/D	1,2,4-Trichlorobenzene
GC/MS	EPA 8260B/C/D	1,2,4-Trimethylbenzene
GC/MS	EPA 8260B/C/D	1,2-Dibromo-3-chloropropane (DBCP)
GC/MS	EPA 8260B/C/D	1,2-Dibromoethane (EDB Ethylene dibromide)
GC/MS	EPA 8260B/C/D	1,2-Dichlorobenzene (o-Dichlorobenzene)
GC/MS	EPA 8260B/C/D	1,2-Dichloroethane
GC/MS	EPA 8260B/C/D	1,2-Dichloroethene (total)
GC/MS	EPA 8260B/C/D	1,2-Dichloropropane
GC/MS	EPA 8260B/C/D	1,2-Dichlorotrifluoroethane (Freon 123)
GC/MS	EPA 8260B/C/D	1,3,5-Trimethylbenzene
GC/MS	EPA 8260B/C/D	1,3-Dichlorobenzene (m-Dichlorobenzene)
GC/MS	EPA 8260B/C/D	1,3-Dichloropropane
GC/MS	EPA 8260B/C/D	1,4-Dichlorobenzene (p-Dichlorobenzene)
GC/MS	EPA 8260B/C/D	1-Chlorohexane
GC/MS	EPA 8260B/C/D	2,2-Dichloropropane
GC/MS	EPA 8260B/C/D	2-Butanone (Methyl ethyl ketone MEK)
GC/MS	EPA 8260B/C/D	2-Chloroethyl vinyl ether
GC/MS	EPA 8260B/C/D	2-Chlorotoluene
GC/MS	EPA 8260B/C/D	2-Hexanone
GC/MS	EPA 8260B/C/D	2-Nitropropane
GC/MS	EPA 8260B/C/D	4-Chlorotoluene

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B/C/D	4-Methyl-2-pentanone (MBK)
GC/MS	EPA 8260B/C/D	Acetone
GC/MS	EPA 8260B/C/D	Acetonitrile
GC/MS	EPA 8260B/C/D	Acrolein (Propenal)
GC/MS	EPA 8260B/C/D	Acrylonitrile
GC/MS	EPA 8260B/C/D	Allyl chloride (3-Chloropropene)
GC/MS	EPA 8260B/C/D	Benzene
GC/MS	EPA 8260B/C/D	Benzyl Chloride
GC/MS	EPA 8260B/C/D	Bromobenzene
GC/MS	EPA 8260B/C/D	Bromochloromethane
GC/MS	EPA 8260B/C/D	Bromodichloromethane
GC/MS	EPA 8260B/C/D	Bromoform
GC/MS	EPA 8260B/C/D	n-Butylbenzene
GC/MS	EPA 8260B/C/D	sec-Butylbenzene
GC/MS	EPA 8260B/C/D	tert-Butylbenzene
GC/MS	EPA 8260B/C/D	Carbon disulfide
GC/MS	EPA 8260B/C/D	Carbon tetrachloride
GC/MS	EPA 8260B/C/D	Chlorobenzene
GC/MS	EPA 8260B/C/D	Chloroethane
GC/MS	EPA 8260B/C/D	Chloroform
GC/MS	EPA 8260B/C/D	Chloroprene
GC/MS	EPA 8260B/C/D	Cyclohexane
GC/MS	EPA 8260B/C/D	Cyclohexanone
GC/MS	EPA 8260B/C/D	cis-1,2-Dichloroethylene
GC/MS	EPA 8260B/C/D	trans-1,2-Dichloroethylene
GC/MS	EPA 8260B/C/D	cis-1,3-Dichloropropene
GC/MS	EPA 8260B/C/D	trans-1,3-Dichloropropylene
GC/MS	EPA 8260B/C/D	cis-1,4-Dichloro-2-butene
GC/MS	EPA 8260B/C/D	trans-1,4-Dichloro-2-butene
GC/MS	EPA 8260B/C/D	Di-isopropylether (DIPE)
GC/MS	EPA 8260B/C/D	Dibromochloromethane
GC/MS	EPA 8260B/C/D	Dibromomethane (Methylene Bromide)
GC/MS	EPA 8260B/C/D	Dichlorodifluoromethane
GC/MS	EPA 8260B/C/D	Diethyl ether
GC/MS	EPA 8260B/C/D; EPA 8260B/C/D SIM	p-Dioxane (1,4-Dioxane)
GC/MS	EPA 8260B/C/D	Ethanol (Ethyl Alcohol)

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B/C/D	Ethyl acetate
GC/MS	EPA 8260B/C/D	Ethyl methacrylate
GC/MS	EPA 8260B/C/D	Ethyl tert-butyl alcohol (ETBA)
GC/MS	EPA 8260B/C/D	Ethyl tert-butyl ether (ETBE)
GC/MS	EPA 8260B/C/D	Ethylbenzene
GC/MS	EPA 8260B/C/D	Ethylene Oxide
GC/MS	EPA 8260B/C/D	Hexachlorobutadiene
GC/MS	EPA 8260B/C/D	Hexane
GC/MS	EPA 8260B/C/D	Iodomethane (Methyl iodide)
GC/MS	EPA 8260B/C/D	Isobutyl alcohol (2-Methyl-1-propanol)
GC/MS	EPA 8260B/C/D	p-Isopropyltoluene
GC/MS	EPA 8260B/C/D	Isopropylbenzene
GC/MS	EPA 8260B/C/D	Methacrylonitrile
GC/MS	EPA 8260B/C/D	Methyl Acetate
GC/MS	EPA 8260B/C/D	Methyl bromide (Bromomethane)
GC/MS	EPA 8260B/C/D	Methyl chloride (Chloromethane)
GC/MS	EPA 8260B/C/D	Methylcyclohexane
GC/MS	EPA 8260B/C/D	Methyl methacrylate
GC/MS	EPA 8260B/C/D	Methyl tert-butyl ether (MTBE)
GC/MS	EPA 8260B/C/D	Methylene chloride
GC/MS	EPA 8260B/C/D	Naphthalene
GC/MS	EPA 8260B/C/D	Pentachloroethane
GC/MS	EPA 8260B/C/D	Propionitrile (Ethyl cyanide)
GC/MS	EPA 8260B/C/D	n-Propylbenzene
GC/MS	EPA 8260B/C/D	Styrene
GC/MS	EPA 8260B/C/D	tert-Amyl alcohol (TAA)
GC/MS	EPA 8260B/C/D	tert-Amyl methyl ether (TAME)
GC/MS	EPA 8260B/C/D	tert-Butyl alcohol (TBA)
GC/MS	EPA 8260B/C/D	tert-Butyl formate (TBF)
GC/MS	EPA 8260B/C/D	Tetrachloroethylene (Perchloroethylene)
GC/MS	EPA 8260B/C/D	Tetrahydrofuran
GC/MS	EPA 8260B/C/D	Toluene
GC/MS	EPA 8260B/C/D	Trichloroethene (Trichloroethylene)
GC/MS	EPA 8260B/C/D	Trichlorofluoromethane
GC/MS	EPA 8260B/C/D	Vinyl acetate
GC/MS	EPA 8260B/C/D	Vinyl chloride

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B/C/D	Xylene (total)
GC/MS	EPA 8260B/C/D	m,p-Xylene
GC/MS	EPA 8260B/C/D	o-Xylene
GC/MS	EPA 8270D/E	1,2,4,5-Tetrachlorobenzene
GC/MS	EPA 8270D/E	1,2,4-Trichlorobenzene
GC/MS	EPA 8270D/E	1,2-Dichlorobenzene (o-Dichlorobenzene)
GC/MS	EPA 8270D/E	1,2-Diphenylhydrazine
GC/MS	EPA 8270D/E	1,3,5-Trinitrobenzene (1,3,5-TNB)
GC/MS	EPA 8270D/E	1,3-Dichlorobenzene (m-Dichlorobenzene)
GC/MS	EPA 8270D/E	1,3-Dinitrobenzene (1,3-DNB)
GC/MS	EPA 8270D/E	1,4-Dichlorobenzene (p-Dichlorobenzene)
GC/MS	EPA 8270D/E	1,4-Naphthoquinone
GC/MS	EPA 8270D/E	1,4-Phenylenediamine
GC/MS	EPA 8270D/E	1-Chloronaphthalene
GC/MS	EPA 8270D/E; EPA 8270D/E SIM	1-Methylnaphthalene
GC/MS	EPA 8270D/E	1-Naphthylamine
GC/MS	EPA 8270D/E	2,3,4,6-Tetrachlorophenol
GC/MS	EPA 8270D/E	2,4,5-Trichlorophenol
GC/MS	EPA 8270D/E	2,4,6-Trichlorophenol
GC/MS	EPA 8270D/E	2,4-Dichlorophenol
GC/MS	EPA 8270D/E	2,4-Dimethylphenol
GC/MS	EPA 8270D/E	2,4-Dinitrophenol
GC/MS	EPA 8270D/E	2,4-Dinitrotoluene (2,4-DNT)
GC/MS	EPA 8270D/E	2,6-Dichlorophenol
GC/MS	EPA 8270D/E	2,6-Dinitrotoluene (2,6-DNT)
GC/MS	EPA 8270D/E	2-Acetylaminofluorene
GC/MS	EPA 8270D/E	2-Chloronaphthalene
GC/MS	EPA 8270D/E	2-Chlorophenol
GC/MS	EPA 8270D/E	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-o-cresol)
GC/MS	EPA 8270D/E; EPA 8270D/E SIM	2-Methylnaphthalene
GC/MS	EPA 8270D/E	2-Methylphenol (o-Cresol)
GC/MS	EPA 8270D/E	2-Naphthylamine
GC/MS	EPA 8270D/E	2-Nitroaniline
GC/MS	EPA 8270D/E	2-Nitrophenol
GC/MS	EPA 8270D/E	2-Picoline (2-Methylpyridine)

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270D/E	3,3`-Dichlorobenzidine
GC/MS	EPA 8270D/E	3,3`-Dimethylbenzidine
GC/MS	EPA 8270D/E	3-Methylcholanthrene
GC/MS	EPA 8270D/E	3&4-Methylphenol (m,p-Cresol)
GC/MS	EPA 8270D/E	3-Nitroaniline
GC/MS	EPA 8270D/E	4-Aminobiphenyl
GC/MS	EPA 8270D/E	4-Bromophenyl phenyl ether
GC/MS	EPA 8270D/E	4-Chloro-3-methylphenol
GC/MS	EPA 8270D/E	4-Chloroaniline
GC/MS	EPA 8270D/E	4-Chlorophenyl phenylether
GC/MS	EPA 8270D/E	4-Dimethyl aminoazobenzene
GC/MS	EPA 8270D/E	4-Nitroaniline
GC/MS	EPA 8270D/E	4-Nitrophenol
GC/MS	EPA 8270D/E	5-Nitro-o-toluidine
GC/MS	EPA 8270D/E	7,12-Dimethylbenz(a) anthracene
GC/MS	EPA 8270D/E; EPA 8270D/E SIM	Acenaphthene
GC/MS	EPA 8270D/E; EPA 8270D/E SIM	Acenaphthylene
GC/MS	EPA 8270D/E	Acetophenone
GC/MS	EPA 8270D/E	Aniline
GC/MS	EPA 8270D; EPA 8270D SIM	Anthracene
GC/MS	EPA 8270D/E	Aramite
GC/MS	EPA 8270D/E	Atrazine
GC/MS	EPA 8270D/E	Benzaldehyde
GC/MS	EPA 8270D/E	Benzidine
GC/MS	EPA 8270D/E; EPA 8270D/E SIM	Benzo(a)anthracene
GC/MS	EPA 8270D/E; EPA 8270D/E SIM	Benzo(a)pyrene
GC/MS	EPA 8270D/E; EPA 8270D/E SIM	Benzo(b)fluoranthene
GC/MS	EPA 8270D/E; EPA 8270D/E SIM	Benzo(g,h,i)perylene
GC/MS	EPA 8270D/E; EPA 8270D/E SIM	Benzo(k)fluoranthene
GC/MS	EPA 8270D/E	Benzoic acid
GC/MS	EPA 8270D/E	Benzyl alcohol
GC/MS	EPA 8270D/E	Biphenyl (1,1'-Biphenyl)
GC/MS	EPA 8270D/E	bis(2-Chloroethoxy) methane
GC/MS	EPA 8270D/E	bis(2-Chloroethyl) ether
GC/MS	EPA 8270D/E	bis(2-Chloroisopropyl) ether (2,2`-Oxybis(1-chloropropane))

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270D/E	bis(2-Ethylhexyl) phthalate (DEHP)
GC/MS	EPA 8270D/E	Butyl benzyl phthalate
GC/MS	EPA 8270D/E	Carbazole
GC/MS	EPA 8270D/E	Caprolactam
GC/MS	EPA 8270D/E	Chlorobenzilate
GC/MS	EPA 8270D/E; EPA 8270D/E SIM	Chrysene
GC/MS	EPA 8270D/E	Diallate
GC/MS	EPA 8270D/E	Di-n-butyl phthalate
GC/MS	EPA 8270D/E	Di-n-octyl phthalate
GC/MS	EPA 8270D/E; EPA 8270D/E SIM	Dibenz(a,h)anthracene
GC/MS	EPA 8270D/E	Dibenz(a,j)acridine
GC/MS	EPA 8270D/E	Dibenzofuran
GC/MS	EPA 8270D/E	Diethyl phthalate
GC/MS	EPA 8270D/E	Dimethyl phthalate
GC/MS	EPA 8270D/E	a,a-Dimethylphenethylamine
GC/MS	EPA 8270D/E	Diphenyl Ether
GC/MS	EPA 8270D/E	p-Dioxane (1,4-Dioxane)
GC/MS	EPA 8270D/E	Ethyl methanesulfonate
GC/MS	EPA 8270D/E; EPA 8270D/E SIM	Fluoranthene
GC/MS	EPA 8270D/E; EPA 8270D/E SIM	Fluorene
GC/MS	EPA 8270D/E	Hexachlorobenzene
GC/MS	EPA 8270D/E	Hexachlorobutadiene
GC/MS	EPA 8270D/E	Hexachlorocyclopentadiene
GC/MS	EPA 8270D/E	Hexachloroethane
GC/MS	EPA 8270D/E	Hexachlorophene
GC/MS	EPA 8270D/E	Hexachloropropene
GC/MS	EPA 8270D/E; EPA 8270D/E SIM	Indeno(1,2,3-cd)pyrene
GC/MS	EPA 8270D/E	Isodrin
GC/MS	EPA 8270D/E	Isophorone
GC/MS	EPA 8270D/E	Isosafrole
GC/MS	EPA 8270D/E	Kepone
GC/MS	EPA 8270D/E	Methapyrilene
GC/MS	EPA 8270D/E	Methyl methanesulfonate
GC/MS	EPA 8270D/E; EPA 8270D/E SIM	Naphthalene
GC/MS	EPA 8270D/E	Nitrobenzene
GC/MS	EPA 8270D/E	Nitroquinoline-1-oxide

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270D/E	n-Nitroso-di-n-butylamine
GC/MS	EPA 8270D/E	n-Nitrosodi-n-propylamine
GC/MS	EPA 8270D/E	n-Nitrosodiethylamine
GC/MS	EPA 8270D/E	n-Nitrosodimethylamine
GC/MS	EPA 8270D/E	n-Nitrosodiphenylamine
GC/MS	EPA 8270D/E	n-Nitrosodiphenylamine/Diphenylamine (analyte pair)
GC/MS	EPA 8270D/E	n-Nitrosomethylethylamine
GC/MS	EPA 8270D/E	n-Nitrosomorpholine
GC/MS	EPA 8270D/E	n-Nitrosopiperidine
GC/MS	EPA 8270D/E	n-Nitrosopyrrolidine
GC/MS	EPA 8270D/E	Pentachlorobenzene
GC/MS	EPA 8270D/E	Pentachloroethane
GC/MS	EPA 8270D/E	Pentachloronitrobenzene
GC/MS	EPA 8270D/E; EPA 8270D/E SIM	Pentachlorophenol
GC/MS	EPA 8270D/E	Phenacetin
GC/MS	EPA 8270D/E; EPA 8270D/E SIM	Phenanthrene
GC/MS	EPA 8270D/E	Phenol
GC/MS	EPA 8270D/E	Pronamide (Kerb)
GC/MS	EPA 8270D/E; EPA 8270D/E SIM	Pyrene
GC/MS	EPA 8270D/E	Pyridine
GC/MS	EPA 8270D/E	Safrole
GC/MS	EPA 8270D/E	Simazine
GC/MS	EPA 8270D/E	o-Toluidine
GC/MS	EPA 8270D/E	Dimethoate
GC/MS	EPA 8270D/E	Disulfoton
GC/MS	EPA 8270D/E	Famphur
GC/MS	EPA 8270D/E	Methyl parathion (Parathion methyl)
GC/MS	EPA 8270D/E	Parathion ethyl
GC/MS	EPA 8270D/E	Phorate
GC/MS	EPA 8270D/E	Sulfotepp
GC/MS	EPA 8270D/E	Thionazin (Zinophos)
GC/MS	EPA 8270D/E	O,O,O-Triethyl phosphorothioate
HPLC	EPA 8330A/B	1,3,5-Trinitrobenzene (1,3,5-TNB)
HPLC	EPA 8330A/B	1,3-Dinitrobenzene (1,3-DNB)
HPLC	EPA 8330A/B	2,4,6-Trinitrotoluene (2,4,6-TNT)

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
HPLC	EPA 8330A/B	2,4-Dinitrotoluene (2,4-DNT)
HPLC	EPA 8330A/B	2,6-Dinitrotoluene (2,6-DNT)
HPLC	EPA 8330A/B	2-Amino-4,6-dinitrotoluene (2-am-dnt)
HPLC	EPA 8330A/B	2-Nitrotoluene
HPLC	EPA 8330A/B	3,5-Dinitroaniline
HPLC	EPA 8330A/B	3-Nitrotoluene
HPLC	EPA 8330A/B	4-Amino-2,6-dinitrotoluene (4-am-dnt)
HPLC	EPA 8330A/B	4-Nitrotoluene
HPLC	EPA 8330A/B	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)
HPLC	EPA 8330A/B	Nitrobenzene
HPLC	EPA 8330A/B	Nitroglycerin
HPLC	EPA 8330A/B	Methyl-2,4,6-trinitrophenylnitramine (Tetryl)
HPLC	EPA 8330A/B	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)
HPLC	EPA 8330A/B	Pentaerythritoltetranitrate (PETN)
HPLC	EPA 8330A/B	DNX
HPLC	EPA 8330A/B	MNX
HPLC	EPA 8330A/B	TNX
LC/MS/MS	EPA 6850	Perchlorate
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorobutanoic Acid (PFBA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoropentanoic Acid (PFPeA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorohexanoic Acid (PFHxA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoroheptanoic Acid (PFHpA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorooctanoic Acid (PFOA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorononanoic Acid (PFNA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorodecanoic Acid (PFDA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoroundecanoic Acid (PFUnA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorododecanoic Acid (PFDoA)

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorotridecanoic Acid (PFTrDA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorotetradecanoic Acid (PFTA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorobutanesulfonic Acid (PFBS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorohexanesulfonic Acid (PFHxS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorooctanesulfonic Acid (PFOS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorononanesulfonic Acid (PFNS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorodecanesulfonic Acid (PFDS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoroheptanesulfonic Acid (PFHpS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoropentanesulfonic Acid (PFPeS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorooctane sulfonamide (PFOSA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	N-Methyl perfluorooctanesulfonamidoacetic acid (MeFOSAA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	N-Ethyl perfluorooctanesulfonamidoacetic acid (EtFOSAA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	4:2 Fluorotelomer Sulfonate (FTS 4:2)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	6:2 Fluorotelomer Sulfonate (FTS 6:2)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	8:2 Fluorotelomer Sulfonate (FTS 8:2)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	ADONA
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA; GenX)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS; F53B minor)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	9-Chlorohexadecafluoro-3-oxanone-1-sulfonic acid (9Cl-PF3ONS; F53B major)

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	3:3 Fluorotelomer carboxylate
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	5:3 Fluorotelomer carboxylate
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	7:3 Fluorotelomer carboxylate
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	10:2 Fluorotelomer sulfonate
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorododecanesulfonic acid
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro-3-methoxypropanoic acid (PFMPA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro-4-methoxybutanoic acid (PFMBA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro (2-ethoxyethane) sulfonic acid (PFEESA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorohexadecanoic acid (PFHxDA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorooctadecanoic acid (PFOcDA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	4-PFecHS (Perfluoro-4-ethylcyclohexanesulfonate)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	N-Methyl perfluorooctane sulfonamide
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	N-Ethyl perfluorooctane sulfonamide
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	N-Methyl perfluorooctane sulfonamidoethanol
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	N-Ethyl perfluorooctane sulfonamidoethanol
LC/MS/MS	Draft EPA Method 1633	Perfluorobutanoic Acid (PFBA)
LC/MS/MS	Draft EPA Method 1633	Perfluoropentanoic Acid (PFPeA)
LC/MS/MS	Draft EPA Method 1633	Perfluorohexanoic Acid (PFHxA)
LC/MS/MS	Draft EPA Method 1633	Perfluoroheptanoic Acid (PFHpA)
LC/MS/MS	Draft EPA Method 1633	Perfluorooctanoic Acid (PFOA)
LC/MS/MS	Draft EPA Method 1633	Perfluorononanoic Acid (PFNA)
LC/MS/MS	Draft EPA Method 1633	Perfluorodecanoic Acid (PFDA)
LC/MS/MS	Draft EPA Method 1633	Perfluoroundecanoic Acid (PFUnA)

Solid and Chemical Materials

Technology	Method	Analyte
LC/MS/MS	Draft EPA Method 1633	Perfluorododecanoic Acid (PFDoA)
LC/MS/MS	Draft EPA Method 1633	Perfluorotridecanoic Acid (PFTrDA)
LC/MS/MS	Draft EPA Method 1633	Perfluorotetradecanoic Acid (PFTA)
LC/MS/MS	Draft EPA Method 1633	Perfluorobutanesulfonic Acid (PFBS)
LC/MS/MS	Draft EPA Method 1633	Perfluorohexanesulfonic Acid (PFHxS)
LC/MS/MS	Draft EPA Method 1633	Perfluorooctanesulfonic Acid (PFOS)
LC/MS/MS	Draft EPA Method 1633	Perfluorononanesulfonic Acid (PFNS)
LC/MS/MS	Draft EPA Method 1633	Perfluorodecanesulfonic Acid (PFDS)
LC/MS/MS	Draft EPA Method 1633	Perfluoroheptanesulfonic acid (PFHpS)
LC/MS/MS	Draft EPA Method 1633	Perfluoropentanesulfonic Acid (PFPeS)
LC/MS/MS	Draft EPA Method 1633	Perfluorododecanesulfonic Acid (PFDoS)
LC/MS/MS	Draft EPA Method 1633	4:2 Fluorotelomer Sulfonate (FTS 4:2)
LC/MS/MS	Draft EPA Method 1633	6:2 Fluorotelomer Sulfonate (FTS 6:2)
LC/MS/MS	Draft EPA Method 1633	8:2 Fluorotelomer Sulfonate (FTS 8:2)
LC/MS/MS	Draft EPA Method 1633	3:3 Fluorotelomer carboxylate (3:3 FTCA)
LC/MS/MS	Draft EPA Method 1633	5:3 Fluorotelomer carboxylate (5:3 FTCA)
LC/MS/MS	Draft EPA Method 1633	7:3 Fluorotelomer carboxylate (7:3 FTCA)
LC/MS/MS	Draft EPA Method 1633	Perfluorooctane sulfonamide (PFOSA)
LC/MS/MS	Draft EPA Method 1633	N-Methyl perfluorooctane sulfonamide (NMeFOSA)
LC/MS/MS	Draft EPA Method 1633	N-Ethyl perfluorooctane sulfonamide (NEtFOSA)
LC/MS/MS	Draft EPA Method 1633	N-Methyl perfluorooctanesulfonamidoacetic acid (MeFOSAA)
LC/MS/MS	Draft EPA Method 1633	N-Ethyl perfluorooctanesulfonamidoacetic acid (EtFOSAA)
LC/MS/MS	Draft EPA Method 1633	N-Methyl perfluorooctane sulfonamidoethanol (NMeFOSE)
LC/MS/MS	Draft EPA Method 1633	N-Ethyl perfluorooctane sulfonamidoethanol (NEtFOSE)
LC/MS/MS	Draft EPA Method 1633	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS; F53B minor)
LC/MS/MS	Draft EPA Method 1633	9-Chlorohexadecafluoro-3-oxanone-1-sulfonic acid (9Cl-PF3ONS; F53B major)
LC/MS/MS	Draft EPA Method 1633	4,8-Dioxa-3H-perfluorononanoic acid (ADONA)

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
LC/MS/MS	Draft EPA Method 1633	2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (HFPO-DA; GenX)
LC/MS/MS	Draft EPA Method 1633	Perfluoro-3-methoxypropanoic acid (PFMPA)
LC/MS/MS	Draft EPA Method 1633	Perfluoro-4-methoxybutanoic acid (PFMBA)
LC/MS/MS	Draft EPA Method 1633	Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)
LC/MS/MS	Draft EPA Method 1633	Perfluoro (2-ethoxyethane) sulfonic acid (PFEESA)
ICP	EPA 6010C/D	Aluminum
ICP	EPA 6010C/D	Antimony
ICP	EPA 6010C/D	Arsenic
ICP	EPA 6010C/D	Barium
ICP	EPA 6010C/D	Beryllium
ICP	EPA 6010C/D	Cadmium
ICP	EPA 6010C/D	Calcium
ICP	EPA 6010C/D	Chromium
ICP	EPA 6010C/D	Cobalt
ICP	EPA 6010C/D	Copper
ICP	EPA 6010C/D	Iron
ICP	EPA 6010C/D	Lead
ICP	EPA 6010C/D	Magnesium
ICP	EPA 6010C/D	Manganese
ICP	EPA 6010C/D	Molybdenum
ICP	EPA 6010C/D	Nickel
ICP	EPA 6010C/D	Potassium
ICP	EPA 6010C/D	Selenium
ICP	EPA 6010C/D	Silver
ICP	EPA 6010C/D	Sodium
ICP	EPA 6010C/D	Strontium
ICP	EPA 6010C/D	Thallium
ICP	EPA 6010C/D	Tin
ICP	EPA 6010C/D	Titanium
ICP	EPA 6010C/D	Vanadium
ICP	EPA 6010C/D	Zinc

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
ICP/MS	EPA 6020A/B	Aluminum
ICP/MS	EPA 6020A/B	Antimony
ICP/MS	EPA 6020A/B	Arsenic
ICP/MS	EPA 6020A/B	Barium
ICP/MS	EPA 6020A/B	Beryllium
ICP/MS	EPA 6020A/B	Cadmium
ICP/MS	EPA 6020A/B	Calcium
ICP/MS	EPA 6020A/B	Chromium
ICP/MS	EPA 6020A/B	Cobalt
ICP/MS	EPA 6020A/B	Copper
ICP/MS	EPA 6020A/B	Iron
ICP/MS	EPA 6020A/B	Lead
ICP/MS	EPA 6020A/B	Magnesium
ICP/MS	EPA 6020A/B	Manganese
ICP/MS	EPA 6020A/B	Molybdenum
ICP/MS	EPA 6020A/B	Nickel
ICP/MS	EPA 6020A/B	Potassium
ICP/MS	EPA 6020A/B	Selenium
ICP/MS	EPA 6020A/B	Silver
ICP/MS	EPA 6020A/B	Sodium
ICP/MS	EPA 6020A/B	Strontium
ICP/MS	EPA 6020A/B	Thallium
ICP/MS	EPA 6020A/B	Tin
ICP/MS	EPA 6020A/B	Titanium
ICP/MS	EPA 6020A/B	Vanadium
ICP/MS	EPA 6020A/B	Zinc
CVAA	EPA 7471B	Mercury
UV/VIS	EPA 7196A	Hexavalent Chromium (Cr6+)
UV/VIS	EPA 9012B	Cyanide (Total)
IC	EPA 9056A	Bromide
IC	EPA 9056A	Chloride
IC	EPA 9056A	Fluoride
IC	EPA 9056A	Nitrate
IC	EPA 9056A	Nitrite

Solid and Chemical Materials

Technology	Method	Analyte
IC	EPA 9056A	Sulfate
IC	EPA 9056A	Total nitrate-nitrite
Gravimetric Methods	SM 2540G	% solids
Electrometric Methods	EPA 9045D	Hydrogen Ion (pH)
Ignitability	EPA 1010A MOD	Flash Point
Ignitability	EPA 1020B MOD	Flash Point
Waste Characterization	EPA Ch.7	Reactive Cyanide and Reactive Sulfide
Waste Characterization	EPA Section 7.3	Reactive Cyanide
Waste Characterization	EPA Section 7.3	Reactive Sulfide
Preparation	**Method**	**Type**
Organics Preparation	EPA 3510C	Separatory Funnel Liquid-Liquid Extraction; Leachates
TCLP Preparation	EPA 1311	Toxicity Characteristic Leaching Procedure
SPLP Preparation	EPA 1312	Synthetic Precipitation Leaching Procedure
Organics Preparation	EPA 8011	Microextraction
Organics Preparation	EPA 3546	Microwave Extraction
Organics Preparation	EPA 3550C	Ultrasonic Extraction
Organics Preparation	EPA 3580A	Waste Dilution for Extractable Organics
Organics Preparation	EPA 8330A; EPA 8332	Ultrasonic Extraction
Organics Preparation	EPA 8330B	Shaker Table Extraction
Volatile Organics Preparation	EPA 3585	Waste Dilution for Volatile Organics
Volatile Organics Preparation	EPA 5030A	Closed System Purge and Trap; Bulk Soils
Volatile Organics Preparation	EPA 5030B	Closed System Purge and Trap; Leachates and Methanol Extracts
Volatile Organics Preparation	EPA 5035; EPA 5035A	Closed System Purge and Trap
Organics Cleanup	EPA 3660B	Sulfur Cleanup
Organics Cleanup	EPA 3665A	Sulfuric Acid Cleanup
Lachat MicroDistillation	EPA 9012B	Cyanide MicroDistillation; proprietary method
Inorganic Preparation	EPA 3010A	Metals Acid Digestion by Hotblock; Leachates
Inorganic Preparation	EPA 3050B	Metals Acid Digestion by Hotblock
Inorganic Preparation	EPA 3060A	Alkaline Digestion, Cr6+
Inorganic Preparation	EPA 7470A	CVAA Digestion by Hotblock; Leachates
Inorganic Preparation	EPA 7471B	CVAA Digestion by Hotblock

Note:

1. This scope is formatted as part of a single document including Certificate of Accreditation No. L2229.

R.D

R. Douglas Leonard Jr., VP, PILR SBU

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2024
Issued April 01, 2023
Revised April 10, 2023

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. NORMAN D. FARMER
SGS NORTH AMERICA INC. - ORLANDO
4405 VINELAND RD STE C-15
ORLANDO, FL 32811

NY Lab Id No: 12022

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category
ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Acrylates

Acrolein (Propenal)	EPA 8260D
Acrylonitrile	EPA 8260D

Amines

1,2-Diphenylhydrazine	EPA 8270E
1,4-Phenylenediamine	EPA 8270E
1-Naphthylamine	EPA 8270E
2-Naphthylamine	EPA 8270E
2-Nitroaniline	EPA 8270E
3-Nitroaniline	EPA 8270E
4,4'-Methylenebis(2-chloroaniline)	EPA 8270E
4-Chloroaniline	EPA 8270E
4-Nitroaniline	EPA 8270E
5-Nitro-o-toluidine	EPA 8270E
a,a-Dimethylphenethylamine	EPA 8270E
Aniline	EPA 8270E
Carbazole	EPA 8270E
Methapyrilene	EPA 8270E
Pronamide	EPA 8270E
Propionitrile	EPA 8260D
Pyridine	EPA 8270E

Benzidines

3,3'-Dichlorobenzidine	EPA 8270E
3,3'-Dimethylbenzidine	EPA 8270E
Benzidine	EPA 8270E

Chlorinated Hydrocarbon Pesticides

4,4'-DDD	EPA 8081B

Serial No.: 67744

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2024
Issued April 01, 2023
Revised April 10, 2023

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. NORMAN D. FARMER
SGS NORTH AMERICA INC. - ORLANDO
4405 VINELAND RD STE C-15
ORLANDO, FL 32811

NY Lab Id No: 12022

is hereby APPROVED as an Environmental Laboratory in conformance with the
National Environmental Laboratory Accreditation Conference Standards (2016) for the category
ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Chlorinated Hydrocarbon Pesticides

4,4'-DDE	EPA 8081B
4,4'-DDT	EPA 8081B
Aldrin	EPA 8081B
alpha-BHC	EPA 8081B
alpha-Chlordane	EPA 8081B
beta-BHC	EPA 8081B
Chlordane Total	EPA 8081B
Chlorobenzilate	EPA 8270E
delta-BHC	EPA 8081B
Diallate	EPA 8270E
Dieldrin	EPA 8081B
Endosulfan I	EPA 8081B
Endosulfan II	EPA 8081B
Endosulfan sulfate	EPA 8081B
Endrin	EPA 8081B
Endrin aldehyde	EPA 8081B
Endrin Ketone	EPA 8081B
gamma-Chlordane	EPA 8081B
Heptachlor	EPA 8081B
Heptachlor epoxide	EPA 8081B
Isodrin	EPA 8270E
Kepone	EPA 8270E
Lindane	EPA 8081B
Methoxychlor	EPA 8081B
Toxaphene	EPA 8081B

Chlorinated Hydrocarbons

1,2,3-Trichlorobenzene	EPA 8260D

Serial No.: 67744

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2024
Issued April 01, 2023
Revised April 10, 2023

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. NORMAN D. FARMER
SGS NORTH AMERICA INC. - ORLANDO
4405 VINELAND RD STE C-15
ORLANDO, FL 32811

NY Lab Id No: 12022

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Chlorinated Hydrocarbons

1,2,4,5-Tetrachlorobenzene	EPA 8270E
1,2,4-Trichlorobenzene	EPA 8270E
1-Chloronaphthalene	EPA 8270E
2-Chloronaphthalene	EPA 8270E
Hexachlorobenzene	EPA 8270E
Hexachlorobutadiene	EPA 8270E
Hexachlorocyclopentadiene	EPA 8270E
Hexachloroethane	EPA 8270E
Hexachloropropene	EPA 8270E
Pentachlorobenzene	EPA 8270E

Chlorophenoxy Acid Pesticides

2,4,5-T	EPA 8151A
2,4,5-TP (Silvex)	EPA 8151A
2,4-D	EPA 8151A
2,4-DB	EPA 8151A
Dalapon	EPA 8151A
Dicamba	EPA 8151A
Dichloroprop	EPA 8151A
Dinoseb	EPA 8151A
Pentachlorophenol	EPA 8151A

Dissolved Gases

Acetylene	RSK-175
Ethane	RSK-175
Ethene (Ethylene)	RSK-175
Methane	RSK-175
Propane	RSK-175

Serial No.: 67744

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2024
Issued April 01, 2023
Revised April 10, 2023

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. NORMAN D. FARMER
SGS NORTH AMERICA INC. - ORLANDO
4405 VINELAND RD STE C-15
ORLANDO, FL 32811

NY Lab Id No: 12022

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category
ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Fuel Oxygenates

Di-isopropyl ether	EPA 8260D
Ethanol	EPA 8260D
Methyl tert-butyl ether	EPA 8260D
tert-amyl alcohol	EPA 8260D
tert-amyl methyl ether (TAME)	EPA 8260D
tert-butyl alcohol	EPA 8260D
tert-butyl ethyl ether (ETBE)	EPA 8260D

Haloethers

2,2'-Oxybis(1-chloropropane)	EPA 8270E
4-Bromophenylphenyl ether	EPA 8270E
4-Chlorophenylphenyl ether	EPA 8270E
Bis(2-chloroethoxy)methane	EPA 8270E
Bis(2-chloroethyl)ether	EPA 8270E

Low Level Halocarbons

1,2-Dibromo-3-chloropropane, Low Le	EPA 8011
1,2-Dibromoethane, Low Level	EPA 8011

Low Level Polynuclear Aromatics

Acenaphthene Low Level	EPA 8270E
Acenaphthylene Low Level	EPA 8270E
Anthracene Low Level	EPA 8270E
Benzo(a)anthracene Low Level	EPA 8270E
Benzo(a)pyrene Low Level	EPA 8270E
Benzo(b)fluoranthene Low Level	EPA 8270E
Benzo(g,h,i)perylene Low Level	EPA 8270E
Benzo(k)fluoranthene Low Level	EPA 8270E
Chrysene Low Level	EPA 8270E

Serial No.: 67744

Property of the New York State Department of Health. Certificates are valid only at the address shown and must be conspicuously posted by the laboratory. Continued accreditation depends on the laboratory's successful ongoing participation in the Program. Consumers may verify a laboratory's accreditation status online at https://apps.health.ny.gov/pubdoh/applinks/wc/elappublicweb/, by phone (518) 485-5570 or by email to elap@health.ny.gov.

Expires 12:01 AM April 01, 2024
Issued April 01, 2023
Revised April 10, 2023

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. NORMAN D. FARMER
SGS NORTH AMERICA INC. - ORLANDO
4405 VINELAND RD STE C-15
ORLANDO, FL 32811

NY Lab Id No: 12022

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category
ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Low Level Polynuclear Aromatics

Dibenzo(a,h)anthracene Low Level	EPA 8270E
Fluoranthene Low Level	EPA 8270E
Fluorene Low Level	EPA 8270E
Indeno(1,2,3-cd)pyrene Low Level	EPA 8270E
Naphthalene Low Level	EPA 8270E
Phenanthrene Low Level	EPA 8270E
Pyrene Low Level	EPA 8270E

Metals I

Barium, Total	EPA 6010D
	EPA 6020B
Cadmium, Total	EPA 6010D
	EPA 6020B
Calcium, Total	EPA 6010D
	EPA 6020B
Chromium, Total	EPA 6010D
	EPA 6020B
Copper, Total	EPA 6010D
	EPA 6020B
Iron, Total	EPA 6010D
	EPA 6020B
Lead, Total	EPA 6010D
	EPA 6020B
Magnesium, Total	EPA 6010D
	EPA 6020B
Manganese, Total	EPA 6010D
	EPA 6020B
Nickel, Total	EPA 6010D

Serial No.: 67744

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2024
Issued April 01, 2023
Revised April 10, 2023

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. NORMAN D. FARMER
SGS NORTH AMERICA INC. - ORLANDO
4405 VINELAND RD STE C-15
ORLANDO, FL 32811

NY Lab Id No: 12022

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category
ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Metals I

Nickel, Total	EPA 6020B
Potassium, Total	EPA 6010D
	EPA 6020B
Silver, Total	EPA 6010D
	EPA 6020B
Sodium, Total	EPA 6010D
	EPA 6020B
Strontium, Total	EPA 6010D
	EPA 6020B

Metals II

Aluminum, Total	EPA 6010D
	EPA 6020B
Antimony, Total	EPA 6010D
	EPA 6020B
Arsenic, Total	EPA 6010D
	EPA 6020B
Beryllium, Total	EPA 6010D
	EPA 6020B
Chromium VI	EPA 7196A
Mercury, Total	EPA 7470A
Selenium, Total	EPA 6010D
	EPA 6020B
Vanadium, Total	EPA 6010D
	EPA 6020B
Zinc, Total	EPA 6010D
	EPA 6020B

Serial No.: 67744

Property of the New York State Department of Health. Certificates are valid only at the address shown and must be conspicuously posted by the laboratory. Continued accreditation depends on the laboratory's successful ongoing participation in the Program. Consumers may verify a laboratory's accreditation status online at https://apps.health.ny.gov/pubdoh/applinks/wc/elappublicweb/, by phone (518) 485-5570 or by email to elap@health.ny.gov.

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2024
Issued April 01, 2023
Revised April 10, 2023

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. NORMAN D. FARMER
SGS NORTH AMERICA INC. - ORLANDO
4405 VINELAND RD STE C-15
ORLANDO, FL 32811

NY Lab Id No: 12022

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER All approved analytes are listed below:

Metals III

Cobalt, Total	EPA 6010D
	EPA 6020B
Molybdenum, Total	EPA 6010D
	EPA 6020B
Thallium, Total	EPA 6010D
	EPA 6020B
Tin, Total	EPA 6010D
	EPA 6020B
Titanium, Total	EPA 6010D
	EPA 6020B

Mineral

Alkalinity	SM 2320B-2011
Chloride	EPA 300.0, Rev. 2.1 (1993)
	EPA 9056A
Fluoride, Total	EPA 300.0, Rev. 2.1 (1993)
	EPA 9056A
Hardness, Total	SM 2340B-2011
Sulfate (as SO4)	EPA 300.0, Rev. 2.1 (1993)
	EPA 9056A

Miscellaneous

Bromide	EPA 300.0, Rev. 2.1 (1993)
	EPA 9056A
Cyanide, Total	EPA 9012B
Oil and Grease Total Recoverable	EPA 1664A
	EPA 1664B
	EPA 9070A (Solvent:Hexane)

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2024
Issued April 01, 2023
Revised April 10, 2023

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

NY Lab Id No: 12022

MR. NORMAN D. FARMER
SGS NORTH AMERICA INC. - ORLANDO
4405 VINELAND RD STE C-15
ORLANDO, FL 32811

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category
ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Miscellaneous

Organic Carbon, Total	SM 5310B-2014
	EPA 9060A
Perchlorate	EPA 6850
Phenols	EPA 420.4, Rev. 1.0 (1993)
Specific Conductance	EPA 120.1 (Rev. 1982)
Sulfide (as S)	SM 4500-S2- F-2011

Nitroaromatics and Isophorone

1,3,5-Trinitrobenzene	EPA 8270E
	EPA 8330A
	EPA 8330B
1,3-Dinitrobenzene	EPA 8270E
	EPA 8330A
	EPA 8330B
1,4-Naphthoquinone	EPA 8270E
2,4,6-Trinitrotoluene	EPA 8330A
	EPA 8330B
2,4-Dinitrotoluene	EPA 8330A
	EPA 8330B
2,6-Dinitrotoluene	EPA 8330A
	EPA 8330B
2-Amino-4,6-dinitrotoluene	EPA 8330A
	EPA 8330B
2-Nitrotoluene	EPA 8330A
	EPA 8330B
3,5-Dinitroaniline	EPA 8330B
3-Nitrotoluene	EPA 8330A
	EPA 8330B

Serial No.: 67744

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2024
Issued April 01, 2023
Revised April 10, 2023

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

NY Lab Id No: 12022

MR. NORMAN D. FARMER
SGS NORTH AMERICA INC. - ORLANDO
4405 VINELAND RD STE C-15
ORLANDO, FL 32811

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Nitroaromatics and Isophorone

4-Amino-2,6-dinitrotoluene	EPA 8330A
	EPA 8330B
4-Nitroquinoline-1-oxide	EPA 8270E
4-Nitrotoluene	EPA 8330A
	EPA 8330B
Hexahydro-1,3,5-trinitro-1,3,5-triazine	EPA 8330A
	EPA 8330B
Isophorone	EPA 8270E
Methyl-2,4,6-trinitrophenylnitramine	EPA 8330A
	EPA 8330B
Nitrobenzene	EPA 8270E
	EPA 8330A
	EPA 8330B
Nitroglycerine	EPA 8330B
Octahydro-tetranitro-tetrazocine	EPA 8330A
	EPA 8330B
Pentaerythritol tetranitrate	EPA 8330B

Nitrosoamines

N-Nitrosodiethylamine	EPA 8270E
N-Nitrosodimethylamine	EPA 8270E
N-Nitrosodi-n-butylamine	EPA 8270E
N-Nitrosodi-n-propylamine	EPA 8270E
N-Nitrosodiphenylamine	EPA 8270E
N-nitrosomethylethylamine	EPA 8270E
N-nitrosomorpholine	EPA 8270E
N-nitrosopiperidine	EPA 8270E
N-Nitrosopyrrolidine	EPA 8270E

Serial No.: 67744

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2024
Issued April 01, 2023
Revised April 10, 2023

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. NORMAN D. FARMER
SGS NORTH AMERICA INC. - ORLANDO
4405 VINELAND RD STE C-15
ORLANDO, FL 32811

NY Lab Id No: 12022

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category
ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Nutrient

Ammonia (as N)	EPA 350.1, Rev. 2.0 (1993)
Kjeldahl Nitrogen, Total	EPA 351.2, Rev. 2.0 (1993)
Nitrate (as N)	EPA 353.2, Rev. 2.0 (1993)
	EPA 300.0, Rev. 2.1 (1993)
	EPA 9056A
Nitrite (as N)	EPA 353.2, Rev. 2.0 (1993)
	EPA 300.0, Rev. 2.1 (1993)
	EPA 9056A
Organic Nitrogen (as N)	TKN minus Ammonia (as N)
Orthophosphate (as P)	EPA 365.3 (Issued 1978)
Phosphorus, Total	EPA 365.3 (Issued 1978)

Organophosphate Pesticides

Atrazine	EPA 8270E
Diazinon	EPA 8270E
Dimethoate	EPA 8270E
Disulfoton	EPA 8270E
Famphur	EPA 8270E
Parathion ethyl	EPA 8270E
Parathion methyl	EPA 8270E
Phorate	EPA 8270E
Simazine	EPA 8270E
Sulfotepp	EPA 8270E
Thionazin	EPA 8270E

Perfluorinated Alkyl Acids

Perfluorooctanesulfonic Acid (PFOS)	SGS MS 014.10
Perfluorooctanoic Acid (PFOA)	SGS MS 014.10

Serial No.: 67744

Property of the New York State Department of Health. Certificates are valid only at the address shown and must be conspicuously posted by the laboratory. Continued accreditation depends on the laboratory's successful ongoing participation in the Program. Consumers may verify a laboratory's accreditation status online at https://apps.health.ny.gov/pubdoh/applinks/wc/elappublicweb/, by phone (518) 485-5570 or by email to elap@health.ny.gov.

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2024
Issued April 01, 2023
Revised April 10, 2023

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. NORMAN D. FARMER
SGS NORTH AMERICA INC. - ORLANDO
4405 VINELAND RD STE C-15
ORLANDO, FL 32811

NY Lab Id No: 12022

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER All approved analytes are listed below:

Petroleum Hydrocarbons

Diesel Range Organics	EPA 8015D
Gasoline Range Organics	EPA 8015D

Phthalate Esters

Benzyl butyl phthalate	EPA 8270E
Bis(2-ethylhexyl) phthalate	EPA 8270E
Diethyl phthalate	EPA 8270E
Dimethyl phthalate	EPA 8270E
Di-n-butyl phthalate	EPA 8270E
Di-n-octyl phthalate	EPA 8270E

Polychlorinated Biphenyls

Aroclor 1016 (PCB-1016)	EPA 8082A EPA 8270E
Aroclor 1221 (PCB-1221)	EPA 8082A EPA 8270E
Aroclor 1232 (PCB-1232)	EPA 8082A EPA 8270E
Aroclor 1242 (PCB-1242)	EPA 8082A EPA 8270E
Aroclor 1248 (PCB-1248)	EPA 8082A EPA 8270E
Aroclor 1254 (PCB-1254)	EPA 8082A EPA 8270E
Aroclor 1260 (PCB-1260)	EPA 8082A EPA 8270E
Aroclor 1262 (PCB-1262)	EPA 8082A
Aroclor 1268 (PCB-1268)	EPA 8082A

Serial No.: 67744

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2024
Issued April 01, 2023
Revised April 10, 2023

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. NORMAN D. FARMER
SGS NORTH AMERICA INC. - ORLANDO
4405 VINELAND RD STE C-15
ORLANDO, FL 32811

NY Lab Id No: 12022

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category
ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Polynuclear Aromatics

2-Acetylaminofluorene	EPA 8270E
3-Methylcholanthrene	EPA 8270E
7,12-Dimethylbenzyl (a) anthracene	EPA 8270E
Acenaphthene	EPA 8270E
Acenaphthylene	EPA 8270E
Anthracene	EPA 8270E
Benzo(a)anthracene	EPA 8270E
Benzo(a)pyrene	EPA 8270E
Benzo(b)fluoranthene	EPA 8270E
Benzo(g,h,i)perylene	EPA 8270E
Benzo(k)fluoranthene	EPA 8270E
Chrysene	EPA 8270E
Dibenzo(a,h)anthracene	EPA 8270E
Fluoranthene	EPA 8270E
Fluorene	EPA 8270E
Indeno(1,2,3-cd)pyrene	EPA 8270E
Naphthalene	EPA 8270E
Phenanthrene	EPA 8270E
Pyrene	EPA 8270E

Priority Pollutant Phenols

2,3,4,6 Tetrachlorophenol	EPA 8270E
2,4,5-Trichlorophenol	EPA 8270E
2,4,6-Trichlorophenol	EPA 8270E
2,4-Dichlorophenol	EPA 8270E
2,4-Dimethylphenol	EPA 8270E
2,4-Dinitrophenol	EPA 8270E
2,6-Dichlorophenol	EPA 8270E

Serial No.: 67744

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2024
Issued April 01, 2023
Revised April 10, 2023

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. NORMAN D. FARMER
SGS NORTH AMERICA INC. - ORLANDO
4405 VINELAND RD STE C-15
ORLANDO, FL 32811

NY Lab Id No: 12022

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category
ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Priority Pollutant Phenols

2-Chlorophenol	EPA 8270E
2-Methyl-4,6-dinitrophenol	EPA 8270E
2-Methylphenol	EPA 8270E
2-Nitrophenol	EPA 8270E
3-Methylphenol	EPA 8270E
4-Chloro-3-methylphenol	EPA 8270E
4-Methylphenol	EPA 8270E
4-Nitrophenol	EPA 8270E
Cresols, Total	EPA 8270E
Pentachlorophenol	EPA 8270E
Phenol	EPA 8270E

Residue

Solids, Total	SM 2540 B-2015
Solids, Total Dissolved	SM 2540 C-2015
Solids, Total Suspended	SM 2540 D-2015

Semi-Volatile Organics

1,1'-Biphenyl	EPA 8270E
1,2-Dichlorobenzene, Semi-volatile	EPA 8270E
1,3-Dichlorobenzene, Semi-volatile	EPA 8270E
1,4-Dichlorobenzene, Semi-volatile	EPA 8270E
2-Methylnaphthalene	EPA 8270E
2-Picoline	EPA 8270E
4-Amino biphenyl	EPA 8270E
Acetophenone	EPA 8270E
Aramite	EPA 8270E
Benzaldehyde	EPA 8270E

Serial No.: 67744

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2024
Issued April 01, 2023
Revised April 10, 2023

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. NORMAN D. FARMER
SGS NORTH AMERICA INC. - ORLANDO
4405 VINELAND RD STE C-15
ORLANDO, FL 32811

NY Lab Id No: 12022

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER All approved analytes are listed below:

Semi-Volatile Organics

Benzoic Acid	EPA 8270E
Benzyl alcohol	EPA 8270E
Caprolactam	EPA 8270E
Dibenzofuran	EPA 8270E
Ethyl methanesulfonate	EPA 8270E
Isosafrole	EPA 8270E
Methyl methanesulfonate	EPA 8270E
n-Decane	EPA 8270E
n-Octadecane	EPA 8270E
O,O,O-Triethyl phosphorothioate	EPA 8270E
p-Dimethylaminoazobenzene	EPA 8270E
Phenacetin	EPA 8270E
Safrole	EPA 8270E

Volatile Aromatics

1,2,4-Trichlorobenzene, Volatile	EPA 8260D
1,2,4-Trimethylbenzene	EPA 8260D
1,2-Dichlorobenzene	EPA 8260D
1,3,5-Trimethylbenzene	EPA 8260D
1,3-Dichlorobenzene	EPA 8260D
1,4-Dichlorobenzene	EPA 8260D
2-Chlorotoluene	EPA 8260D
4-Chlorotoluene	EPA 8260D
Benzene	EPA 8260D
Bromobenzene	EPA 8260D
Chlorobenzene	EPA 8260D
Ethyl benzene	EPA 8260D
Isopropylbenzene	EPA 8260D

Serial No.: 67744

Property of the New York State Department of Health. Certificates are valid only at the address shown and must be conspicuously posted by the laboratory. Continued accreditation depends on the laboratory's successful ongoing participation in the Program. Consumers may verify a laboratory's accreditation status online at https://apps.health.ny.gov/pubdoh/applinks/wc/elappublicweb/, by phone (518) 485-5570 or by email to elap@health.ny.gov.

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2024
Issued April 01, 2023
Revised April 10, 2023

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. NORMAN D. FARMER
SGS NORTH AMERICA INC. - ORLANDO
4405 VINELAND RD STE C-15
ORLANDO, FL 32811

NY Lab Id No: 12022

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Volatile Aromatics

m/p-Xylenes	EPA 8260D
Naphthalene, Volatile	EPA 8260D
n-Butylbenzene	EPA 8260D
n-Propylbenzene	EPA 8260D
o-Xylene	EPA 8260D
p-Isopropyltoluene (P-Cymene)	EPA 8260D
sec-Butylbenzene	EPA 8260D
Styrene	EPA 8260D
tert-Butylbenzene	EPA 8260D
Toluene	EPA 8260D
Total Xylenes	EPA 8260D

Volatile Halocarbons

1,1,1,2-Tetrachloroethane	EPA 8260D
1,1,1-Trichloroethane	EPA 8260D
1,1,2,2-Tetrachloroethane	EPA 8260D
1,1,2-Trichloro-1,2,2-Trifluoroethane	EPA 8260D
1,1,2-Trichloroethane	EPA 8260D
1,1-Dichloroethane	EPA 8260D
1,1-Dichloroethene	EPA 8260D
1,1-Dichloropropene	EPA 8260D
1,2,3-Trichloropropane	EPA 8260D
1,2-Dibromo-3-chloropropane	EPA 8260D
1,2-Dibromoethane	EPA 8260D
1,2-Dichloro-1,1,2-Trifluoroethane	EPA 8260D
1,2-Dichloroethane	EPA 8260D
1,2-Dichloropropane	EPA 8260D
1,3-Dichloropropane	EPA 8260D

Serial No.: 67744

Property of the New York State Department of Health. Certificates are valid only at the address shown and must be conspicuously posted by the laboratory. Continued accreditation depends on the laboratory's successful ongoing participation in the Program. Consumers may verify a laboratory's accreditation status online at https://apps.health.ny.gov/pubdoh/applinks/wc/elappublicweb/, by phone (518) 485-5570 or by email to elap@health.ny.gov.

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2024
Issued April 01, 2023
Revised April 10, 2023

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. NORMAN D. FARMER
SGS NORTH AMERICA INC. - ORLANDO
4405 VINELAND RD STE C-15
ORLANDO, FL 32811

NY Lab Id No: 12022

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category
ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Volatile Halocarbons

2,2-Dichloropropane	EPA 8260D
2-Chloro-1,3-butadiene (Chloroprene)	EPA 8260D
2-Chloroethylvinyl ether	EPA 8260D
3-Chloropropene (Allyl chloride)	EPA 8260D
Bromochloromethane	EPA 8260D
Bromodichloromethane	EPA 8260D
Bromoform	EPA 8260D
Bromomethane	EPA 8260D
Carbon tetrachloride	EPA 8260D
Chloroethane	EPA 8260D
Chloroform	EPA 8260D
Chloromethane	EPA 8260D
cis-1,2-Dichloroethene	EPA 8260D
cis-1,3-Dichloropropene	EPA 8260D
cis-1,4-Dichloro-2-butene	EPA 8260D
Dibromochloromethane	EPA 8260D
Dibromomethane	EPA 8260D
Dichlorodifluoromethane	EPA 8260D
Hexachlorobutadiene, Volatile	EPA 8260D
Methyl iodide	EPA 8260D
Methylene chloride	EPA 8260D
Tetrachloroethene	EPA 8260D
trans-1,2-Dichloroethene	EPA 8260D
trans-1,3-Dichloropropene	EPA 8260D
trans-1,4-Dichloro-2-butene	EPA 8260D
Trichloroethene	EPA 8260D
Trichlorofluoromethane	EPA 8260D

Serial No.: 67744

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2024
Issued April 01, 2023
Revised April 10, 2023

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. NORMAN D. FARMER
SGS NORTH AMERICA INC. - ORLANDO
4405 VINELAND RD STE C-15
ORLANDO, FL 32811

NY Lab Id No: 12022

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2016) for the category
ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Volatile Halocarbons

Vinyl chloride	EPA 8260D

Volatiles Organics

1,4-Dioxane	EPA 8260C SIM
	EPA 8260D SIM
	EPA 8270D SIM
	EPA 8270E SIM
2-Butanone (Methylethyl ketone)	EPA 8260D
2-Hexanone	EPA 8260D
2-Nitropropane	EPA 8260D
4-Methyl-2-Pentanone	EPA 8260D
Acetone	EPA 8260D
Acetonitrile	EPA 8260D
Carbon Disulfide	EPA 8260D
Di-ethyl ether	EPA 8260D
Ethyl Acetate	EPA 8260D
Ethylene Glycol	EPA 8260D
Isobutyl alcohol	EPA 8260D
Isopropanol	EPA 8260D
n-Butanol	EPA 8260D
o-Toluidine	EPA 8270E
Vinyl acetate	EPA 8260D

Sample Preparation Methods

	EPA 5030C
	SGS OP 069.5
	EPA 3010A
	EPA 3510C

Serial No.: 67744

Property of the New York State Department of Health. Certificates are valid only at the address shown and must be conspicuously posted by the laboratory. Continued accreditation depends on the laboratory's successful ongoing participation in the Program. Consumers may verify a laboratory's accreditation status online at https://apps.health.ny.gov/pubdoh/applinks/wc/elappublicweb/, by phone (518) 485-5570 or by email to elap@health.ny.gov.

Appendix B

Field Forms

This page intentionally left blank

Daily Field Form

Site:____________________________
Location:_________________________
Project:__________________________

DATE:	**Prepared by:**

Personnel Onsite:	

Arrive at site: (am)
Leave site: (pm)

Weather	Bright Sun	Clear	Overcast	Rain	Snow
Temperature	To 32 º F	32 to 50 º F	50 to 70 º F	70 to 85 º F	85+ º F
Wind	Still	Moderate	High		
Humidity	Dry	Moderate	Humid		

Temperature º F (am) (pm)
Humidity (am) (pm)
Wind direction (am) (pm)

Additional Details: (i.e. additional information regarding weather conditions. Changing conditions, heavy rain, other precipitation types, time periods of precipitation/storms, etc.).

Material Deliveries/Equipment On Site:

Inspections Conducted:

Daily Field Form

Site:_____________________________
Location:_____________________________
Project:_____________________________

Description of Field Activities:

Issues/Problems Encountered/Deficiencies/Deviations from UFP-QAPP (and resolutions):

Proposed Plan for Next Day

Attachments

FIELD CALIBRATION FORM

Site Name:

INSTRUMENT:	INSTRUMENT ID No:
OPERATOR:	WEATHER:
SPAN GAS TYPE:	DATE:
CALIBRATION NOTES:	
COMMENTS:	
SIGNATURE:	DATE:

WATER QUALITY METER INITIAL DAILY FIELD CALIBRATION FORM

YSI 3800
pH, CONDUCTIVITY, TEMPERATURE, TURBIDITY, ORP, AND DISSOVED OXYGEN

CALIBRATION
DATE:
METER ID:
SONDE ID:

pH CALIBRATION

Time: ________

pH STANDARD	PRE-CALIBRATION READING	POST-CALIBRATION READING (calibration requirement: within 0.2 pH unit of standard)
4.0		
7.0		
10.0		

CONDUCTIVITY CALIBRATION

Time: ________

CONDUCTIVITY STANDARD	PRE-CALIBRATION READING	POST-CALIBRATION READING (calibration requirement: within 10% of standard)
1.413		

TURBIDITY CALIBRATION

Time: ________

TURBIDITY STANDARD	PRE-CALIBRATION READING	POST-CALIBRATION READING (calibration requirement: within 10% of standard)
0 NTU		
126 NTU		

ORP CALIBRATION

Time: ________

ORP STANDARD	PRE-CALIBRATION READING	POST-CALIBRATION READING (calibration requirement: within 20 mV of standard)
240 millivolts		

DISSOLVED OXYGEN CALIBRATION

Time: ________

DO STANDARD	PRE-CALIBRATION READING	POST-CALIBRATION READING (calibration requirement: within <95% of standard)
100% AIR SATURATION		

COMMENTS

____

____

____

SIGNATURE ____

WATER QUALITY METER DAILY CALIBRATION CHECK FIELD FORM

YSI 3800
pH, CONDUCTIVITY, TEMPERATURE, TURBIDITY, ORP, AND DISSOVED OXYGEN

CALIBRATION
DATE:
METER ID:
SONDE ID:

pH CALIBRATION CHECK

Time: ________

pH STANDARD	CALIBRATION CHECK READING (if not within 0.2 pH unit of standard, recalibrate)	RECALIBRATION REQUIRED? (Y/N)	POST-RE-CALIBRATION READING
4.0			
7.0			
10.0			

CONDUCTIVITY CALIBRATION CHECK

Time: ________

CONDUCTIVITY STANDARD	CALIBRATION CHECK READING (if not within 10% of standard, recalibrate)	RECALIBRATION REQUIRED? (Y/N)	POST-RE-CALIBRATION READING
1.413			

TURBIDITY CALIBRATION CHECK

Time: ________

TURBIDITY STANDARD	CALIBRATION CHECK READING (if not within 10% of standard, recalibrate)	RECALIBRATION REQUIRED? (Y/N)	POST-RE-CALIBRATION READING
0 NTU			
126 NTU			

ORP CALIBRATION CHECK

Time: ________

ORP STANDARD	CALIBRATION CHECK READING (if not within 20 mV of standard, recalibrate)	RECALIBRATION REQUIRED? (Y/N)	POST-RE-CALIBRATION READING
240 millivolts			

DISSOLVED OXYGEN CALIBRATION CHECK

Time: ________

DO STANDARD	CALIBRATION CHECK READING (if <95% of standard, recalibrate)	RECALIBRATION REQUIRED? (Y/N)	POST-RE-CALIBRATION READING
100% AIR SATURATION			

COMMENTS

____

____

SIGNATURE ____

WATER QUALITY METER END OF DAY CALIBRATION CHECK FIELD FORM

YSI 3800
pH, CONDUCTIVITY, TEMPERATURE, TURBIDITY, ORP, AND DISSOVED OXYGEN

CALIBRATION
DATE:
METER ID:
SONDE ID:

pH CALIBRATION CHECK

Time: ________

pH STANDARD	END OF DAY CALIBRATION READING	PASS/FAIL? (if not within 0.2 pH unit of standard, fail)
4.0		
7.0		
10.0		

CONDUCTIVITY CALIBRATION CHECK

Time: ________

CONDUCTIVITY STANDARD	END OF DAY CALIBRATION READING	PASS/FAIL? (if not within 10% of standard, fail)
1.413		

TURBIDITY CALIBRATION CHECK

Time: ________

STANDARD	END OF DAY CALIBRATION READING	PASS/FAIL? (if not within 10 % of standard, fail)
0 NTU		
126 NTU		

ORP CALIBRATION CHECK

Time: ________

STANDARD	END OF DAY CALIBRATION READING	PASS/FAIL? (if not within 20 mV of standard, fail)
240 millivolts		

DISSOLVED OXYGEN CALIBRATION CHECK

Time: ________

STANDARD	END OF DAY CALIBRATION READING	PASS/FAIL? (if <95% of standard, fail)
100% AIR SATURATION		

COMMENTS

____

____

____

____

____

SIGNATURE ______________________________

EPA Region 2 Superfund Well Assessment Checklist

Facility Information

Site Name: ____

Site Address: ____

Site County: ____

Site State: ____

EPA Site ID Number: ____

Site Owner: ____

EPA Project Manager: ____

Well Locational Information

State Well ID: ____

Well Tag ID: ____

Well Installation date: ____

	From Log	By GPS
Ground Surface Elevation		
Latitude		
Longitude		
Northing (State Plane)		
Easting (State Plane)		

Cross streets (if applicable): ____

GPS Instrument used: ____

Datum:____

Accuracy/Precision: ____

Well Construction Details

Type of well (Circle one) Flush Mount Stick up Multilevel Well*

Well lock\security type: ____

Elevation (top of inner casing): ____

Surface casing material: ____

Well casing material: ____

Surface Casing diameter: ______________________ ***inches***

Well Diameter: ______________________ ***inches***

Well Depth (as installed): ______________________ ***ftbgs***

Well Depth (as measured): ______________________ ***fttoc***

Screened interval: ______________________ ***ft***

Open hole interval: ______________________ ***ft***

Depth to water: ______________________ ***ftbtoc***

Date: ______________ ***Time:*** ______________

* If multilevel well please see attached worksheet.

EPA Region 2 Superfund Well Assessment Checklist

Well Headspace Readings

PID/FID Reading taken inside top of casing (if applicable): _______________ ***ppm***

Multi-gas/CGI meter Readings taken (if applicable):

LEL: _________________ ***% LEL***
O_2: _________________ ***40% Vol.***
CO: _________________ ***ppm***
H_2S: _________________ ***ppm***

Do readings indicate unsafe conditions exist?	Yes	No

Well Condition

Is the concrete pad in good condition?	Yes	No
Is the well surface casing in good condition?	Yes	No
Is the surface casing vertical?	Yes	No
Is there an internal well seal?	Yes	No
Has there been physical damage to the well?	Yes	No
Does sounding depth match completed depth?	Yes	No
Is measuring point marked?	Yes	No
Is the well clearly labeled?	Yes	No
Flush mount - Is it secure from runoff?	Yes	No

Other Comments ____

____

Recommendations

Well needs to be redeveloped	Yes	No
Well needs to be re-surveyed.	Yes	No
Well needs to be repaired.	Yes	No
Well needs to be replaced.	Yes	No
Well needs to be properly abandoned.	Yes	No
No action necessary.	Yes	No

Comments

Inspected by: ______________________________
Date of Inspection: ______________________________
Reviewed by: ______________________________ **(Print)**
______________________________ **(Sign)**

MONITORING WELL GAUGING LOG

Site Name:

Inspector(s):

Date/Time:

Weather Conditions:

Well ID	PID Reading (ppm)	DTW (ft. below TOC)	DTB (ft. below TOC)	Well Condition / Notes

WELL PURGING AND SAMPLING RECORD

Site Name/Location	Project No:	Page of
Well ID	Date	Time
Well Site Description		
Weather/Temp		
Field Technician		

WELL CONSTRUCTION DATA

TOC Elevation (ft amsl)	Screened Interval (ft bgs)
Well Diameter (in.)	Nominal Borehole Diameter (in.)

FIELD MEASUREMENTS

Well Depth (gauge after sampling) (ft)	Gallons per foot of depth
Depth to product (ft)	Static water level (ft)
Product column height (ft)	Water column height (ft)
Product volume (Gallons)	Water volume (Gallons)

PURGE INFORMATION

Pump Type / ID	Water Quality Meter Type / ID
Pump Intake Depth (ft)	Flow-Thru Cell Volume (L)
Purge Start Time	Appearance/Odor (Start)
Purge End Time	Appearance/Odor (End)
Average Purge Rate (mL/min)	Total Drawdown (ft)

Well Went Dry (Y/N)	Stop Time	Volume removed (L)
Recovery Time	Recovery Rate (mL/min)	Restart Purge Time

Total Volume Removed (L)	Total Pump Time (min)

Date	Time	Purge Rate (mL/min)	Volume Removed (LPM)	pH (+/-0.1)	Cond. (µS/cm) (+- 3%)	Temp. (°C) (+- 3%)	ORP (mV) (+/- 10)	Turbidity (NTU) +/-10% or <5 NTU	DO (mg/L) +/-10% or <0.5 mg/L	Depth to Water (ft below TOC)

COMMENTS ____

____

SAMPLE COLLECTION

Sample Date	Sample Time
Sample ID	
QA/QC Collected / ID	Sample Appearance/Odor
Analyses	
Sampler	Signature

INVESTIGATIVE DERIVED WASTE INVENTORY SHEET

Drum ID	Drum Contents	Monitoring Well ID	Accumulation Start Date	Accumulation End Date	Gallons

(a) Purge water, decontamination fluids

NOTES:
ID = Identification
IDW = Investigative Derived Waste

EA Engineering, Science,
and Technology, Inc., PBC

FIELD RECORD OF MONITORING WELL DEVELOPMENT (Page 1 of 3)

Well Designation: ______________________
Project Name: ______________________
Project Location: ______________________
Weather: ______________________
Developer Initials: ______________________

Well Development Date: ______________________ Development Time: ______________________
Gauge Date: ______________________ Gauge Time: ______________________
Static Water Level: ______________________ Measurement Reference: TOC
Well Grout Date: ______________________ Well Installation Date: ______________________
Well Diameter (inches): ______________________ Screen Length (ft): ______________________
Stick up/down (ft): ______________________ Sounding Method: ______________________
Condition: ______________________
Surge device and surge technique:____
Start/Stop times of surging intervals: ____
Pump device (type, size, capacity) and pump technique:____
Start/Stop times of pumping intervals:____
Quantity of water lost during drilling, removed prior to well installation, and other loss (list gallons and explain):____
____
Quantity of water added during granular filter placement, other additions (list gallons and explain):_______________
____

Well Volume Calculation (prior to development):
A. Depth to bottom: ________ ft [from top of casing (TOC)]
B. Depth to water ________ft from TOC
C. Liquid depth (A-B) (ft) ________ft
D. Well volume/ft ________gallons/ft (2" – 0.1667 gallons/ft)

	Beginning	1	2	3	4	5
Time (min):						
Pump rate (well yield) (gpm):						
Volume purged (gal):						
pH:						
Temperature (ºC):						
Specific Conductivity (µS/cm):						
Dissolved oxygen (mg/L):						
ORP (mV):						
Turbidity (NTU):						

FIELD RECORD OF MONITORING WELL DEVELOPMENT (Page 2 of 3)

	6	7	8	9	10	11
Time (min):						
Pump rate (well yield) (gpm):						
Volume purged (gal):						
pH:						
Temperature (ºC):						
Specific Conductivity (µS/cm):						
Dissolved oxygen (mg/L):						
ORP (mV):						
Turbidity (NTU):						

	12	13	14	15	16	17
Time (min):						
Pump rate (well yield) (gpm):						
Volume purged (gal):						
pH:						
Temperature (ºC):						
Specific Conductivity (µS/cm):						
Dissolved oxygen (mg/L):						
ORP (mV):						
Turbidity (NTU):						

FIELD RECORD OF MONITORING WELL DEVELOPMENT (Page 3 of 3)

Total volume of water removed (gal): ____________

Physical characteristics of water removed (including changes in clarity, color, particulates, and any odor noted during development):____

Estimated recharge rate:__________gpm

Depth to water 24 hours after development:_________ft

Depth to sediment before development_____ft   Depth to sediment after development: _____ft

Total surging time: ______hours

____

____

____

PLEASE NOTE

- **A 1-quart (2-pint) sample of the final water removed during development should be placed in a clear glass jar and labeled with well number and date. Each sample should be individually agitated and immediately photographed (close-up). Photograph No.:** ________________________
- **A minimum removal of three times the volume of standing water in the well and further volumetric removal should include**:
    (a) For those wells where the boring was advanced without the use of drilling fluid (mud and/or water) but water was added during well installation, then three times the volume of any water unrecovered from the well during installation should be removed (in addition to three volumes of standing water in the well).
    (b) For those wells where the boring was advanced or enlarged (totally or partially) with the use of drilling fluid (mud and/or water), then three times the measured (or estimated) volume of total fluids lost while drilling plus three times the volume used for well installation should be removed (in addition to three volumes of standing water in the well).
- Monitoring well development is complete when the discharge from the well at the maximum pumping rate has a **turbidity of 50 NTU or less and temperature, pH, specific conductivity, dissolved oxygen, Eh, and turbidity are within 10 percent during three successive readings at 10 minute intervals.**
- **READ APPENDIX A OF WORK PLAN FOR MONITORING WELL DEVELOPMENT DETAILS**

Source: USACE SOW and USACE EM 1110-1-4000

BORING/WELL LOG

Client

HOLE NUMBER AND PERMIT NUMBER

1. COMPANY NAME
EA Engineering, Science, and Technology, Inc., PBC

2. DRILL SUBCONTRACTOR

SHEET 1 OF SHEETS

3. PROJECT

4. GEOLOGIST

5. COMPONENT

6. AREA

7. GRID LOC./BIASED POINT

8. NAME OF DRILLER

9. MANUFACTURER'S DESIGNATION OF DRILL

10. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT

TYPE OF LINER USED, IF APPLICABLE

11. SURFACE ELEVATION AND CONDITIONS

12. DIRECT READING PARAMETERS: PID (ppm)

13. DATE STARTED

14. DATE COMPLETED

15. OVERBURDEN THICKNESS

16. DEPTH GROUNDWATER ENCOUNTERED

17. DEPTH DRILLED INTO ROCK

18. DEPTH TO WATER AND ELAPSED TIME ATFER DRILLING COMPLETED

19. TOTAL DEPTH OF HOLE

20. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

21. WELL INSTALLED? IF SO COMPLETE CONSTRUCTION DIAGRAM

22. SAMPLE TYPE:

23. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS

24. SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS
COD (if applicable)=
Hexavalent Chromium (if applicable)=

25. SCREENING ANALYSIS
COD=
Heavalent Chromium=

27. DISPOSITION OF HOLE

28. IF NOT A WELL, BACKFILLED WITH:

USCS LOG	DEPTH (FT)	DESCRIPTION OF MATERIALS	DIRECT READING		ANALYTICAL SAMPLE DESIGNATION AND INTERVAL	DEPTH (FT)	RECOVERY (IN.)	REMARKS
			VOC (ppm)					

PROJECT:

HOLE NO.:

BORING/WELL LOG

Client

HOLE NUMBER AND PERMIT NUMBER

1. COMPANY NAME
EA Engineering, Science, and Technology, Inc., PBC

2. DRILL SUBCONTRACTOR

SHEET 1 OF SHEETS

3. PROJECT

4. GEOLOGIST

5. COMPONENT

6. AREA

7. GRID LOC./BIASED POINT

8. NAME OF DRILLER

9. MANUFACTURER'S DESIGNATION OF DRILL

10. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT

TYPE OF LINER USED, IF APPLICABLE

11. SURFACE ELEVATION AND CONDITIONS

12. DIRECT READING PARAMETERS: PID (ppm)

13. DATE STARTED

14. DATE COMPLETED

15. OVERBURDEN THICKNESS

16. DEPTH GROUNDWATER ENCOUNTERED

17. DEPTH DRILLED INTO ROCK

18. DEPTH TO WATER AND ELAPSED TIME ATFER DRILLING COMPLETED

19. TOTAL DEPTH OF HOLE

20. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

21. WELL INSTALLED?

IF SO COMPLETE CONSTRUCTION DIAGRAM

22. SAMPLE TYPE:

23. SAMPLE INTERVAL AND DESIGNATION FOR LAB ANALYSIS

24. SAMPLE INTERVAL AND DESIGNATION FOR FIELD SCREENING ANALYSIS
COD (if applicable)=
Hexavalent Chromium (if applicable)=

25. SCREENING ANALYSIS
COD=
Heavalent Chromium=

27. DISPOSITION OF HOLE

28. IF NOT A WELL, BACKFILLED WITH:

USCS LOG	DEPTH (FT)	DESCRIPTION OF MATERIALS	DIRECT READING		ANALYTICAL SAMPLE DESIGNATION AND INTERVAL	DEPTH (FT)	RECOVERY (IN.)	REMARKS
			VOC (ppm)					

PROJECT:

HOLE NO.:

EA Engineering, Science,
and Technology, Inc., PBC

LOG OF SOIL/ROCK BORING

GPS Coordinates: ____________________
GPS Projection/Datum: ____________________
Surveyed Coordinates: ____________________
Survey Projection/Datum: ____________________
Surface Elevation: ____________________
Casing Below Surface: ____________________
Reference Elevation: ____________________
Reference Desc: ____________________

Job. No.	Client:	Location:
Drilling Method:		Boring No.
Sampling Method:		Sheet 1 of

				Drilling	
				Start	Finish
Water Level					
Time	-				
Date					
Reference					

Sample Type	Inches Drvn/In. Recvrd	SC	pH	PID ppm	Blows per 6 in.	Depth in Feet		USCS Log	Surface Conditions:
						21			
						22			
						23			
						24			
						25			
						26			
						27			
						28			
						29			
						30			
						31			
						32			
						33			
						34			
						35			
						36			
						37			
						38			
						39			
						40			
						41			

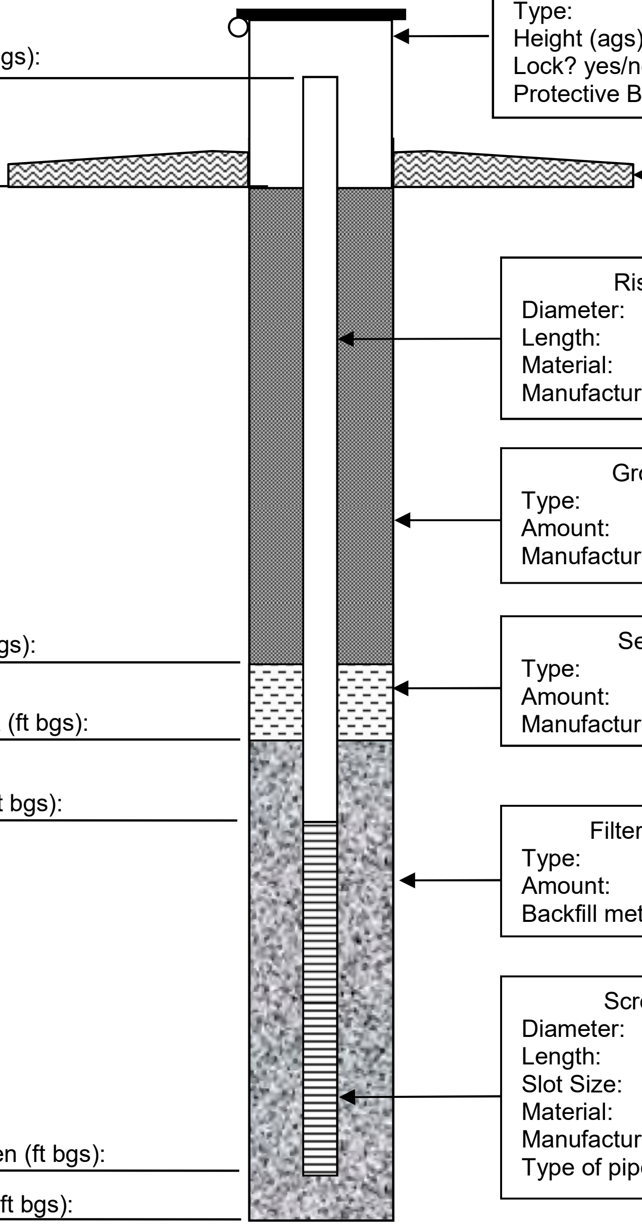
Logged by: ____________________ Date: ____________________

Drilling Contractor: ____________________ Driller: ____________________

RECORD OF WELL CONSTRUCTION

(STICK-UP)

EA Engineering, Science, and Technology, Inc., PBC	Well/Soil Boring ID No.:
Project Title/ Project No.:	Date/Time Installed: Time Finished:
Location:	Depth to Water:
Site Geologist:	Drilling Method:



Protective Casing
Type:
Height (ags):
Lock? yes/no
Protective Bollards:

Top of riser (ft ags):

Ground surface

Sloped pad
Material:
Slope:

Riser Information
Diameter:
Length:
Material:
Manufacturer:

Grout Information
Type:
Amount:
Manufacturer:

Top of seal (ft bgs):

Seal Information
Type:
Amount:
Manufacturer:

Top of filterpack (ft bgs):

Top of screen (ft bgs):

Filterpack Information
Type:
Amount:
Backfill method:

Screen Information
Diameter:
Length:
Slot Size:
Material:
Manufacturer:
Type of pipe joints:

Bottom of screen (ft bgs):

Bottom of well (ft bgs):

Note: All features not to scale

ags – Above Ground Surface
bgs – Below Ground Surface

EA Engineering, Science,
and Technology, Inc., PBC

FIELD RECORD OF MONITORING WELL DEVELOPMENT (Page 1 of 3)

Well Designation: ____________________
Project Name: ____________________
Project Location: ____________________
Weather: ____________________
Developer Initials: ____________________

Well Development Date: ____________________
Development Time: ____________________
Gauge Date: ____________________
Gauge Time: ____________________
Static Water Level: ____________________
Measurement Reference: TOC
Well Grout Date: ____________________
Well Installation Date: ____________________
Well Diameter (inches): ____________________
Screen Length (ft): ____________________
Stick up/down (ft): ____________________
Sounding Method: ____________________
Condition: ____________________

Surge device and surge technique: ____________________
Start/Stop times of surging intervals: ____________________
Pump device (type, size, capacity) and pump technique: ____________________
Start/Stop times of pumping intervals: ____________________
Quantity of water lost during drilling, removed prior to well installation, and other loss (list gallons and explain): ____
____
Quantity of water added during granular filter placement, other additions (list gallons and explain): ____________________
____

Well Volume Calculation (prior to development):

A. Depth to bottom: ________ ft [from top of casing (TOC)]
B. Depth to water ________ft from TOC
C. Liquid depth (A-B) (ft) ________ft
D. Well volume/ft ________gallons/ft (2" – 0.1667 gallons/ft)

	Beginning	1	2	3	4	5
Time (min):						
Pump rate (well yield) (gpm):						
Volume purged (gal):						
pH:						
Temperature (ºC):						
Specific Conductivity (µS/cm):						
Dissolved oxygen (mg/L):						
ORP (mV):						
Turbidity (NTU):						

FIELD RECORD OF MONITORING WELL DEVELOPMENT (Page 2 of 3)

	6	7	8	9	10	11
Time (min):						
Pump rate (well yield) (gpm):						
Volume purged (gal):						
pH:						
Temperature (ºC):						
Specific Conductivity (µS/cm):						
Dissolved oxygen (mg/L):						
ORP (mV):						
Turbidity (NTU):						

	12	13	14	15	16	17
Time (min):						
Pump rate (well yield) (gpm):						
Volume purged (gal):						
pH:						
Temperature (ºC):						
Specific Conductivity (µS/cm):						
Dissolved oxygen (mg/L):						
ORP (mV):						
Turbidity (NTU):						

FIELD RECORD OF MONITORING WELL DEVELOPMENT (Page 3 of 3)

Total volume of water removed (gal): ____________

Physical characteristics of water removed (including changes in clarity, color, particulates, and any odor noted during development):______________________________

Estimated recharge rate:__________gpm

Depth to water 24 hours after development:_________ft

Depth to sediment before development_____ft Depth to sediment after development: _____ft

Total surging time: _____hours

____

____

____

PLEASE NOTE

- **A 1-quart (2-pint) sample of the final water removed during development should be placed in a clear glass jar and labeled with well number and date. Each sample should be individually agitated and immediately photographed (close-up). Photograph No.: ________________________**
- **A minimum removal of three times the volume of standing water in the well and further volumetric removal should include**:
  (a) For those wells where the boring was advanced without the use of drilling fluid (mud and/or water) but water was added during well installation, then three times the volume of any water unrecovered from the well during installation should be removed (in addition to three volumes of standing water in the well).
  (b) For those wells where the boring was advanced or enlarged (totally or partially) with the use of drilling fluid (mud and/or water), then three times the measured (or estimated) volume of total fluids lost while drilling plus three times the volume used for well installation should be removed (in addition to three volumes of standing water in the well).
- Monitoring well development is complete when the discharge from the well at the maximum pumping rate has a **turbidity of 50 NTU or less and temperature, pH, specific conductivity, dissolved oxygen, Eh, and turbidity are within 10 percent during three successive readings at 10 minute intervals.**
- **READ APPENDIX A OF WORK PLAN FOR MONITORING WELL DEVELOPMENT DETAILS**

Source: USACE SOW and USACE EM 1110-1-4000

Well Purging and Sampling Record

Well ID: ____________ **Sample ID:** ____________ **Sample Date/Time:** ____________

Casing diameter/type: Well location: Weather:

Screened interval(s): Sampling personnel:

Total depth: Sampling method:

Initial depth to water (w/o pump): Water level indicator:

Final depth to water (w/o pump): Water quality meter:

Measuring point: **North side of casing** Pump depth setting: Pump type/model:

	Δ < 1º C	Δ < 10%	Δ <10%	Δ <10%	Δ < 0.1 pH	Δ < 10 mV	Δ < 0.3 ft	< 1L/min	Δ < 10 NTU		
Time	**Temp (^{o}C)**	**Conductivity (mS/cm)** or **(µS/cm)**	**DO (%)**	**DO (mg/L)**	**pH**	**ORP (mV)**	**Water Level (feet btoc)**	**Flow Rate (L/min)** or **(mL/min)**	**Turbidity (NTU)**	**Purge Volume (L)** or **(mL)**	**Additional Comments**

Note:

Parameter Stabilization Limits:
(3 consecutive readings) for percent difference type parameters
Percent difference formula =
ABS[((first reading - second reading)/first reading) x 100]
Ex: Readings 12, 16, 15, 13
((12-16)/12)*100 = 33% ((16-15)/16)*100 = 6%
((15-13)/15)*100 = 13% In example, stabilization has not occurred.

# of Bottles / Analysis:

____
____
____
____
____
____
____

EA Engineering, Science, and Technology, Inc., PBC

Log of Sediment Sample Collection

Job. No.	**Client:** **Project:**	**Location**
Sampling Location Description:		**Sample Location ID:**
		Sheet 1 of 1

Coordinates: Northing: Easting:

Surface Water Elevation:

Reference Elevation:

Reference Description:

Sample Method:

Depth of Water Body:

Width of Water Body:

Water Body Location

Sampling Date/Time	
Start	**Finish**
DATE	DATE
TIME	TIME

Surface Conditions:

Weather:

	Water Quality Parameters							
	Time	**pH**	**Cond.**	**Turb.**	**DO**	**Temp**	**ORP**	
	(hrs)	**(pH units)**	**(mS/cm)**	**(ntu)**	**(mg/L)**	**(^{o}C)**	**(mV)**	**Description of Sample**

Samplers:

Sampling Date:

Sampling Time:

Split Sample With:

Sample Type:

EA Engineering, Science, and Technology, Inc., PBC

Site Name	Project No.
Site Location	Date/Time
Page of	Field Technician
Surface Conditions:	
Weather / Temperature:	
Drilling Equipment	
Sample Collection Equipment/Method	
Analyses	

Sample Interval (in.)	PID (ppm)	Sample Date	Sample Time	Sample ID	QA/QC Collected	Sample Appearance / Description

Logged by: ______________________ Signature ______________________

PHOTOIONIZATION DETECTORFIELD CALIBRATION FORM

Site Name:

INSTRUMENT:	INSTRUMENT ID No:
OPERATOR:	WEATHER:
SPAN GAS TYPE:	DATE:
CALIBRATION NOTES:	
COMMENTS:	
SIGNATURE:	DATE:

WATER QUALITY METER FIELD CALIBRATION FORM

Model:
Parameters for Measurement:

CALIBRATION
DATE:
TIME:
METER ID:

pH CALIBRATION

pH STANDARD	INITIAL READING	FINAL READING
4.0		
7.0		
10.0		

CONDUCTIVITY CALIBARATION

CONDUCTIVITY STANDARD	STANDARD READING	FINAL READING
1.413		

TURBIDITY CALIBRATION

STANDARD	INITIAL READING	FINAL READING
0 NTU		
126 NTU		

ORP CALIBRATION

STANDARD	FINAL READING
240 millivolts	

DISSOLVED OXYGEN CALIBRATION

STANDARD	INTITIAL READING	FINAL READING
100% AIR SATURATION		

COMMENTS

SIGNATURE

NOTE: The manufacturer's acceptable range for calibrated readings will be notated on the form if available.
If the final reading is +/- 20% of the standard; Recalibrate or replace unit (if necessary).

Well Assessment Checklist

Facility Information

Site Name:
Site Address:
Site County:
Site State:
Site ID Number:
Site Owner:
Project Manager:

Well Locational Information

State Well ID:
Well Tag ID:
Well Installation date:

	From Log	*By GPS*
Ground Surface		
TOC Elevation		
Latitude (WGS84)		
Longitude (WGS84)		
Northing (State Plane) NAD27		
Easting (State Plane) NAD27		

Cross streets (if applicable):

GPS Instrument used:
Datum:
Accuracy/Precision:

Well Construction Details

Type of well (Circle one) Flush Mount Stick up Multilevel Well*
Well lock\security type:
Elevation (top of inner casing):
Surface casing material:
Well casing material:
Surface Casing diameter: *inches*
Well Diameter: *inches*
Well Depth (as installed): *ftbgs*
Well Depth (as measured): *fttoc*
Screened interval: *ft*
Open hole interval: *ft*
Depth to water: *ftbtoc*
Date: ________________ *Time:*

* If multilevel well please see attached worksheet.

Well Assessment Checklist

Well Headspace Readings

PID/FID Reading taken inside top of casing (if applicable): *ppm*

Multi-gas/CGI meter Readings taken (if applicable):

LEL: ________________ *% LEL*
O_2: ________________ *40% Vol.*
CO: ________________ *ppm*
H_2S: ________________ *ppm*

Do readings indicate unsafe conditions exist?	Yes	No

Well Condition

Is the concrete pad in good condition?	Yes	No
Is the well surface casing in good condition?	Yes	No
Is the surface casing vertical?	Yes	No
Is there an internal well seal?	Yes	No
Has there been physical damage to the well?	Yes	No
Does sounding depth match completed depth?	Yes	No
Is measuring point marked?	Yes	No
Is the well clearly labeled?	Yes	No
Flush mount - Is it secure from runoff?	Yes	No

Other Comments:

Recommendations

Well needs to be redeveloped	**Yes**	**No**
Well needs to be re-surveyed.	**Yes**	**No**
Well needs to be repaired.	**Yes**	**No**
Well needs to be replaced.	**Yes**	**No**
Well needs to be properly abandoned.	**Yes**	**No**
No action necessary.	**Yes**	**No**

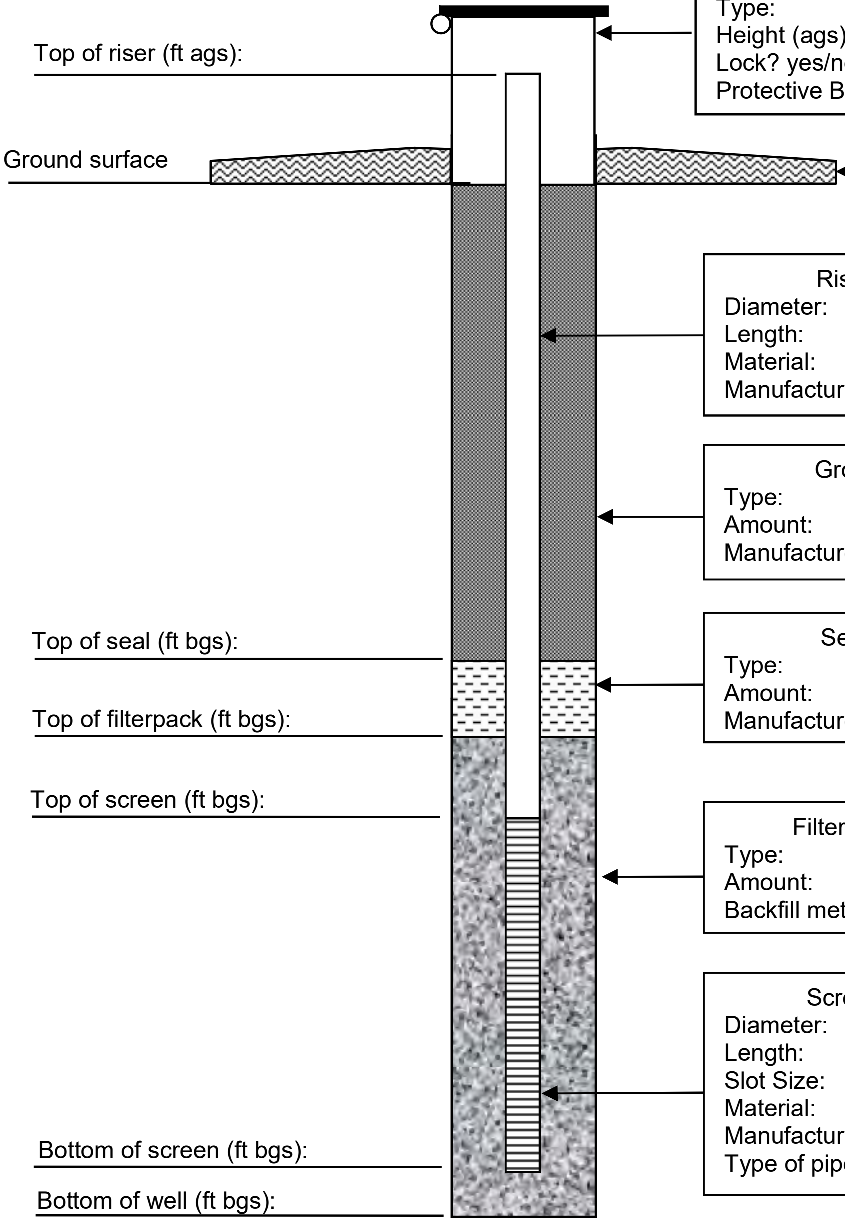
Comments

Inspected by: ________________________________
Date of Inspection: ________________________________
Reviewed by: ________________________________ **(Print)**
________________________________ **(Sign)**

RECORD OF WELL CONSTRUCTION

(STICK-UP)

EA Engineering, Science, and Technology, Inc., PBC	Well/Soil Boring ID No.:
Project Title/ Project No.:	Date/Time Installed: Time Finished:
Location:	Depth to Water:
Site Geologist:	Drilling Method:



Top of riser (ft ags):

Top of seal (ft bgs):

Top of filterpack (ft bgs):

Top of screen (ft bgs):

Bottom of screen (ft bgs):

Bottom of well (ft bgs):

Protective Casing
Type:
Height (ags):
Lock? yes/no
Protective Bollards:

Sloped pad
Material:
Slope:

Riser Information
Diameter:
Length:
Material:
Manufacturer:

Grout Information
Type:
Amount:
Manufacturer:

Seal Information
Type:
Amount:
Manufacturer:

Filterpack Information
Type:
Amount:
Backfill method:

Screen Information
Diameter:
Length:
Slot Size:
Material:
Manufacturer:
Type of pipe joints:

Note: All features not to scale

ags – Above Ground Surface
bgs – Below Ground Surface

EA Engineering, Science,
and Technology, Inc., PBC

FIELD RECORD OF MONITORING WELL DEVELOPMENT (Page 1 of 3)

Well Designation: ______________________

Project Name: ______________________

Project Location: ______________________

Weather: ______________________

Developer Initials: ______________________

Well Development Date: ______________________

Development Time: ______________________

Gauge Date: ______________________

Gauge Time: ______________________

Static Water Level: ______________________

Measurement Reference: TOC

Well Grout Date: ______________________

Well Installation Date: ______________________

Well Diameter (inches): ______________________

Screen Length (ft): ______________________

Stick up/down (ft): ______________________

Sounding Method: ______________________

Condition: ______________________

Surge device and surge technique:____

Start/Stop times of surging intervals: ____

Pump device (type, size, capacity) and pump technique:____________________________

Start/Stop times of pumping intervals:____

Quantity of water lost during drilling, removed prior to well installation, and other loss (list gallons and explain):____

____

Quantity of water added during granular filter placement, other additions (list gallons and explain):______________

____

Well Volume Calculation (prior to development):

A. Depth to bottom: ________ ft [from top of casing (TOC)]

B. Depth to water ________ft from TOC

C. Liquid depth (A-B) (ft) ________ft

D. Well volume/ft ________gallons/ft (2" – 0.1667 gallons/ft)

	Beginning	1	2	3	4	5
Time (min):						
Pump rate (well yield) (gpm):						
Volume purged (gal):						
pH:						
Temperature (ºC):						
Specific Conductivity (µS/cm):						
Dissolved oxygen (mg/L):						
ORP (mV):						
Turbidity (NTU):						

FIELD RECORD OF MONITORING WELL DEVELOPMENT (Page 2 of 3)

	6	7	8	9	10	11
Time (min):						
Pump rate (well yield) (gpm):						
Volume purged (gal):						
pH:						
Temperature (ºC):						
Specific Conductivity (µS/cm):						
Dissolved oxygen (mg/L):						
ORP (mV):						
Turbidity (NTU):						

	12	13	14	15	16	17
Time (min):						
Pump rate (well yield) (gpm):						
Volume purged (gal):						
pH:						
Temperature (ºC):						
Specific Conductivity (µS/cm):						
Dissolved oxygen (mg/L):						
ORP (mV):						
Turbidity (NTU):						

EA Engineering, Science,
and Technology, Inc., PBC

FIELD RECORD OF MONITORING WELL DEVELOPMENT (Page 3 of 3)

Total volume of water removed (gal): ____________

Physical characteristics of water removed (including changes in clarity, color, particulates, and any odor noted during development):____

Estimated recharge rate:__________gpm

Depth to water 24 hours after development:________ft

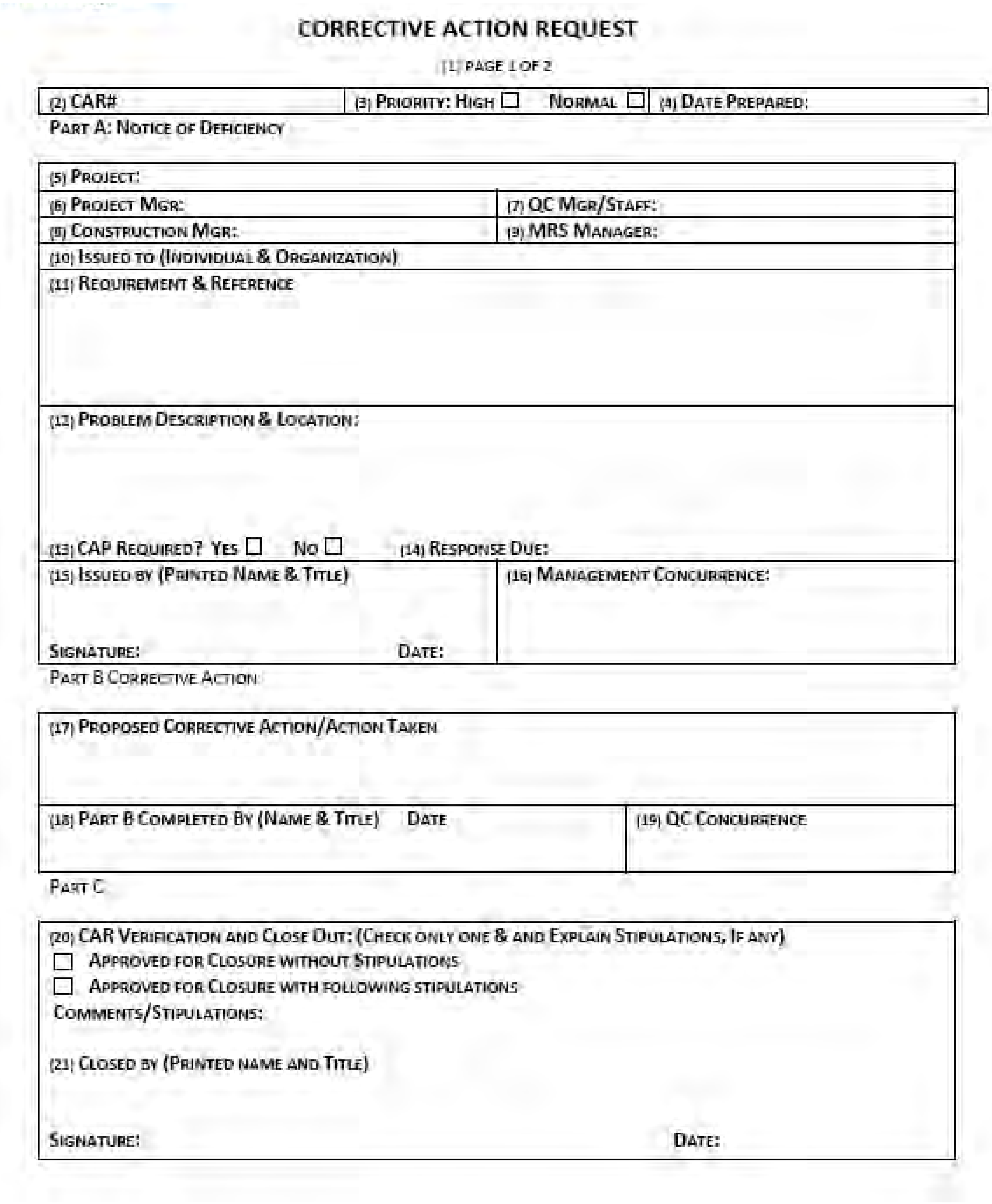
Depth to sediment before development_____ft   Depth to sediment after development: _____ft

Total surging time: _____hours

PLEASE NOTE

- **A 1-quart (2-pint) sample of the final water removed during development should be placed in a clear glass jar and labeled with well number and date. Each sample should be individually agitated and immediately photographed (close-up). Photograph No.: ________________________**
- **A minimum removal of three times the volume of standing water in the well and further volumetric removal should include**:
  (a) For those wells where the boring was advanced without the use of drilling fluid (mud and/or water) but water was added during well installation, then three times the volume of any water unrecovered from the well during installation should be removed (in addition to three volumes of standing water in the well).
  (b) For those wells where the boring was advanced or enlarged (totally or partially) with the use of drilling fluid (mud and/or water), then three times the measured (or estimated) volume of total fluids lost while drilling plus three times the volume used for well installation should be removed (in addition to three volumes of standing water in the well).
- Monitoring well development is complete when the discharge from the well at the maximum pumping rate has a **turbidity of 50 NTU or less and temperature, pH, specific conductivity, dissolved oxygen, Eh, and turbidity are within 10 percent during three successive readings at 10 minute intervals.**
- **READ APPENDIX A OF WORK PLAN FOR MONITORING WELL DEVELOPMENT DETAILS**

Source: USACE SOW and USACE EM 1110-1-4000



CORRECTIVE ACTION REQUEST

(1) PAGE 1 OF 2

(2) CAR#
(3) PRIORITY: HIGH ☐ NORMAL ☐
(4) DATE PREPARED:

PART A: NOTICE OF DEFICIENCY

(5) PROJECT:

(6) PROJECT MGR:
(7) QC MGR/STAFF:

(8) CONSTRUCTION MGR:
(9) MRS MANAGER:

(10) ISSUED TO (INDIVIDUAL & ORGANIZATION)

(11) REQUIREMENT & REFERENCE

(12) PROBLEM DESCRIPTION & LOCATION:

(13) CAP REQUIRED? YES ☐ NO ☐
(14) RESPONSE DUE:

(15) ISSUED BY (PRINTED NAME & TITLE)

SIGNATURE:
DATE:

(16) MANAGEMENT CONCURRENCE:

PART B CORRECTIVE ACTION

(17) PROPOSED CORRECTIVE ACTION/ACTION TAKEN

(18) PART B COMPLETED BY (NAME & TITLE) DATE

(19) QC CONCURRENCE

PART C

(20) CAR VERIFICATION AND CLOSE OUT: (CHECK ONLY ONE & AND EXPLAIN STIPULATIONS, IF ANY)

☐ APPROVED FOR CLOSURE WITHOUT STIPULATIONS
☐ APPROVED FOR CLOSURE WITH FOLLOWING STIPULATIONS

COMMENTS/STIPULATIONS:

(21) CLOSED BY (PRINTED NAME AND TITLE)

SIGNATURE:
DATE:

CORRECTIVE ACTION REQUEST (CAR) INSTRUCTION SHEET

(1) QC Manager: Verify that the total number of pages includes all attachments.

(2) QC Manager: Fill in CAR number from CAR log.

(3) CQC System Manager: Fill in appropriate priority category. High priority indicates resolution of deficiency requires expediting corrective action plan and correction of deficient conditions noted in the CAR and extraordinary resources may be required due to the deficiencies impact on continuing operations. Normal priority indicates that the deficiency resolution process may be accomplished without further impacting continuing operations.

(4) CAR Requestor: Fill in date CAR is initiated.

(5) CAR Requestor: Identify project name, number, CTO, and WAD.

(6) CAR Requestor: Identify Project Manager.

(7) CAR Requestor: Identify CQC System Manager.

(8) CAR Requestor: Identify project organization, group, or discrete work environment where deficiency was first discovered.

(9) CAR Requestor: Identify line manager responsible for work unit where deficiency was discovered.

(10) QC Manager: Identify responsible manager designated to resolve deficiency (this may not be work unit manager).

(11) CAR Requestor: Identify source of requirement violated in contract, work planning document, procedure, instruction, etc; use exact reference to page and, when applicable, paragraph.

(12) CAR Requestor: Identify problem as it relates to requirement previously stated. Identify location of work activities impacted by deficiency.

(13) QC Manager: Identify if Corrective Action Plan (CAP) is required. CAP is typically required where one or more of the following conditions apply: CAR priority is High; deficiency requires a rigorous corrective action planning process to identify similar work product or activities affected by the deficiency; or deficiency requires extensive resources and planning to correct the deficiency and to prevent future recurrence.

(14) QC Manager: Identify date by which proposed corrective action is due to QC for concurrence.

(15) QC Manager: Sign and date CAR and forward to responsible manager identified in (10) above.

(16) Responsible Manager: Initial to acknowledge receipt of CAR.

(17) Responsible Manager: Complete corrective action plan and identify date of correction. Typical corrective action response will include statement regarding how the condition occurred, what the extent of the problem is (if not readily apparent by the problem description statement in (12)), methods to be used to correct the condition, and actions to be taken to prevent the condition from recurring. If a CAP is required, refer to CAP only in this section.

(18) Responsible Manager: Sign and date corrective action response.

(19) QC Manager: Initial to identify concurrence with corrective action response from responsible manager.

(20) QC Manager: Check appropriate block to identify if corrective action process is complete so that CAR may be closed. Add close-out comments relevant to block checked.

(21) QC Manager: Indicate document closeout by signing and dating.

CORRECTIVE ACTION REQUEST

(1) PAGE 1 OF 2

PART A: TO BE COMPLETED BY PROJECT MANAGER OR DESIGNEE

(1)PROJECT:		
(2) PROJECT MGR:	(3) QC MGR/STAFF:	
(4) CAR NO (S)AND DATE (S) ISSUED		
(5) DEFICIENCY DESCRIPTION AND LOCATION		
(6) PLANNED ACTIONS	(7) ASSIGNED RESPONSIBILITY	(8) COMPLETION DUE DATE
(9) PROJECT MANAGER SIGNATURE:	DATE:	

PART B TO BE COMPLETED BY QCS SYSTEM MANGER OR DESIGNEE

(10) CAP REVIEWED BY	DATE
(11) REVIEWER COMMENTS	
(12) CAP DISPOSITION: (CHECK ONLY ONE AND EXPLAIN STIPULATIONS, IF ANY: ☐ APPROVED WITHOUT STIPULATIONS ☐ APPROVED WITH STIPULATIONS ☐ APPROVED DELAYED, FURTHER PLANNING REQUIRED COMMENTS:	
(13) QC MANAGER SIGNATURE	DATE

DAILY QUALITY CONTROL REPORT

Date: ____/____/____ Contract #: ___________ **Task Order #:** __________
Site/Location: ________________________________
Weather: _________________ Temperature: ______ Rainfall: ________

1. Preparatory Inspection: ____
____
____
Results: ____

2. QC Audits Performed *

a. Operations: ____
____
____
Results: ____

b. Safety: ____
____
____
Results: ____

b. Administrative: ____
____
____
Results: ____

d. Equipment: ____
____
____
____
Results: ____
____

Note: * A formal surveillance needs to be completed at a minimum of once weekly for each task that is performed during that week.

Daily Quality Control Report Cont'd:

3. QC Performed (Grids)

Number of Grids QC'd: __________ Results: _______ # Pass _______ # Fail _________

Comments: ____

____

____

____

4. Follow-Up Inspections and Results

Section(s): ____

____

____

Results: ____

5. Instructions Received: ____

____

____

____

____

Remarks: ____

____

____

____

QC Signature: ____________________________________ **Date:** ____/____/____

Printed Name: ____________________________________

+CQC DAILY FORM

DATE:

CONTRACT NUMBER AND NAME OF CONTRACTOR:

DESCRIPTION AND LOCATION OF THE WORK:

WEATHER CLASSIFICATION:

CLASS A	No interruptions of any kind from weather conditions occurring this or previous shifts.
CLASS B	Weather occurred during this shift that caused a complete stoppage of all work.
CLASS C	Weather occurred during this shift that caused a partial stoppage of work.
CLASS D	Weather overhead excellent or suitable during shift. Work stopped due to results of previous adverse weather.
CLASS E	Weather overhead excellent or suitable during shift but work partially stopped due to previous adverse manner.
OTHER	Explain.

CLASSIFICATION:

CLASS: ____________________

TEMPERATURE:

MAX: MIN: ____________________

PRECIPITATION:

INCHES

CONTRACTOR/SUBCONTRACTORS AND AREA OF RESPONSIBILITY FOR WORK PERFORMED TODAY: (*Attach list of items of equipment either idle or working as appropriate*)

1)

2)

3)

4)

1. **WORK PERFORMED TODAY:** (*Indicate location and description of work performed)*

2. **TYPE AND RESULTS OF INSPECTION:** (*Indicate whether: P = Preparatory, I = Initial, or F = Follow-up and include satisfactory work completed or deficiencies with action to be taken.)*

3. **TESTS REQUIRED BY PLANS AND/OR SPECIFICATIONS PERFORMED AND RESULTS OF TESTS:**

4. **VERBAL INSTRUCTIONS RECEIVED:** (*List any instructions given by Government personnel on construction deficiencies, retesting required, etc., with action to be taken.)*

5. **REMARKS:** (*Cover any conflicts in plans, specifications, or instructions: acceptability of incoming materials; offsite*

surveillance activities; progress of work, delays, causes, and extent thereof; days of no work with reasons for same. Note if a Preparatory or Initial Phase Meeting was held, and attach a copy of the checklist.)

5. a. **REQUESTS FOR INFORMATION**: (*Note that there is an RFI attached to this daily report, assign a control number, and attach a sheet to this report which fully describes the RFI, and recommends a solution if applicable*.)

☐ RFI Attached; Control Number =

5. b. **ENVIRONMENTAL QUALITY CONTROL**
Environmental Quality Control Requirements are in place and have been checked? ☐ Yes ☐ Not Applicable
Have any endangered species been encountered? ☐ Yes ☐ No
(If Yes, attach required reports in accordance with Section ENVIRONMENTAL PROTECTION!)

5. c. **VISITORS TO THE SITE:** *(List the name of all official visitors to the site and who they represent i.e., State DEP, OSHA)*

1)

2)

3)

4)

6. **SAFETY**: (*Include all infractions of the accident prevention plan; COE Safety and Health Requirements Manual, EM 385-1-1; or instructions from Government QA personnel.* ***Describe corrective actions taken.***)

Safety meeting held today? ☐ Yes, ☐ No (If Yes, state the subject and report number of personnel in attendance)

Safety meeting subject:

Number of Contractor personnel attending =

Number of Subcontractor personnel attending =

Name of Reporting QC Inspector/s:

____

Signature and Date:______________________________ Date: _____________

CONTRACTOR's CERTIFICATION: I certify that the above report is complete and correct and that all material and equipment used, work performed, and tests conducted during this reporting period were in compliance with the contract except as noted above.

____
Contractor's QC Manager/Authorized Representative

DEFICIENCY MANAGEMENT RECORD

CONTRACT NO.: __________________ PROJECT: ___________________________ CONTRACTOR: EA_____________________________________

Date	Deficiency	No. Category	Deficiency Description	Discipline	Corrected Date	CQC Initials	QA Initials

Category: 1 = Urgent, 2 = Significant, 3 = Requires Written Letter of Non-Compliance.					
Receipt Acknowledged:		Signature QC Staff:		Date:	

FINAL/PRE-FINAL INSPECTION CHECKLIST

1. Contract: _________________

2. Contractor: _______________

3. Project: ___________________

4. Date of (Final) (Pre-Final) Inspection: _________________

5. Names and Positions of all Participants:

   ____________________ , CQC Manager

   ____________________ , Government's QA

   Representative

6. Topics Reviewed:

Topics Reviewed:	Yes	No	N/A	Initials
a. All submittals received and approved?				
b. All payroll received?				
c. All measured quantities have been correctly measured in the field?				
d. Are all parties in agreement with final measured quantities?				
e. Are all change orders finalized? If “no,” the date set for final negotiations is ___________.				
f. Is warranty received and correct?				
g. (Final) (Pre-Final) log received?				
h. As-built drawings received?				
i. Is work per plans and specifications?				
j. Is performance rating complete?				
k. Is safety rating complete?				
l. Was project turned over to beneficial occupant (keys, utilities, manuals, acceptance)?				
m. Final inspection date set for _________.				

ACTIVITY ________________ ANALYZED BY/DATE ____________________ REVIEWED BY/DATE ____________________

Principal Steps	Potential Hazards	Recommended Controls

Equipment to be Used	Inspection Requirements	Training Requirements

INITIAL PHASE CHECKLIST

Date: ____________________

Contract No. _______________ Spec. Sect. & Para.: ________________

Description and Location of Work Inspected: ___________________________________

REFERENCE CONTRACT DRAWINGS

A. PERSONNEL PRESENT

Name	Position	Company
1.		
2.		
3.		
4.		
5.		
6.		

B. MATERIALS BEING USED ARE IN STRICT COMPLIANCE WITH THE CONTRACT PLANS AND SPECIFICATIONS
Yes _____ No _____

If not, explain:

C. PROCEDURES AND/OR WORK METHODS WITNESSED ARE IN STRICT COMPLIANCE WITH THE REQUIREMENT OF THE CONTRACT SPECIFICATIONS
Yes _____ No _____

If not, explain:

D. WORKMANSHIP IS ACCEPTABLE Yes _____ No _____

State areas where improvement is needed:

E. SAFETY VIOLATIONS AND CORRECTIVE ACTION TAKEN

____

Quality Control Representative

DEFICIENCY MANAGEMENT RECORD

CONTRACT NO.: W912DR-12-D-0006 PROJECT: West Point CONTRACTOR: EA

Date	Deficiency	No. Category	Deficiency Description	Discipline	Corrected Date	CQC Initials	QA Initials

Category: 1 = Urgent, 2 = Significant, 3 = Requires Written Letter of Non-Compliance.

Receipt Acknowledged:		Signature QC Staff:		Date:	

Non-Conformance Report

Project **Original to EA Corporate QC Manager**	**NCR No.**	**Date**
Item: **Work Plan Reference** **Requirement**		
Non-conformance		
Issued by **Name**	**Title**	**Organization**
Date		
Disposition	**Accept**	**Reject**
Disposition Approvals		
UXOQCS	**Date:**	**FCR Required? Yes No**
Project Manager	**Date:**	**Distribution**
Remarks		

PREPARATORY PHASE CHECKLIST

Date: _________________

Contract No.: ___________________Spec. Sect. & Para.: ______________

Title: ___________________ Drawing No.: ___________________

MAJOR DEFINABLE SEGMENT OF WORK: ___________________________________

A. PERSONNEL PRESENT

Name	Position	Company
1.		
2.		
3.		
4.		
(List additional personnel on attached sheet)		

B. HAS EACH SPEC. PARAGRAPH AND DRAWING AND SHOP DRAWING DETAIL BEEN STUDIED

Yes _____ No _____

C. TRANSMITTALS INVOLVED: Yes _____ No _____

Number and Item	Code	Contractor/Government Approval
1.		
2.		
3.		
4.		
5.		
6.		

C-I. Have all items involved been approved? Yes _____ No _____
If No, list items:

D. ARE ALL MATERIALS ON HAND? Yes _____ No _____

D-I. Have all materials been checked for contract compliance against approved shop drawings?
Yes _____ No _____

D-II. Items not on hand or not in accordance with transmittals:

1.
2.
3.
4.

E. TESTS REQUIRED IN ACCORDANCE WITH CONTRACT REQUIREMENTS

Test	Paragraph
1.	
2.	
3.	

F. ACCIDENT PREVENTION PRE-PLANNING – HAZARD CONTROL MEASURES

F-I. Applicable Outlines (attach completed copies):

1.
2.
3.
4.

F-II. Operational Equipment Checklists:

Attached for:
1.
2.
3.

On File for:
1.
2.
3.

G. HAVE PROCEDURES FOR ACCOMPLISHING WORK BEEN REVIEWED WITH APPROPRIATE PEOPLE?
Yes _____ No _____

H. HAS ALL PRELIMINARY WORK BEEN ACCOMPLISHED IN ACCORDANCE WITH CONTRACT REQUIREMENTS AND IS THIS SEGMENT OF WORK READY TO START?
Yes _____ No _____

H-I. Explain any problems:

Quality Control Representative

QUALITY CONTROL SURVEILLANCE REPORT	Report Number:
Project Name:	Contract No:
Client:	Project Manager:

1 - Activity

☐ Project Management
☐ Intrusive Investigation
☐ Surface Sweep
☐ Geophysical Data Collection
☐ Geophysical Data Processing
☐ Anomaly Reacquisition
☐ Data Management
☐ Demolition
☐ Scrap Processing
☐ Brush Cutting/Clearing
☐ UXO Avoidance

☐ MC Sampling:________________________________ ☐ Other:__________________________________

2 - Phase

☐ Preparatory	☐ Initial	☐ Follow up

3 – Attendees/Organization at Inspection

4 – Observed Condition/Activities and Comments:

5 – Results of Surveillance

☐ Acceptable	☐ Unacceptable	Deficiency #: NCR #:

Conducted By:	Signature:	Date:

6 – Project Manager or Representative Review:

☐ Concur ☐ Non-Concur	Signature:	Date:

7 - Distribution

☐ PM ☐ Field Task Manager ☐ SUXOS ☐ UXOQCS/SO ☐ Other:

SEAD LUC Inspections

Site Inspection Checklist

I. Site Information

Site Name:

Date of Inspection:

Location and Region:

EPA ID:

Five-Year Review:

Weather:

Inspector:

Signature:

Remedy Includes: **(Check all that apply)**

- ☐ Landfill Cover/Containment
- ☐ Access Controls
- ☐ Institutional Controls
- ☐ Groundwater Pump and Treatment
- ☐ Surface Water Collection and Treatment
- ☐ Monitored Natural Attenuation
- ☐ Groundwater Containment
- ☐ Vertical Barrier Walls
- ☐ Other:______________________________

Comments:

Attachments:

Observations:

Current Land Use: ______________________________

Intrusive Activities Noted?

Yes ☐ No ☐

If yes, describe:______________________________

Erosion Noted?

Yes ☐ No ☐

If yes, describe:______________________________

Adequate Signage:

Yes ☐ No ☐

If no, describe:______________________________

II. Interviews

Type	Date	Type:	Contact Information	Problems/Suggestions:

This page intentionally left blank

Appendix C

Laboratory Standard Operating Procedures

SOP: Analysis of Dissolved Gases by Gas Chromatography Flame Ionization Detector (GC 019.12)

SOP: Total Organic Carbon in Aqueous Samples (GN 215.13)

SOP: Determination of Inorganic Anions by Ion Chromatography (GN237-01)

SOP: Digestion of Water Samples for ICP/ICPMS Analysis (MET 103.18)

SOP: Cold Vapor Analysis of Mercury for Water Samples (MET 106.14)

SOP: Metals by Inductively Couples Plasma Atomic Emission Spectrometry (ICP) (MET 107.05)

SOP: Analysis of Volatile Organics by GC/MS (MS 020.3)

SOP: Standard Operating Procedure for the Introduction of Volatile Organics Analytes Using Purge and Trap (OP021.14)

SOP: Standard Operating Procedure for Sample Preparation for Dissolved Gases in Aqueous Samples (OP025.10)

ANALYSIS OF DISSOLVED GASES BY GAS CHROMATOGRAPHY, FLAME IONIZATION DETECTOR

Prepared by: Norm Farmer Date: 02/22/2021

Approved by: Melissa Mangual Date: 02/24/2021

Annual Review

Reviewed by: Svetlana Izosimova Date: 08/11/2022

Reviewed by: ____________________ Date: __________

Reviewed by: ____________________ Date: __________

Internal Document Control

Issued to: QA Department - digital Date: 02/26/2021

Issued to: GC Volatile Department - digital Date: * 02/26/2021

Issued to: ____________________ Date: __________

Issued to: ____________________ Date: __________

Issued to: ____________________ Date: __________

Effective 7 days after “*” date

CONTROLLED COPY
DO NOT DUPLICATE

TITLE: ANALYSIS OF DISSOLVED GASES BY GAS CHROMATOGRAPHY, FLAME IONIZATION DETECTOR

REFERENCES: RSKSOP-147 and RSKSOP-175

REVISED SECTIONS: 1.2.3, 2.2.2, 6.1, 6.2, 7.4.1.1, 7.4.1.2 and 7.4.2

1.0 SUMMARY, SCOPE AND APPLICATION

1.1 Scope and Application

1.1.1 This method is used to determine the concentrations of specific dissolved gases in water samples utilizing a gas chromatograph equipped with a flame ionization detector.

1.1.2 The following compounds can be reported by this method:

Methane
Ethane
Ethylene
Acetylene
Propane

1.1.3 Reporting limits (RL) are based on the sample-prep procedure and the lowest calibration standard. Reporting levels for this method are in the range of 1.0 ug/l.

1.1.4 The Method Detection Limit (MDL) for each analyte is evaluated on an annual basis for each matrix and instrument. MDLs are pooled for each matrix, and the final pooled MDLs are verified. The verified MDLs are stored in the LIMS and should be at least 2 to 3 times lower than the RL. Exceptions may be made on a case by case basis; however, at no point shall the MDL be higher than the reported RL.

1.1.5 Compounds detected at concentrations between the RL and MDL are quantitated and qualified as estimated values and reported with either a “J” or “I” qualifier. Some program or project specifications may require that no values below the RL be reported.

1.2 Summary

1.2.1 This method is adapted from RSKSOP-147 and RSKSOP-175.

1.2.2 Samples are received, stored and analyzed within the appropriate holding times.

1.2.3 Sample preparation is performed in accordance with SGS - Orlando SOP OP025.

1.2.4 The samples are analyzed on a gas chromatograph equipped with flame ionization detector.

1.2.5 Manual integrations are performed in accordance with SOP QA029.

2.0 PRESERVATION AND HOLDING TIME

2.1 Preservation

2.1.1 Samples shall be collected in 40-ml glass vials with Teflon lined septa and caps. Samples are preserved by adjusting the pH to <2 with HCl.

2.1.2 The samples must be refrigerated at ≤ 6°C from the time of collection until analysis.

2.2 Holding Time

2.2.1 Aqueous samples must be analyzed within 14 days of collection.

2.2.2 Some agencies and project plans may require unpreserved samples to be analyzed with 7 days of collection.

3.0 INTERFERENCES

3.1 Data from all blanks, samples, and spikes must be evaluated for interferences.

3.2 Method interferences may be caused by diffusion of volatile organics through the septum seal of the sample vial during shipment and storage.

4.0 DEFINITIONS

4.1 Batch: A group of samples which are similar with respect to matrix and the testing procedures being employed and which are processed as a unit. A sample batch is limited to a maximum of 20 samples or samples loaded on an instrument within the same 12-hour shift, whichever comes first.

4.2 Blank Spike (BS): An analyte-free matrix spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. Blank Spike Recoveries are used to document laboratory performance for a given method. This may also be called a Laboratory Control Sample (LCS).

4.3 Blank Spike Duplicate (BSD): An analyte-free matrix replicate spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The Blank Spike Duplicate recoveries are used to document laboratory precision and accuracy for a given method. This may also be called a Laboratory Control Sample Duplicate (LCSD).

4.4 Continuing Calibration Verification (CCV): A check standard used to verify instrument calibration throughout an analytical run. For all GC and HPLC methods, a CCV must be analyzed at the beginning of the analytical run, after every 10 samples, and at the end of the run.

4.5 Holding Time: The maximum times that samples may be held prior to preparation and/or analysis and still be considered valid.

4.6 Initial Calibration (ICAL): A series of standards used to establish the working range of a particular instrument and detector. The low point must be at a level equal to or below the reporting level.

4.7 Initial Calibration Verification (ICV): A standard from a source different than that used for the initial calibration. A different vendor must be used whenever possible. The ICV is used to verify the validity of an Initial Calibration. This may also be called a QC check standard.

4.8 Matrix Spike (MS): A sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The matrix spike recoveries are used to document the bias of a method in a given sample matrix.

4.9 Method Blank (MB): An analyte-free matrix to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank is processed simultaneously with the samples through all the steps of the analytical procedure. The method blank is used to document contamination resulting from the analytical process.

4.10 Sample Duplicate (DUP): A replicate sample which is used to document the precision of a method in a given sample matrix.

4.11 Preservation: Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical integrity of the sample.

4.12 Trip Blank: A sample of analyte-free matrix taken from the laboratory to the sampling site and returned to the laboratory unopened. A trip blank is used to document contamination attributable to shipping and field handling procedures. This type of blank is useful in documenting contamination of volatile organic samples.

5.0 REAGENTS

5.1 Methanol – Purge and trap grade or equivalent

5.2 Organic stock standards – Traceable to Certificate of Analysis

5.3 UHP Helium – Ultra high purity

6.0 APPARATUS

6.1 Gas Chromatograph – Agilent 6890N

Suitable gas chromatograph equipped with a large volume injection port and flame ionization detector.

6.2 Data System – Agilent Technologies MS Chemstation rev. DA 00.01 and EA 02.0x

6.2.1 A computer system interfaced to the gas chromatograph that allows for the continuous acquisition and storage of all data obtained throughout the duration of the chromatographic program.

6.2.2 Data is archived to a backup server for long term storage.

6.3 Carboxen – 1006 PLOT or equivalent: 30m X 0.53mm

6.4 Suitable Gastight TLL syringes for dilutions of standards and samples. A point-style 5 (side-hole) needle should be used with these syringes.

7.0 PROCEDURE

7.1 Standards Preparation

Standards are prepared from commercially available certified reference standards. All standards must be logged in the Organics Standards Logbook. All standards shall be traceable to their original source. The standards must be stored at room temperature. Calibration levels, spike and surrogate concentrations, preparation information, and vendor part numbers can be found in the GCVOA STD Summary in the Active SOP directory.

7.1.1 Stock Standard Solutions

Stock standards are available from several commercial vendors. All vendors must supply a “Certificate of Analysis” with the standard. The certificate will be retained by the lab. Hold time for unopened stock standards is until the vendor’s expiration date.

7.1.2 Calibration Standards

Calibration standards are prepared by injection of commercially prepared gas mixes. Measured volumes of standards are taken directly from a pressurized tank containing the mix, via a pressure regulator and attached syringe adapter. Injected volumes range from 5ul up to 500ul. The stock gas mixes are available at 15ppmv, 1000ppmv, and 1%.

7.2 Gas Chromatograph Conditions

Manual injection

Carrier gas – UHP Helium (~10 ml/min)

Detector gas – UHP Hydrogen (30 ml/min)
USP Air (300 ml/min)

Injection port temperature – 175 °C

Detector temperature – 250 °C

Oven program – 100 °C for 0 minutes
25°C/min to 240 °C for 3 minutes

GC conditions are optimized for each instrument. Actual conditions may vary slightly from those listed above.

7.3 Sample Preparation

A headspace is created in the sample vial in which the dissolved gases are allowed to equilibrate. A measured volume of the headspace is injected onto the column and the resulting peak area is used to calculate the final result. Refer to OP025 for a detailed procedure.

7.4 Gas Chromatographic Analysis

Instrument calibration consists of two major sections:

Initial Calibration Procedures
Continuing Calibration Verification

7.4.1 Initial Calibration Procedures

Before samples can be run, the chromatographic system must be calibrated, and retention time windows must be determined.

7.4.1.1 External Standard Calibration

A minimum 5-point calibration curve is created for the dissolved gases using an external standard technique. SGS Orlando routinely performs a 7-point calibration to maximize the calibration range.

Calibration factors (CF) for each analyte are determined at each concentration by dividing the area of each compound by the concentration of the standard.

The mean CF and standard deviation of the CF are determined for each analyte. The percent relative standard deviation (%RSD) of the response factors is calculated for each analyte as follows:

%RSD = (Standard Deviation of CF X 100) / Mean CF

If the %RSD $\leq$ 20%, linearity through the origin can be assumed and the mean CF can be used to quantitate target analytes in the samples. Alternatively, if the %RSD > 20% a calibration curve of response vs. amount can be plotted. If the correlation coefficient (r) is $\geq$0.995 (r^2 $\geq$0.990) then the curve can be used to quantitate target analytes in the samples.

7.4.1.2 Initial Calibration Verification (ICV)

The validity of the initial calibration curve must be verified through the analysis of an initial calibration verification (ICV) standard. The ICV must be prepared from a second source at a mid-range concentration.

The %D for all analytes of interest should be $\leq$ 15%. If the ICV does not meet this criteria, a second standard must be prepared. If this ICV meets criteria, proceed with sample analysis. If the ICV still does not meet criteria, analyze an ICV prepared from a third source or lot. Determine which two standards agree. Make fresh calibration standards and an ICV from the two sources that agree. Recalibrate the instrument.

.

7.4.1.3 Retention Time Windows

Retention time windows must be established whenever a new column is installed in an instrument or whenever a major change has been made to an instrument.

Retention time windows are crucial to the identification of target compounds. Absolute retention times are used for compound identification in all GC and HPLC methods that do not employ internal standard calibration. Retention time windows are established to compensate for minor shifts in absolute retention times that result from normal chromatographic variability. The width of the retention time window should be carefully established to minimize the occurrence of both false positive and false negative results.

Retention time windows are established by injecting all standard mixes three times over the course of 72 hours. The width of the retention time window for each analyte, surrogate, and major constituent in multi-component analytes is defined as ± 3 times the standard deviation of the mean absolute retention time or 0.03 minutes, whichever is greater.

Establish the center of the retention time window for each analyte and surrogate by using the absolute retention time for each analyte and surrogate from the calibration verification standard at the beginning of the analytical shift. For samples run during the same shift as an initial calibration, use the retention time of the mid-point standard of the initial calibration.

Peak identification is based on the retention time of a peak falling within the retention time window for a given analyte. Time reference peaks (surrogates) are used to correct for run-to-run variations in retention times due to temperature, flow, or injector fluctuations.

The retention time windows should be used as a guide for identifying compounds; however, the experience of the analyst should weigh heavily in the interpretation of the chromatograms. The analyst should monitor the retention times of known peaks (standards and surrogates) throughout an instrument run as an indication of instrument performance.

Because calculated retention time windows are generally very tight (less than ± 0.03 minutes), the retention time windows for the data processing method are generally set wider than the calculated window. This is done to ensure that the software does not miss any potential "hits". The analyst will then review these "hits" and determine if the retention times are close enough to the retention time of the target analyte to positively identify the peak or to require confirmation.

7.4.2 Continuing Calibration Verification (CCV)

Continuing calibration verification standards for dissolved gases are prepared at various concentrations; at least one CCV must be below the mid-point of the calibration curve. A continuing calibration standard must be analyzed at the beginning and end of each run to verify that the initial calibration is still valid. Additionally, a CCV must be analyzed after every 10 samples

The percent difference (%D) for each analyte of interest will be monitored. The |%D| should be ≤ 15% for each analyte.

If the first continuing calibration verification does not meet criteria, a second standard may be injected. If the second standard does not meet criteria, the system must be recalibrated. If the second standard meets criteria then the system is considered in control and results may be reported.

Rationale for second standard such as instrument maintenance, clipped column, remade standard, etc. must be documented in the run log or maintenance log. Reanalysis of second standard without valid rationale may require the analysis of a third standard (in which case both the second and third standard would have to pass).

NOTE: For any DoD QSM project, if the second standard meets criteria, then a third standard must be analyzed. If the third standard also meets criteria then the system is considered in control and results may be reported.

If the |%D| is greater than 15%, then documented corrective action is necessary. This may include recalibrating the instrument and reanalyzing the samples, performing instrument maintenance to correct the problem and reanalyzing the samples, or qualifying the data. Under certain circumstances, the data may be reported. i.e. The CCV failed high, the associated QC passed, and the samples were ND.

NOTE: For any DoD QSM project, if samples must be reported with a target analyte having a %D > 15%, then the data must be qualified accordingly, regardless of whether the analyte was detected or not.

NOTE: Any target analytes that are detected in the samples must be bracketed by an acceptable initial calibration curve and acceptable CCV standards; otherwise, the samples must be reanalyzed, or the data must be qualified.

7.4.3 Sample Analysis

7.4.3.1 Samples are analyzed in a set referred to as an analysis sequence or batch. A batch consists of the following:

Initial Calibration Standards (or Initial CCV)
Helium Blank
Method Blank (MB)
Blank Spike (BS)
Blank Spike Duplicate (BSD)
Matrix Spike (MS)
Sample Duplicate (DUP)
CCV Standards

7.4.3.2 Syringes used for samples and standards must be gas-tight and equipped with a sampling valve, which must be closed before the syringe is removed from the septa.

7.4.3.3 Appropriate volumes from standards are taken via a syringe adapter from a pressurized tank containing the gaseous standard. The tank regulator should be set to 5psig. Setting the tank regulator any higher than 5psig introduces a significant correction factor to the calculations.

7.4.3.4 Appropriate volumes from QC samples and samples are taken from the headspace generated in each vial as described in SOP OP025. Injection volume is 500ul unless the sample is being diluted.

7.4.3.5 There is no suitable surrogate standard for this method.

7.4.3.6 Insert the syringe (with the valve closed) containing the sample/standard into the injection port only when the GC is ready for the next injection. Immediately open the sampling valve, inject the sample/standard, and then press the “start” button on the GC control panel.

7.4.3.7 Identification of an analyte occurs when the peaks from the sample fall within the established retention time windows for a calibrated compound on the analytical column.

7.4.3.8 Confirmations are generally not performed for this method.

7.4.3.9 If the analyte response exceeds the linear range of the system, the sample must be re-prepped and analyzed using a smaller volume.

7.5 Maintenance and Trouble Shooting

7.5.1 Refer to SOP GC001 for routine instrument maintenance and trouble shooting.

7.5.2 All instrument maintenance must be documented in the appropriate “Instrument Repair and Maintenance” log. The log will include such items as problem, action taken, correction verification, date, and analyst.

7.5.3 Repairs performed by outside vendors must also be documented in the log. The analyst or Department Supervisor responsible for the instrument must complete the log if the repair technician does not.

7.5.4 PC and software changes must be documented in the “Instrument Repair and Maintenance” log. Software changes may require additional validation.

8.0 METHOD PERFORMANCE

Method performance is monitored through the routine analysis of negative and positive control samples. These control samples include method blanks (MB), blank spikes (BS), blank spike duplicate (BSD), matrix spikes (MS), and sample duplicates (DUP). The MB and BS/BSD are used to monitor overall method performance, while the MS and DUP are used to evaluate the method performance in a specific sample matrix.

Blank spike, blank spike duplicate, matrix spike, and sample duplicate results are compared to statistically generated control limits. These control limits are reviewed and updated annually. Control limits are stored in the LIMS. Additionally, blank spike accuracy is regularly evaluated for statistical trends that may be indicative of systematic analytical errors.

9.0 QUALITY ASSURANCE / QUALITY CONTROL

Accuracy and matrix bias are monitored by the analysis of a QC set that is prepared with each batch (maximum of 20 samples) of samples. The QC set consists of a helium blank, method blank (MB), blank spike (BS), blank spike duplicate (BSD), matrix spike (MS), and sample duplicate.

9.1 Helium Blank

The helium blank is a 500ul injection of the helium used to prepare the samples (as described in OP025). The helium blank is used to determine if there are any background levels of target analytes in the helium. The helium blank must be free of any analytes of interest or interferences at ½ the required reporting level to be acceptable. If the helium blank is not acceptable, corrective action must be taken to determine the source of the contamination, this may include replacing the helium cylinder. Samples associated with a contaminated helium blank shall be evaluated as to the best corrective action for each particular sample. This may include reanalyzing the samples or qualifying the results with a “B” or “V” qualifier.

9.2 Method Blank

9.2.1 The method blank (MB) is an aliquot of DI water. The MB is then analyzed to determine any contamination from the system or ambient sources. The MB must be free of any analytes of interest or interferences at ½ the required reporting level to be acceptable. If the method blank is not acceptable, corrective action must be taken to determine the source of the contamination. Samples associated with a contaminated method blank shall be evaluated as to the best corrective action for each particular sample. This may include reanalyzing the samples or qualifying the results with a “B” or “V” qualifier.

9.2.2 If the MB is contaminated but the samples are non-detect, then the source of contamination must be investigated and documented. The sample results can be reported without qualification.

9.2.3 If the MB is contaminated but the samples results are > 10 times the contamination level, the source of the contamination must be investigated and documented. The samples results may be reported with the appropriate “B” or “V” qualifier. This must be approved by the department supervisor.

9.2.4 If the MB is contaminated but the samples results are < 10 times the contamination level, the source of the contamination must be investigated and documented. The samples must be reanalyzed for confirmation. If there is insufficient sample to reanalyze, or if the sample is reanalyzed beyond hold time, the appropriate footnote and qualifiers must be added to the results. This must be approved by the department supervisor.

9.3 Blank Spike and Blank Spike Duplicate

9.3.1 The blank spike is de-ionized water to which the spike standard has been added. The blank spike is then analyzed with the other samples to monitor the accuracy of the analytical procedure. The percent recovery for each analyte is calculated as follows:

% Recovery = (Blank Spike Amount / Amount Spiked) X 100

9.3.2 If the blank spike recoveries are not within established control limits the following are required.

9.3.2.1 Check to be sure that there are no errors in calculations, dilutions, integrations, spike solutions or internal standards. If errors are found, recalculate the data accordingly.

9.3.2.2 Check instrument performance. If an instrument performance problem is identified, correct the problem and reanalyze the sample.

9.3.2.3 Check to see if the recoveries that are outside of control limits are analytes of concern. If the analytes are not being reported, additional corrective action is not necessary, and the sample results can be reported without qualification.

9.3.2.4 If the recovery of an analyte in the BS is high and the associated sample is non-detect, the data may be reportable. For any DoD QSM projects the resulting data must be qualified accordingly.

9.3.2.5 If no problem is found, the department supervisor shall review the data and determine what further corrective action is best for each particular sample. That may include reanalyzing the samples or qualifying the results as estimated.

9.3.2.6 If there is insufficient sample to reanalyze, or if the sample is reanalyzed beyond hold time, the appropriate footnote and qualifiers must be added to the results. This must be approved by the department supervisor.

9.3.3 Precision

Blank spike and blank spike duplicate recoveries for each analyte are used to calculate the relative percent difference (RPD) for each compound.

RPD = [| BS Result – BSD Result | / Average Result] X 100

The RPD for each analyte should fall within the established control limits. If the RPDs fall outside of the established control limits, the BS and BSD should be reanalyzed to ensure that there was no injection problem. If upon reanalysis the RPDs are still outside of the control limits, the department supervisor shall review the data and determine if any further action is necessary. RPD failures are generally not grounds for batch re-analysis.

9.4 Matrix Spike and Sample Duplicate

9.4.1 Matrix spikes are sample aliquots to which the spike standard has been added. The matrix spike is then analyzed along with the other samples to monitor the accuracy of the method. The percent recovery for each analyte is calculated as follows:

% Recovery = [(Spike Amount – Sample Amount) / Amount Spiked] X 100

The percent recovery for each analyte of interest must fall within the established control limits for the results to be acceptable.

9.4.2 If the matrix spike recoveries are not within established control limits the following are required.

9.4.2.1 Check to be sure that there are no errors in calculations, dilutions, integrations, or spike solutions. If errors are found, recalculate the data accordingly.

9.4.2.2 Check instrument performance. If an instrument performance problem is identified, correct the problem and reanalyze the sample.

9.4.2.3 If no problem is found, compare the recoveries to those of the blank spike. If the blank spike recoveries indicate that the problem is sample related, document this on the run narrative. Matrix spike recovery failures are not grounds for reanalysis but are an indication of the sample matrix effects.

9.4.3 Precision

Sample duplicate recoveries for each analyte are used to calculate the relative percent difference (RPD) for each compound.

RPD = [| Sample Result – Duplicate Result | / Average Result] X 100

The RPD for each analyte should fall within the established control limits. If the RPD falls outside of the established control limits, the sample and/or duplicate should be reanalyzed. If upon reanalysis the RPDs are still outside of the control limits, the department supervisor shall review the data and determine if any further action is necessary.

10.0 CALCULATIONS

The calculations used to determine concentration of the target analytes are rather complex. The result is dependent on ambient temperature, headspace volume, and sample volume. Results are transferred to LIMS in PPMV. LIMS utilizes a series of constants and calculations to calculate the ug/l value. A brief summary is listed below.

Water (ug/l) = $A_1 + C$

A_1 = $(A_h / V)*(D)*(1000mg/g)*(1L/1000ml)$
C = $55.5(p_g/H)*(MW)*(1000mg/g)$
A_h = (ml of headspace)*(p_g)
V = Volume of sample remaining in vial (L)
D = MW / (22.4 L/mole)*(ST ^{o}K / 273 ^{o}K)
P_g = partial pressure of the gas (from instrument curve)
H = Henry's Law constant (from table imbedded in custom Report template)
MW = molecular weight of the gas
ST = sample temperature (^{o}K)

11.0 SAFETY AND POLLUTION PREVENTION

11.1 Safety

The analyst must follow normal safety procedures as outlined in the SGS Health and Safety Plan and Personal Protection Policy, which includes the use of safety glasses, gloves, and lab coats.

The toxicity of each reagent and target analyte has not been precisely defined; however, each reagent and sample must be treated as a potential health hazard. Material Safety Data Sheets (MSDS) or Safety Data Sheets (SDS) are available for all reagents and many of the target analytes. Exposure must be reduced to the lowest possible level. Personal protective equipment must be used by all analysts.

11.2 Pollution Prevention

Samples are archived and stored for 30 days after analysis. After the storage time has elapsed, the remaining aqueous samples are transferred to the appropriate drums for disposal.

12.0 REFERENCES

RSKSOP-147 Revision 0, January 1993

RSKSOP-175 Revision 2, May 2004

ANALYSIS OF DISSOLVED GASES BY GAS CHROMATOGRAPHY, FLAME IONIZATION DETECTOR

SOP Acknowledgement Form

I have read and understand this SOP. I will not knowingly deviate from this approved SOP without approval of the Department Supervisor, QA Officer, or Technical Director. If I notice any discrepancies between this SOP and the routine procedure, I will notify the Department Supervisor so that either the SOP or procedure can be changed. Furthermore, I understand that this SOP is property of SGS North America Inc. – Orlando and may not be printed nor duplicated in any manner.

Internal SOPs referenced within this SOP: OP025, GC001, QA020, QA029

Print Name	**Signature**	**Date**

Print the SOP Acknowledgement Form, sign, and submit to the SGS Orlando QA department.

TOTAL ORGANIC CARBON IN AQUEOUS SAMPLES

Prepared by: Robyn-Cherry Seigler Date: 12/21/2020

Approved by: Svetlana Izosimova Date: 12/21/2020

Annual Review

Reviewed by: Svetlana Izosimova Date: 12/09/2021

Reviewed by: ______ Date: ______

Reviewed by: ______ Date: ______

Document Control

Issued to: QA Department – digital Date: 12/21/2020

Issued to: General Chemistry Department – digital Date: * 12/21/2020

Issued to: ______ Date: ______

Issued to: ______ Date: ______

Issued to: ______ Date: ______

Issued to: ______ Date: ______

Effective 7 days after “*” date

CONTROLLED COPY
DO NOT DUPLICATE

TITLE: TOTAL ORGANIC CARBON IN AQUEOUS SAMPLES

REFERENCES: SM5310B-2000 editorial revision 2011; SW846 9060A, Rev. 1.0, November 2004; SM5020-2010; Shimadzu TOC 5000 Instrument Manual; Code of Federal Register, Chapter 40 – Protection of Environment; TNI Standards, 20169 revision; GN196, SAM108, QA006, QA020, QA042 current revisions; DoD QSM 5-series, current revision

1.0 SCOPE AND APPLICATION

This method can be used to determine total organic carbon or dissolved organic carbon in any aqueous matrix. The total organic carbon is being determined as non-purgeable organic carbon. Volatile compounds are lost during the sparging process to remove inorganic carbon.

The product for total organic carbon is TOC and the product for dissolved organic carbon is DOC. Both of these products require prep and analytical work groups. Total carbon (TCAR) can also be analyzed following this method. However, for total carbon, both total and inorganic carbon must be measured and no sparging of the sample is done.

The normal reporting limit for TOC and DOC in aqueous samples is 1.0 mg/L. The normal reporting limit for TCAR is also 1.0 mg/L. Inorganic carbon (ICAR) is calculated as the difference between TCAR and TOC and has a normal reporting limit of 1.0 mg/L.

Very high level water samples (> 500 mg/L) or samples containing high levels of particulates may need dilution.

2.0 SUMMARY

Total organic carbon is determined by combusting an acidified sample and converting the carbon dioxide CO2 into methane CH4, which is measured by NDIR. Amount of CH4 is directly proportionate to the amount of carbonaceous material in the sample. The quantitation is done by comparison to a linear calibration curve.

Dissolved organic carbon is determined following the same method, but the sample is filtered through a 0.45 μm filter before analysis. Filters are checked for their contribution to DOC by analyzing a filtered blank.

Total carbon is determined following the same method, but the sample is not sparged.

3.0 REPORTING LIMIT AND METHOD DETECTION LIMIT

3.1 Reporting Limit: The reporting limit for this method is established at the lowest concentration standard in the calibration curve, currently 1 mg/L. Detected concentrations below this concentration are not reported.

3.1.1 Establish reporting limits at the concentration of the low standard used to generate the calibration range. This concentration is defined as the lower limit for quantitative accuracy.

3.2 Method Detection Limit: Experimentally determine MDLs using the procedure specified in 40 CFR, Part 136, Appendix B. This value represents the lowest reportable concentration of an individual compound that meets the method qualitative identification criteria.

3.2.1 Experimental MDLs must be determined annually for this method.

3.2.2 Process all raw data for the replicate analysis in each MDL study.

4.0 DEFINITIONS

Batch: A group of samples which are similar with respect to matrix and the testing procedures being employed and which are processed as a unit. A sample batch is limited to a maximum of 20 samples or samples loaded on an instrument within the same 12-hour shift, whichever comes first.

Blank Spike (BS): An analyte-free matrix spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. Blank Spike Recoveries are used to document laboratory performance for a given method. This may also be called a Laboratory Control Sample (LCS).

Continuing Calibration Verification (CCV): A check standard used to verify instrument calibration throughout an analytical run. CCV must be analyzed at the beginning of the analytical run, after every 10 samples, and at the end of the run.

Dissolved Organics Carbon: Fraction of TOC that passes through 0.45 µm filter.

Holding Time: The maximum time that samples may be held prior to preparation and/or analysis and still be considered valid.

Initial Calibration (ICAL): A series of standards used to establish the working range of a particular instrument and detector. The low point should be at a level equal to or below the reporting level.

Initial Calibration Verification (ICV): A standard from a source different than that used for the initial calibration. A different vendor should be used whenever possible. The ICV is used to verify the validity of an Initial Calibration. This may also be called a QC check standard.

Matrix Spike (MS): A sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The matrix spike recoveries are used to document the bias of a method in a given sample matrix.

Matrix Spike Duplicate (MSD): A replicate sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The matrix spike duplicate recoveries are used to document the precision and bias of a method in a given sample matrix.

Method Blank (MB): An analyte-free matrix to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank is processed simultaneously with the samples through all the steps of the analytical procedure. The method blank is used to document contamination resulting from the analytical process.

Method Detection Limits (MDLs): MDL is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. This definition is qualitative in nature and does not evaluate an acceptable quantitative limit for method performance. MDLs should be determined annually for every matrix and method. Refer to SOP QA020, current revision.

Reagent Blank: The reagent blank is a blank that has the same matrix as the samples, i.e., all added reagents, but did not go through sample preparation procedures. The reagent blank is an indicator for contamination introduced during the analytical procedure. For methods requiring no preparation step, the reagent blank is equivalent to the method blank.

Reagent Grade: Analytical reagent (AR) grade, ACS reagent grade, and reagent grade are synonymous terms for reagents, which conform to the current specifications of the Committee on Analytical Reagents of the American Chemical Society.

Reagent Water: Water that has been generated by any method, which would achieve the performance specifications for ASTM Type II water.

Reference Material: A material containing known quantities of target analytes in solution or in a homogeneous matrix. It is used to document the bias of the analytical process.

Preservation: Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical integrity of the sample.

5.0 HEALTH & SAFETY

The analyst should follow normal safety procedures as outlined in the SGS Accutest Health and Safety Program which includes the use of safety glasses and lab coats. In addition, all acids are corrosive and should be handled with care. Flush spills with plenty of water. If acids contact any part of the body, flush with water and contact the supervisor.

The toxicity or carcinogenicity of each reagent used in this method has not been precisely determined; however, each chemical should be treated as a potential health hazard. Exposure to these reagents should be reduced to the lowest possible level. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of data handling sheets should be made available to all personnel involved in these analyses.

The furnaces in the TOC analyzers are heated to high temperatures. Do not handle the furnaces or furnace glassware until they are cooled down.

6.0 COLLECTION, PRESERVATION, AND HOLDING TIME

6.1 Water samples for TOC or DOC should be preserved with HCl to a pH <2. Samples should be kept under refrigeration at 4°C until they are analyzed. (Sulfuric acid preservation is allowed by the method but will quickly degrade the columns on the TOC analyzer.)

6.1.1 Total carbon preservation is not directly addressed in the methods. Normally an unpreserved sample is used to prevent the loss of CO2 formed from acidified inorganic carbon. If an acid preserved sample is used, it should be handled like a volatile sample to minimize the loss of this CO2.

6.1.2 For North Carolina and South Carolina samples, sulfuric acid preservation is required. These samples must generally be run at a 1:5 dilution to prevent degradation of the column (H2SO4) or catalyst (H3PO4) on the TOC.

6.2 DOC samples should be filtered through a 0.45 µm filter before analysis. It is recommended that this be done at the time of sampling and collected in VOA vials without headspace. If it is done in the lab, a filter blank must also be prepared and analyzed.

6.3 All samples should be analyzed within 28 days of the date of collection per 40 CFR.

7.0 APPARATUS

The following items are needed for the analysis of samples following the method outlined below:

7.1 Shimadzu 5000 TOC analyzer or equivalent, equipped with autosampler.

At the time of SOP revision, the software version is TOC Control V Ver. 2.0 (TOC 2). Data systems software versions will be updated at the scheduled SOP revision. For interim software changes refer to Maintenance Log assigned to the individual unit.

7.1.1 See instrument maintenance outlined below.

7.1.1.1 Every day, the humidifier should be checked to ensure that the water level is within the two white lines on the side of the humidifier.

7.1.1.2 Each day of analysis, the baseline should be checked to make sure that it is stable and near zero

7.1.1.3 Whenever calibration check recoveries are low or blank results are high, the flow and the condition of the catalyst should be checked. Refer to the instrument manual for additional information. Never change the catalyst without first checking with the area supervisor or manager.

7.2 Analytical balance, capable or weighing to 0.1 mg. The calibration of the analytical balance should be verified each day before use. Calibrated and serviced annually by outside contractor.

7.3 Eppendorf pipettes. For maintenance and calibration refer to SOP QA006, current revision.

7.4 Volumetric glassware, class A (flasks, pipettes, etc.). For standards and reagent preparation.

7.5 Filters, 0.45 um pore size. (For DOC only)

8.0 REAGENTS

All chemicals listed below are reagent grade unless otherwise specified. Organic-free deionized water taken from the DI taps in the lab should be used whenever water is required. Make sure to properly label all reagents and record the reagent preparation in the reagent logbook. Note: HCl is the preferred preservative for all of the work with the Shimadzu analyzer.

Commercially available standards should be used whenever possible. These standards and reagents must be accompanied by the Certificate of Analysis (CoA). CoA is examined for accuracy and completeness of the information, including verification of the standard concentration

8.1 Potassium hydrogen phthalate (KHP), stock solution, 100 mg carbon/L: Dissolve 0.2125 g of potassium hydrogen phthalate (primary standard grade, dried to a constant weight, approximately 1 hour at 105^0 C) in approximately 800 mL of DI water. Add concentrated HCl to bring the pH to <2 and dilute to a final volume of 1000 mL with DI water. This standard may be stored under refrigeration for 3 months.

8.2 Potassium hydrogen phthalate (KHP) calibration solutions: All standards should be made up in volumetric flasks using volumetric pipettes. All standards should be acidified to a pH of < 2 with HCl and diluted to the final volume of 100 mL with DI water. Note: the concentrations shown below are suggested levels. Alternate calibrations may be used as long as a minimum of a blank and 5 standards are analyzed. Calibration standards may be stored under refrigeration for up to 28 days.

Volume of Dilution Std	Conc. of Dilution Std	Final Conc. in mg/L
0.00	0.00	0.00
1.00	100	1.00
2.00	100	2.00
5.00	100	5.00
10.0	100	10.0
20.0	100	20.0
30.0	100	30.0

8.3 CCV Check solution: To make the CCV for the curve shown above, add 15.0 mL of 100 mgC/L to a 100 mL volumetric flask and dilute to approximately 95 ml with DI water. Acidify to a pH of < 2 with HCl and dilute to the final volume of 100 mL with DI water. Mix well. The true value for this solution is 15.0 mg/L of TOC. **Note**: The CCV must be made from a different source than the initial calibration standards.

8.4 ICV stock solution, 1000 mg carbon/L: The ICV must be from a different source than the calibration curve. Prepare the second source KHP solution as follows: dissolve 0.2125 g of potassium hydrogen phthalate (primary standard grade, dried to a constant weight, approximately 1 hour at 105ºC) in approximately 80 mL of DI water. Add concentrated HCl to bring the pH to <2 and dilute to a final volume of 100 ml with DI water. This standard may be stored under refrigeration for 3 months.

8.5 ICV Check solution. Any concentration within the range of the curve may be used. One acceptable preparation is to add 1.5 mL of 1000 mg C/l to a 100 mL volumetric flask and dilute to approximately 95 mL with DI water. Acidify to a pH of < 2 with HCl and dilute to the final volume of 100 mL with DI water. Mix well. The true value of this solution is 15 mg/L of TOC.

9.0 INTERFERENCES

9.1 High results may be obtained if the inorganic carbon is not completely removed from the sample before analysis. The sample must be acidified to a pH of <2 and sparged for at least 6 minutes to remove the inorganic carbon. Samples that are expected to contain high amounts of inorganic carbon may be logged into the LIMS with the product code TOCEP, which indicates that an extended purge (sparge) time is needed. A minimum of a 15-minute sparge time is required for these samples.

9.2 Large particulate in the sample may not be pulled into the needle during the sample injection and may result in a low bias.

9.3 Filtration can result in loss or gain of DOC, depending on the physical properties of the carbons containing compounds and the adsorption of carbonaceous material on the filter or its desorption from it.

10.0 PROCEDURE

10.1 Below is the procedure to be followed for the analysis of aqueous samples for total organic carbon using the Shimadzu TOC analyzer. All standards and samples must be analyzed using a minimum of duplicate injections.

10.2 Turn on the compressed air. The pressure in the water module should be set at 5 and the carrier gas should be set as marked on the dial (150 mL/min). The air pressure at the tank must be at least 50 psi to maintain sufficient pressure at the instrument. Check to make sure that the humidifier contains sufficient water. It should be filled to within the two white lines on the side of the humidifier. (The humidifier is located inside the water analyzer at the right side of the instrument.)

10.3 If the power is off, then turn on the power at the side water modules and for the computer.

10.4 **Refer to Attachment I for instrument-specific start up procedures.**

10.5 **Go to view and click on the background monitor. A graph will appear on screen showing the position of the baseline and the status of the furnace temperature. Wait for the baseline to stabilize and for the furnace temperature to indicate that it is OK. If the baseline is not within several steps of zero, then the zero of the instrument may need to be adjusted. Check with the lab supervisor or manager for further instructions.**

10.6 If the instrument has not been calibrated within the last month, then it is recommended that it be calibrated at this point. (A new calibration is required at least once per quarter.)

10.6.1 Select new file and insert standards. A minimum of 2 injections must be used for each standard. Five standards and a blank are required for the calibration. The lowest standard should be at 1.0 mg C/L or lower. A 100 µL injection size should be used for all standards. A 6-minute sparge time (or greater) should be used for all standards and samples.

10.6.2 After the standard file is created and inserted into the run file, then save the run file using the save as command. The file should be named with the instrument identifier (A or B), year (1 digit), the month (2 digits), the day, and a designation for the matrix and the run number for that matrix. For example, the first water run on instrument A from 3/12/02 would be named A20312w1.

10.6.3 Pour out the standards into the standard vials on the autosampler. Check to make sure that the pH is <2 for all standards. Cover the standard vials with a tight layer of foil and anchor it in place with a plastic ring.

10.6.4 Save the file under the proper name before starting the analysis. Open up the real-time monitor to view the peaks as the analysis is done. With the cursor positioned on the autosampler file, the start button should be highlighted. Use the mouse to click on the start button and the analysis should begin.

10.6.5 When all of the standards have been completed, then review the curve using the view, calibration option. Make sure "zero shift" box is unchecked, as it forces curve through 0,0 point (forces through origin). If a correlation coefficient of greater than 0.995 is obtained and the intercept is <1/2 RL, then save the curve using the "file save" option.

10.6.6 Initial calibration must be verified by analyzing an ICV. The ICV must be within 10% of the true value.

10.6.7 Verify quantitation at RL by analyzing RL standard at least quarterly. This requirement of SM5020B-2011, sec. 1.c is met via DoD LOQ/LOD verification process.

10.7 If a previous calibration is being used, then it must be verified with a CCV and a calibration blank before proceeding on each analysis day. CCV must be within 10% of the true value. If the CCV solution is not within 10% of the true value, analyst must demonstrate acceptable performance with two CCVs analyzed immediately (started within 1 hour), with no samples between failing CCV and the two additional CCVs. If they are still not in control, then all bracketed samples for that analyte must be reanalyzed. The blank must contain <1/2RL for TOC. Make sure to use duplicate injections for all analyses. **Note:** The method blank may be used as the calibration blank check.

10.8 After every 10 samples and at the end of the run, a continuing calibration check sample and a continuing calibration blank should be analyzed. The CCV must be made from a separate source than the initial calibration standards. The continuing calibration check should be a standard near the mid-range of the curve. It is recommended that a check standard at 15 mg C/l be used as the continuing calibration check standard. The continuing calibration check should agree within 10% of the true value. Procedure in sec. 10.7 applies. The result for the continuing calibration blank must be <1/2RL. If either the CCV or the CCB do not meet criteria, then all samples bracketed by this QC must be reanalyzed.

10.9 Begin analyzing the samples following the procedure outlined below.

10.9.1 Write out a run log, with the sample numbers and check standards recorded in the order in which they are to be run. All samples and check standards must be analyzed with duplicate injections.

10.9.2 Shake the samples well to make sure they are completely homogenized and pour out an aliquot into an autosampler tube.

10.9.2.1 If a sample contains a high level of particulates, check with the lab supervisor before proceeding. The sample may need to be analyzed using the soil module.

10.9.3 Check the pH of each sample. If the pH is not <2, then add HCl drop-wise to bring the pH to < 2. Check the final pH with pH paper and record it on the run log.

10.9.3.1 *North Carolina and South Carolina samples must be preserved with sulfuric acid.* Dilute all sulfuric acid preserved samples by a factor of 5 to prevent degradation of the column.

10.9.4 Method blank and spike blank must be analyzed with every batch. Matrix spikes are analyzed at the 10% matrix frequency. All of these quality control points must be analyzed using duplicate injections for SM5310B and in quadruplicate for EPA 9060A.

10.9.4.1 Prepare the Matrix Spike and Matrix Spike Duplicate by adding 0.075 mL of 1000 mg C/L standard solution to 5.00 mL of acidified sample.

10.9.4.2 The spike blank may be prepared by adding -0.75 mL of 1000 mg C/L standard solution to 50 mL of acidified blank. Alternatively, the external check may be used as the spike blank.

10.9.4.3 For both the matrix spikes and the spike blank, sample and standard amounts may be varied as necessary as long as the same final spike concentrations are used for each of these QC points.

10.9.5 Analyze continuing calibration checks as outlined in 10.8 above.

10.9.6 When all samples and quality control have been poured into the autosampler tray, enter the run log information into the sample file. Make sure that a 6 minute sparge time is used and the proper autosampler vials are indicated for each sample. Enter any dilution factors both in the dilution column and in the column to the right of the sample ID. Save the file using the save as option. The file should be named with the instrument designation (A or B), the year (last digit), the month (2 digits), the day, and a designation for the matrix and the run number for that matrix.

10.9.6.1 The software may not accept large dilution factors (>100). In that case, enter in the dilution in the column to the right of the sample ID and correct the final result in the LIMS system for the sample dilution.

10.9.7 Open up the real-time monitor to view the peaks as the analysis is done. With the cursor positioned on the autosampler file, the start button should be highlighted. Use the mouse to click on the start button and the analysis should begin.

10.9.8 After the analysis is complete, check through the data to make sure that all QC is within criteria, that samples are within the curve, and that good reproducibility is obtained for the duplicate injections.

10.9.8.1 If the duplicate sample injections have a %RPD of >10%, then repeat the analysis until duplicate injections are within 10% of each other.

$$\%RPD = (\text{Std Dev}_{n-1} / \text{mean}) \times 100$$

10.9.8.1.1 If, on the repeated analysis, a high %RPD is still obtained, and there is no evidence of an analytical problem, then the sample results should be reported with a flag due to possible sample non-homogeneity.

10.9.8.2 If there is carryover from a previous high analysis then the first of three injections may be excluded. If a bad injection is observed, then that injection may also be excluded as long as it is documented.

10.9.9 Add dilutions and reruns to the end of the file, along with the appropriate quality control. Make sure to save the file both before and after the additions. When restarting the analysis, make sure to select the append option. Never use the overwrite option.

10.9.10 Review the run for completeness and data and quality control problems. Then export the data file and copy it into the LIMS system. Make any necessary corrections in GNAPP and provide the supervisor with the data for additional review. See the area supervisor or manager for further details.

11.0 METHOD PERFORMANCE

Method performance is monitored through the routine analysis of negative and positive control samples. These control samples include method blanks (MB), blank spikes (BS), matrix spikes (MS), and matrix spike duplicates (MSD). The MB and BS are used to monitor overall method performance, while the MS and MSD are used to evaluate the method performance in a specific sample matrix.

Blank spike, matrix spike, and matrix spike duplicate samples are compared to method defined control limits. Control limits are stored in the LIMS. Additionally, blank spike accuracy is regularly evaluated for statistical trends that may be indicative of systematic analytical errors.

12.0 QUALITY ASSURANCE

Below is a summary of the quality control requirements for this method. Make sure to check with the laboratory supervisor or manager for any additional client specific quality control requirements. All calculations are to be performed according to SOP QA042, current revision.

12.1 Method Detection Limits (MDLs): MDLs should be established using a blank sample spiked at approximately 3 times the estimated detection limit. To determine the MDL values, take seven replicate aliquots of the spiked sample and process through the entire analytical method. The MDL is calculated by multiplying the standard deviation of the replicate analyses by 3.14, which is the Student's t-value for a 99% confidence level. MDLs should be determined approximately once per year.

12.2 Per SM5020-2010 and DOD QSM, LOQ and LOD studies must be run quarterly. See QA020, current revision on Method Performance.

12.3 Method Blank: The laboratory must prepare and analyze a method blank with each batch. The method blank must not contain the analyte at >1/2RL.

12.4 Spike Blank: The laboratory must prepare and analyze a spike blank with each batch. The laboratory should assess laboratory performance of the spike blank against recovery limits of 90 - 110%.

12.5 Matrix Spike: The laboratory must add a known amount of each analyte to a minimum of 10% of matrix.

12.5.1 The spike recovery should be assessed using +/-10% acceptance criteria. If a matrix spike is out of control, then the results should be flagged with the appropriate footnote. If the matrix spike amount is less than one fourth of the sample amount, then the sample cannot be assessed against the control limits and should be footnoted to that effect.

12.5.2 The matrix spike recovery should be calculated as shown below.

$$\frac{\text{(Spiked Sample Result - Sample Result)}}{\text{(Amount Spiked)}} \times 100 = \text{MS Recovery}$$

12.6 Matrix Spike Duplicate. The laboratory should analyze a matrix spike duplicate sample for a minimum of 1 in 10 samples. The relative percent difference (RPD) between the duplicate and the sample should be assessed. The duplicate %RPD is calculated as shown below.

12.6.1 The duplicate RPD should be assessed using in house limits. Until these limits can be generated, then default limits of 20% RPD should be applied. If a duplicate is out of control, then the results should be flagged with the appropriate footnote. If the sample and the duplicate are <5*RL and are within a range of ± RL, then the duplicate is considered to be in control.

12.6.2 The duplicate RPD should be calculated as shown below.

$$\frac{\text{(Sample Result - Duplicate Result)} \times 100}{\text{(Sample Result + Duplicate Result)} \times 0.5} = \text{\% RPD}$$

12.7 Quality Control Sample (also referred to as Initial Calibration Verification Standard, ICV): It is required that this be run with each new calibration curve. This ICV should be within 10% of the true value. If the ICV is not within acceptance criteria, a second ICV should be prepared and analyzed. If the ICV is still outside of the limits, sample analysis must be discontinued and the cause determined (preparation of ICV from third source, instrument recalibration, etc). Note: The spike blank may be used in place of the ICV as long as a separate source standard is used and the 10% criterion is met.

12.8 Continuing Calibration Verification Sample (CCV): Analyze the continuing calibration verification solution after every tenth sample and at the end of the sample run. The CCV concentration should be at or near the mid-range of the calibration curve. If the CCV solution is not within 10% of the true value, analyst must demonstrate acceptable performance with two CCVs analyzed immediately (started within 1 hour), with no samples between failing CCV and the two additional CCVs. If they are still not in control, then all bracketed samples for that analyte must be reanalyzed. (Note: Also see section "Contingencies for handling out-of-control QC" below) See 12.9 below.

12.9 For all analyses done following Standard Methods 5310B analyze the continuing calibration blank solution after every CCV check (every tenth sample and at the end of the sample run). The continuing calibration blank must be <1/2 RL. If the CCB solution is not <1/2RL, then no samples can be reported in the area bracketed by that CCB. (Note: the exception is if the CCB is biased high and the samples are less than the detection limit. In that case, the samples can be reported with no flag.)

12.10 ***Contingencies for handling out-of-control QC***: Upon certain circumstances data can be reported from batches with QC non-conformances. Such samples are to be qualified accordingly. Examples include:

- If the MB is contaminated but the samples are non-detect, then the source of contamination should be investigated and documented. The sample results can be reported, with qualification and footnotes why data is acceptable. If the MB is contaminated but the samples results are > 10 times the contamination level, the source of the contamination should be investigated and documented. The samples results may be reported with the appropriate "B" or "V" qualifier. *This must be approved by the department supervisor.* Samples with hits <10 times contamination are reprepped and reanalyzed. If there is insufficient sample to reanalyze, or if the sample is re-analyzed beyond hold time, the appropriate footnote and qualifiers should be added to the results. *This must be approved by the department supervisor*
- Similarly, if the recovery of LCS or CCV is high and the associated sample is non-detect, the data may be reportable with appropriate footnotes and qualifiers. If the recovery of LCS or CCV is below lower acceptance limit, the department supervisor shall review the data and determine what further corrective action is best for each particular sample. That may include reanalyzing the samples, reprepping and/or reanalyzing the samples, or qualifying the results as estimated. *This must be approved by the department supervisor.* If there is insufficient sample to reanalyze, or if the sample is re-analyzed beyond hold time, the appropriate footnote and qualifiers should be added to the results. *This must be approved by the department supervisor.*

- If the matrix spike recoveries are not within the established control limits, compare the recoveries to those of the LCS to assess method performance in clean QC matrix. Matrix spike recovery failures are not grounds for reanalysis but are an indication of the sample matrix effects.

13.0 DOCUMENTATION

13.1 A run log, showing any dilutions, should be recorded on an approved form. Make sure to record any comments regarding unusual sample appearance or any other problems or observations. All reagent reference numbers should be recorded on the data sheet.

13.2 All reagent information should be recorded in reagent logs.

13.3 Balance checks and calibrations should be recorded on the balance logs provided with each balance. Each balance must be checked at least once per day before use. The balance checks should be within the criteria listed in the balance logbook.

14.0 DATA REVIEW AND REPORTING

14.1 All samples should be updated to both prep (GP) and analysis (GN) batches in the LIMS system. The analyst should calculate all matrix spike, duplicate, external, and CCV recoveries and review the results of all blanks.

14.2 All documentation must be completed, including reagent references and spike amounts and spiking solution references.

14.3 A final report should be printed out from the TOC software. Make sure to check that all samples meet replication requirements (<10% CV) and that the samples are within the range of the calibration curve.

14.4 A data file should be exported to the LIMS system and the spike amounts should be entered into the file at the GNAPP process step.

14.5 A final data package, consisting of the raw data sheet (run log), QC summary sheet, TOC printout, and workgroup printout, should be turned into the area supervisor for review.

15.0 POLLUTION PREVENTION & WASTE MANAGEMENT

15.1 Users of this method must perform all procedural steps in a manner that controls the creation and/or escape of wastes or hazardous materials to the environment. The amounts of standards, reagents, and solvents must be limited to the amounts specified in this SOP. All safety practices designed to limit the escape of vapors, liquids or solids to the environment must be followed. All method users must be familiar with the waste management practices described in section 15.2.

15.2 Waste Management. Individuals performing this method must follow established waste management procedures as described in the waste management SOP, SAM108, current revision. This document describes the proper disposal of all waste materials generated during the testing of samples.

16.0 GLASSWARE CLEANING

All glassware should be washed with soap and tap water and then rinsed with de-ionized water as described in SOP GN196, current revision

REVISION HISTORY

Revision Date	Revision Number	Affected Section(s)	Revision Description
12/2020	12	Entire document	Added Revision History and removed Revised Sections. Removed Additional References and moved the references to the References section. Removed references to TOC1. Attachment I removed and Attachment II became Attachment I. Removed mention of Solid TOC SOP in section 1.0. Corrected detector from FID to NDIR in section 2.0. Updated document formatting throughout as needed.

Table 1 QC Criteria

Quality Control	Frequency	Acceptance Criteria	Corrective Action
Initial Calibration: r = coefficient of correlation	At least quarterly	≥0.995	Rerun calibration standards, and/or prepare new calibration standards and recalibrate the instrument, or document why the data are acceptable.
Initial Calibration Verification standard (ICV)	One per calibration	90 - 110% of the standard's true value	Rerun standard, and/or prepare new standard, and/or recalibrate instrument, or document why the data are acceptable.
Continuing Calibration Verification standard (CCV)	Every tenth sample	90 - 110% of the standard's true value	Rerun standard, and/or recalibrate instrument and reanalyze all samples run since the last acceptable CCV, or document why the data are acceptable.
Method blank (MB) and Calibration Blank (CB)	One per batch	< ½RL	Reanalyze, and/or stop the run and determine the source of contamination, or document why the data are acceptable.
Blank Spike (BS or LCS)	One per batch	90-110%	Determine and correct the problem, reanalyze samples, if necessary, or document why data are acceptable.
MS/MSD	10% of matrix	90-110%	Determine and correct the problem, reanalyze samples and MS/MSD, or document why data are acceptable
MSD	10% of matrix	≤20% RPD	Determine and correct cause of the poor reproducibility

Attachment I

TOC 2

Go to TOC software (TOC-V Sample Table Editor)

To start a up the instrument, go to File-New

1.1 Calibration Curve (if instrument is calibrated proceed to 1 .2)

- 1.1.1 Calibration Wizard window will pop-up
- 1.1.2 In System, select TOC-2
- 1.1.3 Make sure that Edit calibration manually box is checked
- 1.1.4 In analysis, select NPOC or TC, uncheck zero shift box, and in file name, enter the **TOC 2cal-curve mmddyyyy** or **TC 2 cal-curve mmddyyyy**
- 1.1.5 In unit, select mg/L
- 1.1.6 Press add to enter the calibration curve point starting with the lower concentration to the higher
- 1.1.7 Check use default setting box and Correlation Coefficient box

1.2 Go to File-New

- 1.2.1 A Select H/W Setting will pop-up
- 1.2.2 In System, select NPOC or TC
- 1.2.3 In File Name, enter the name of the run using the following template for NPOC method **TOC 2mmddyyyy** and for TC method **TC 2 mmddyyyy,** save.

1.3 Connect

- 1.3.1 Select Connect icon.
  - **1.3.1.1** A pop-up window will appear once the connection is complete this window will close.

1.4 To turn on the furnace

- 1.4.1 Go to Instrument – H/W Setting
  - **1.4.1.1** Under TOC tab: TC Furnace (Deg. C) select 680

1.5 To schedule calibration and/or samples

- 1.5.1 To run the calibration, go to Insert – Calibration Curve select the calibration that is going to be performed.
  - **1.5.1.1** Press start, in file name, enter the date MMDDYYYY and start.
  - **1.5.1.2** To update the method with the new calibration, go to File-Open
    - **1.5.1.2.1** In File of type select Method
    - **1.5.1.2.2** Select NPOC or TC
    - **1.5.1.2.3** Calibration curve browse for the last calibration that passed.
- 1.5.2 To run a sample sequence, go to Insert – Auto Generate
  - **1.5.2.1** In Method, select NPOC or TC
  - **1.5.2.2** In Sample Number: enter the number of sample to be analyzed including the standards. Press next until finished.

2.0 Before start the run go to Instrument - Maintenance and select the following option in order

- **2.1** Zero point detection
- **2.2** Regeneration of TC catalyst
- **2.3** Residual Removal
- **2.4** Washing

DETERMINATION OF INORGANIC ANIONS BY ION CHROMATOGRAPHY

Prepared by: Jordynn Rice Date: 04/21/2023

Approved by: Elizabeth Kent Date: 04/26/2023

Annual Review

Reviewed by: Date:

Reviewed by: Date:

Reviewed by: Date:

Internal Document Control

Issued to: QA Department (digital) Date: 04/26/2023

Issued to: General Chemistry Department (digital) Date: * 04/26/2023

Issued to: Date:

Issued to: Date:

Issued to: Date:

Issued to: Date:

Effective 7 days after “*” date

CONTROLLED COPY
DO NOT DUPLICATE

DETERMINATION OF INORGANIC ANIONS BY ION CHROMATOGRAPHY

REFERENCES: EPA 300.0, Revision 2.1, 1993; SW846 9056A, Revision 1, 2007

1.0 SCOPE AND APPLICATION

1.1 This method is for the measurement of anions such as bromide, chloride, fluoride, nitrate, nitrite, ortho-phosphate, and sulfate by ion chromatography. The method is applicable to potable and non-potable water, solids after extractions, and neutral leachates.

2.0 SUMMARY OF METHOD

2.1 This method addresses the sequential determination of the anions: fluoride, chloride, nitrite-N, bromide, nitrate-N, ortho-phosphate-P, and sulfate found in aqueous and solid samples. A small volume of aqueous sample is injected into an ion chromatograph to flush and fill a constant-volume sample loop. The sample is then injected into a flowing stream of carbonate-bicarbonate eluent. The sample is pumped through two different ion exchange columns, then a conductivity suppressor device, and into a conductivity detector. The two ion exchange columns, a precolumn or guard column and a separator column, are packed with an anion exchange resin. Ions are separated into discrete bands based on their affinity for the exchange sites of the resin. The suppressor is an ion exchange-based device that reduces the background conductivity of the eluent to a low or negligible level and simultaneously converts the anions in the sample to their more conductive acid forms. The separated anions in their acid forms are measured using an electrical conductivity cell. Anion identification is based on the comparison of analyte signal peak retention times relative to those of known standards. Quantitation is accomplished by measuring the peak area and comparing it to a calibration curve generated from known standards.

REPORTING LIMIT AND METHOD DETECTION LIMIT

3.1 Reporting Limit. The reporting limits for this method are supported by the lowest concentration of standards in the initial calibration. Detected concentrations below this concentration are not reported unless MDL reporting is being done. Reporting limits were set as follows:

Analyte	Reporting Limit
Fluoride	0.20 mg/L
Chloride	2.00 mg/L
Nitrite-N	0.10 mg/L
Bromide	0.50 mg/L

Analyte	Reporting Limit
Nitrate-N	0.10 mg/L
Ortho-Phosphate-P	0.10 mg/L
Sulfate	2.00 mg/L

3.2 Method Detection Limit. Determine MDLs using the procedure specified in 40 CFR, Part 136, Appendix B, Rev. 2, 2016. This value represents the lowest reportable concentration of an individual compound that meets the method qualitative identification criteria. Refer to SOP QA020, current revision, for further details.

4.0 DEFINITIONS

4.1 **Batch:** A group of samples which are similar with respect to matrix and the testing procedures being employed and which are processed as a unit. A sample batch is limited to a maximum of 20 samples or samples loaded on an instrument within the same 12-hour shift, whichever comes first.

4.2 **Blank Spike (BS):** An analyte-free matrix spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. Blank Spike Recoveries are used to document laboratory performance for a given method. This may also be called a Laboratory Control Sample (LCS).

4.3 **Continuing Calibration Verification (CCV):** A check standard used to verify instrument calibration throughout an analytical run. CCV must be analyzed at the beginning of the analytical run, after every 10 samples, and at the end of the run.

4.4 **Holding Time:** The maximum times that samples may be held prior to preparation and/or analysis and still be considered valid.

4.5 **Initial Calibration (ICAL):** A series of standards used to establish the working range of a particular instrument and detector. The low point should be at a level equal to or below the reporting level.

4.6 **Initial Calibration Verification (ICV):** A standard from a source different than that used for the initial calibration. A different vendor should be used whenever possible. The ICV is used to verify the validity of an Initial Calibration. This may also be called a QC check standard.

4.7 **Matrix Spike (MS):** A sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The matrix spike recoveries are used to document the bias of a method in a given sample matrix.

4.8 **Matrix Spike Duplicate (MSD):** A replicate sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The matrix spike duplicate recoveries are used to document the precision and bias of a method in a given sample matrix.

4.9 **Method Blank (MB):** An analyte-free matrix to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank is processed simultaneously with the samples through all the steps of the analytical procedure. The method blank is used to document contamination resulting from the analytical process.

4.10 **Method Detection Limits (MDLs):** MDL is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is distinguishable from method blank results. Refer to SOP QA020, current revision.

4.11 **Reagent Blank:** The reagent blank is a blank that has the same matrix as the samples, i.e., all added reagents, but did not go through sample preparation procedures. The reagent blank is an indicator for contamination introduced during the analytical procedure. For methods requiring no preparation step, the reagent blank is equivalent to the method blank.

4.12 **Reagent Grade:** Analytical reagent (AR) grade, ACS reagent grade, and reagent grade are synonymous terms for reagents, which conform to the current specifications of the Committee on Analytical Reagents of the American Chemical Society.

4.13 **Reagent Water:** Water that has been generated by any process, which shall meet method-specified requirements.

4.14 **Reference Material:** A material containing known quantities of target analytes in solution or in a homogeneous matrix. It is used to document the bias of the analytical process.

4.15 **Sample Duplicate (DUP):** A replicate sample which is used to document the precision of a method in a given sample matrix.

4.16 **Preservation:** Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical integrity of the sample.

4.17 **Linear Calibration Range (LCR):** The calibration range over which the instrument response is linear.

5.0 HEALTH & SAFETY

5.1 The analyst should follow normal safety procedures as outlined in the SGS North America, Inc. Health and Safety Program which includes the use of safety glasses and lab coats. Gloves should be worn. In addition, all acids are corrosive and should be handled with care. Flush spills with plenty of water. If acids contact any part of the body, flush with water and contact the supervisor.

5.2 The toxicity or carcinogenicity of each reagent used in this method has not been precisely determined; however, each chemical should be treated as a potential health hazard. Exposure to these reagents should be reduced to the lowest possible level. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of data handling sheets should be made available to all personnel involved in these analyses.

6.0 COLLECTION, PRESERVATION, AND HOLDING TIME

6.1 Samples must be cooled to a temperature above the freezing point of water to 6°C at the time of collection.

6.2 Bromide, Chloride, Fluoride, and Sulfate must all be analyzed within 28 days. Nitrite, Nitrate and Ortho-phosphate must be analyzed within 48 hours for aqueous samples. For solids, the same hold time applies, after the samples are prepared (see section 10.1.)

Note: State of West Virginia requires 48 hours from collection to completion for NO2/NO3, regardless of matrix.

7.0 APPARATUS AND MATERIALS

7.1 Ion Chromatograph with a guard column, an analytical column, a suppressor column, and a conductivity detector. This SOP is written for the use with the Metrohm 930 Compact IC Flex and associated 858 Autosampler. System is equipped with an Ultrafiltration cell that filters all samples to 0.20 µm. The eluent used is dependent upon column selection and should be based off the supporting literature. Any augmentation/changes made to the suggested eluent should be properly recorded in the solution prep log, and Section 8 of this document updated accordingly. The columns used are listed below. Alternate columns may be used if all method requirements can be met.

Maintenance and troubleshooting procedures are described in detail in Metrohm Operation Manual. Most basic procedures include checking connections for leaks, cleaning and/or replacing tubing, monitoring and recording the pressure. See Sec.12.0.

7.1.1 Suppressors, Primary suppression is accomplished by use of the Metrohm MSM Chemical Suppression Module, and CO2 suppression is accomplished by use of the Metrohm MCS module.

7.1.2 Guard Column, Metrosep A Supp 4/5 Guard (or equivalent). Metrohm PN 61006500.

7.1.3 Analytical Column, Metrosep A Supp 5-150 (or equivalent). Metrohm PN 61006520

7.1.4 Data System, MagIC Net version 3.2 Build 123 Data system's revisions will be updated during annual SOP revisions. Data system changes prior to the date of revision are to be recorded in Maintenance log.

7.2 Top loading balance, capable of weighing to 0.01g. Calibrated and serviced annually by outside vendor and verified daily with Class 1 weights. Refer to SOP QA005, current revision.

7.3 Analytical balance capable of accurately weighing to the nearest 0.0001 g. The balance calibration must be verified each day before use with Class 1 certified weights. At a minimum the balance undergoes annual maintenance and recertification by qualified outside contractor, or whenever performance becomes suspect. Refer to SOP QA005, current revision.

7.4 Centrifuge Centra CL2, or equivalent

7.5 Class 1 weights

7.6 Volumetric glassware, Class A. Alternately, 50mL digestion tubes may be used to prepare solutions in smaller volumes provided these tubes are certified Class A equivalent.

7.7 IC vials and caps (Metrohm PN SNG-IC31000)

7.8 Volumetric pipettes, Class A or auto pipettors. Note: If auto-pipettes are used, make sure that the calibration is checked before use as specified in SOP QA006, current revision.

7.9 Nylon 0.45µm membrane filters or equivalent.

7.10 Disposable syringes, for sample filtering of soil extracts and extremely solid-laden aqueous samples. Pre-filtration is not necessary for most samples. The IC system has inline filtration of all samples to 0.20 µm.

7.11 Ultrafiltration membrane-Nylon 0.20 µm/47mm. (Metrohm PN 62714020), or equivalent.

7.12 Conductivity meter to pre-determine dilutions for possible interferences. This screening step may be omitted if sample history is known, and or sample matrix appears to be relatively clean. The system will auto-dilute any over range samples, so pre-screening is not critical unless samples are suspected to be of an extreme nature (i.e.: brines, plating baths, etc.). If needed, samples can be pre-diluted prior to going on the instrument provided that manual dilution is recorded properly in the software to ensure correct sample concentration is reported. See Attachment B.

8.0 REAGENTS AND STANDARDS

All chemicals should be made from ACS grade reagents/standards unless otherwise noted. Deionized water must be used whenever water is required. Commercially purchased reagent and standards must be accompanied by Certificate of Analysis (CoA). CoA is examined for accuracy and completeness of the information, including verification of the reagent/standard concentration and expiration date. For further details on reagent/standard traceability refer to SOP QA017, current revision.

8.1 Individual Parent Stock Solutions: It is suggested that 1000mg/L individual anion standards be purchased commercially for Fluoride, Chloride, Nitrite (as N), Bromide, Nitrate (as N), Ortho-Phosphate (as P), and Sulfate. If needed, prepared stocks can be made using the appropriate amount of a respective ACS grade salt. Reference the available methods/literature for proper amounts. **Note that two sources are required for each anion standard. 1st Source is used for calibration, a 2nd Source for calibration verification.**

8.2 Combined Anion Working Stock Calibration Solution: 1st Source. A single Combined Anion Working Calibration Stock solution is used for the calibration of the instrument. The Combined Anion Working Stock is the same concentration as Standard 10 for the calibration curve. This standard can be made of commercially available individual parent anion standards, or solutions prepared from salts (Section 8.1). Prepare fresh for each calibration. **Appropriate expiration dates must be applied to all standards and reagents.**

Concentrated solutions greater than 100mg/L may be kept for 1 month, while working solutions (i.e.: CCV and BS) should be prepared fresh daily for solutions containing NO2, NO3 and OPO4. Prepare as indicated below.

To prepare 50mL of Combined Anion Working Stock Calibration

Analyte	**Final Concentration**	**Vol. of 1000 mg/L Parent Stock for 50 ml**	**Concentration of Parent Stock**
Fluoride	10 mg/L	0.50 ml	1000 mg/l
Chloride	100 mg/L	5.0 ml	1000 mg/l
Nitrite-N	10 mg/L	5.0 ml	100 mg/l
Bromide	20 mg/L	1.00 ml	1000 mg/l
Nitrate-N	10 mg/L	5.0 ml	100 mg/l
Ortho-Phosphate-P	10 mg/L	0.50 ml	1000 mg/l
Sulfate	100 mg/L	5.0 ml	1000 mg/l

8.2.1 The Combined Anion Working Stock Calibration Standard (8.2) is loaded directly onto the instrument for calibration. Per the selected method, the instrument software will prepare the calibration curve by diluting the Working Stock solution (up to 100x). The suggested final concentrations and their corresponding dilutions for the method are listed in the table below, but alternate ranges can be used to meet various reporting requirements. **Standard 100 is the Calibration Blank and consists of DI Water.**

Standard ID	**Std 100**	**Std 1**	**Std 2**	**Std 3**	**Std 4**	**Std 5**	**Std 6**	**Std 7**	**Std 8**	**Std 9**	**Std 10**
Dilution Factor	1	100	50	40	20	10	5	2.5	2	1.25	1
Concentration mg/L											
Fluoride	0.0	0.10	0.20	0.25	0.5	1.0	2.0	4.0	5.0	8.0	10
Chloride	0.0	1.0	2.0	2.5	5.0	10	20	40	50	80	100
Nitrite-N	0.0	0.10	0.20	0.25	0.5	1.0	2.0	4.0	5.0	8.0	10
Bromide	0.0	0.20	0.40	0.50	1.0	2.0	4.0	8.0	10	16	20
Nitrate-N	0.0	0.10	0.20	0.25	0.5	1.0	2.0	4.0	5.0	8.0	10
Ortho-Phosphate-P	0.0	0.10	0.20	0.25	0.5	1.0	2.0	4.0	5.0	8.0	10
Sulfate	0.0	1.0	2.0	2.5	5.0	10	20	40	50	80	100

**Note that all calibration points may not be used for the final working calibration. The number of points used are based on the curve fit used and the corresponding method requirements. It is suggested that a minimum of six points with a quadratic curve fit and 1/x weighting be applied when possible. Use of this calibration model is dependent upon regulatory guidance from the state where the sample is collected. Note that WV and PA do not allow for Quadratic curve fit at the time of this SOP revision. All other states allow for this curve fit per 40 CFR Part 136, section 136.6 b.4.x.A which specifically calls out EPA 300.0 as a method in which the curve fit is one of a non-linear response.

8.3 Continuing Calibration Verification (CCV) 1st Source. Continuing Calibration Verification is prepared from the Individual Parent Stock solutions (8.1). Suggested concentrations are as follows:

CCV	**mg/L**
Fluoride	2.5
Chloride	50
Nitrite-N	2.5
Bromide	10
Nitrate-N	2.5
Ortho-Phosphate-P	2.5
Sulfate	50

8.4 Initial Calibration Verification (ICV) and Blank Spike (BSP, LCS) 2nd Source. The ICV can be made at the same concentrations that the CCV is but MUST be from a different source than the CCV. It must be within the range of the curve. Alternatively, it can be purchased from an outside supplier.

8.5 Stock Eluent (100x Concentration-320mM Na2CO3, 100mM NaHCO3): In a 1000mL flask, add approximately 300mL of DI H20. Using oven dried reagent, dried at 105˚C, (temperature should not exceed 110 °C) weigh 33.916 +/- 0.0005 g of Na2CO3 and 8.401+/- 0.0005 g of NaHCO3, and add to flask. Bring this solution to volume. Store tightly closed to eliminate CO2 adsorption. Stable for at least 1 month at room temperature, and up to 6 months if refrigerated.

8.6 Working Eluent Solution (3.2mM Na2CO3, 1.0mM NaHCO3): Dilute Stock Eluent –Sec. 8.5 using 20mL of stock in a 2000mL flask and bring up to volume. This solution is stable for several weeks if proper care is given to avoid CO2 absorption.

8.7 Suppressor Regenerant Solution-500mM H_2SO_4: Pipet 28 mL of concentrated H_2SO_4 into 100 mL DI and dilute to final volume of 1000mL with DI. Solution can be augmented with up to 100mM Oxalic Acid (12.607g/L Oxalic Acid Dihydrate) if analyzing samples suspected to be high in heavy metals.

9.0 INTERFERENCES

9.1 Interferences can be caused by substances with retention times that are similar to and overlap those of the anion of interest. This interference is especially important at low concentrations.

9.2 The acetate anion elutes early during the chromatographic run and can cause elution times of other anions to vary when large amounts of acetate are present. High levels of acetate also can cause interference with the fluoride peak. Therefore, this method is not recommended for leachates containing acetic acid.

Large amounts of an anion can interfere with the peak resolution of an adjacent anion. High concentrations of an anion can also cause the peak to be misidentified on the chromatograph due to the large width of the peak. Sample dilution and fortification can be used to correct most interference problems connected with peak resolution.

10.0 SAMPLE PREPARATION PROCEDURE

10.1 For soil samples, follow the preparation outlined below.

10.1.1 Mix the sample well and remove any artifacts as discussed in SOP QA034, current revision. Weigh approximately 5g of sample and add 50mL of DI water. Record the weight to the nearest 0.01g on preparation log.

10.1.2 For matrix spikes, make sure to spike the aliquot of the sample directly and then add the volume of DI water needed to make the volume of liquid being added to the soil sample equal to 50 mL including the volume of the spike solutions. In most cases this will be 41.75 mL of DI.

10.1.3 Prepare blank QC (Method Blank and Blank Spike) using a clean solid matrix, using approximately 5g aliquot and 50mL of DI water. Record the weight to nearest 0.01g.

10.1.4 Check with the lab supervisor if there is insufficient sample to use a 5g aliquot. Smaller aliquots may be used if a homogeneous portion of the sample can be obtained. The sample must always be extracted with 10 times the sample weight of DI water.

10.1.5 Mix the samples and QC for 10 minutes on the wrist action shaker.

10.1.6 Centrifuge samples and QC for 10 minutes at 2000 RPM. Decant supernatant of centrifugation procedure directly into sample tube if clear of suspended material. Samples still containing suspended matter or turbidity may be further filtered using 0.45μm syringe filters

For aqueous samples containing large amounts of particulate matter, or extreme turbidity, pre-filter samples through 0.45μm filters pouring into sample vials. Matrix spikes must be spiked before filtration. Pre-filter method blanks and blank spikes to act as QC check of the filters, only if there are samples in the batch that have been filtered. Record which samples have been filtered and the lot number of the filters in the run log. An unfiltered Method Blank and unfiltered Blank Spike are required for every batch of samples.

11.0 ION CHROMATOGRAPHY ANALYSIS PROCEDURE

11.1 A general knowledge of MagIC Net software is needed for effective operation of the instrument. This document assumes the operator has had training on the software and has a general understanding of instrumental analysis and concepts as they relate to ion chromatography (separation theory, linear regression, calibration principles, etc.)

11.2 Instrument Calibration

11.2.1 It is recommended that a new calibration be run a minimum of once per month. (It is required that a calibration be run once per quarter.) Calibrations standards may be varied from the one stated in this SOP depending on the levels of each anion that are to be reported. A minimum of 5 standards and a blank are required and a low standard must be at or below the reporting limit for each anion. A correlation coefficient of 0.995 or greater is required. Percent relative error for the mid-level and lowest calibration standards must be within laboratory-derived limits (See Table 1). If the correlation coefficient or the percent relative error criteria are not met, then the instrument must be recalibrated prior to the analysis of samples. Force to Origin (aka Force to Zero) is not permitted.

11.2.1.1 Using weighed regression 1/concentration is also acceptable. Same correlation coefficient of 0.995 or better is required for this calibration model. *For greater details refer to SOP QA042, current revision. (see also section 8.2.1 for additional information regarding acceptable calibration models)*

11.2.2 The IC is calibrated using external standard quantitation.

11.2.3 Establish ion chromatographic operating parameters per instrument manufacturers suggestion.

11.2.4 Establish the linear calibration range semi-annually. This is done by examining a calibration curve made with standards below and above the expected range. Determine at what concentrations the calibration is no longer linear.

11.2.5 Load the calibration standards via the autosampler. All calibration standards must be scheduled as sample type “**Standard**”.

11.2.6 The results are used to prepare a calibration curve for each analyte.

11.2.7 Immediately following calibration, a low-level standard at the reporting limit must be analyzed. This low check must have the levels in standard 1 or at the reporting limit for the calibration outlined in this SOP and recoveries must be in the range of 50–150%. On a daily basis, it is recommended that a mid-level 2nd Source check standard (ICV) be analyzed prior to analysis of client samples. Recoveries must be within the range of 90-110%. (At a minimum, this check (ICV) must be analyzed immediately following each new calibration.) Continuing calibration checks (CCV) and continuing calibration blanks (CCB) must be ran every 10 samples as well to provide bracketing QC for all reportable samples. The continuing calibration checks must have recoveries in the range of 90-110%. Refer to the quality control section of this SOP for more detail on these quality control samples.

11.2.8 After the run is completed, review all of the chromatograms and check for overlapping peaks, dilutions, etc.

11.2.9 If one or more calibration levels are responsible for the calibration curve *not* being linear, the offending level can be dropped if, and only if, the offender is the highest level or lowest level of calibration.

11.2.10 If linearity still cannot be achieved, new standards must be prepared and/or instrument operation must be examined.

11.2.11 Verify the working calibration curve on each working day by running a CCV standard before any samples. The calibration must also be verified whenever the eluent strength is changed

11.2.12 If the retention time of any anion in the ICV or CCV check standards has shifted more than 10% from the original calibration curve retention time, then no results can be reported for that anion. The column should be reconditioned, if necessary, and the instrument recalibrated before any more samples are reported for that anion. Affected samples are reanalyzed after the problem has been corrected.

11.2.13 If a sample peak has shifted significantly from the original retention time (and the ICV and CCV check standards are within the 10% retention time window), then verify the reported result using a spike on that sample. Do not report results from peaks where the retention time has shifted more than 10 percent unless the peak can be verified using a known spike.

11.2.14 For large or overlapping peaks, make dilutions. If at all possible, make dilutions and reruns on the same run as the original sample.

11.2.15 Refer to section 14.7 for information on how to determine the appropriate retention time window.

11.3 Samples may be scheduled using the Determination Series found in the Workplace of the software. Special attention need be given to ensure proper sample table setup when using advanced techniques such as Metrohm in-Vial Dilution Technique (MiVDT). **With advanced methods, the various information fields found in the Sample Table drive the logic of the method. It is very important to adhere to the guidance indicated in *Attachment A: Sample Table Control Guideline to ensure proper scheduling.***

11.4 Review all data and update the appropriate tests in the LIMS system. A write-up including a run log, a calibration summary, batch quality control summary, and copies of all chromatograms should be turned into the area supervisor for each batch.

11.4.1 If edits are needed in the calibration after the data has been calculated, the run can be reprocessed using the batch function in the software. Refer to the instrument manuals or on-screen help for addition information.

12.0 INSTRUMENT MAINTENANCE

12.1 If system pressure increases from nominal values, the suppressor may need to be cleaned. Refer to Metrohm document number 8.110.8010 for cleaning instructions.

12.2 The four in-line sample filters on the 930 Compact IC Flex and the one in-line filter on the 858 Professional Sample Processor need to be changed on a regular basis (Quarterly) or as needed.

12.3 Guard and analytical columns should be changed as dictated by instrument response and standard recoveries. An increase in nominal system pressure can be an indication of fouling from either the columns or the inline filters.

12.4 The instrument must be recalibrated whenever new guard or analytical columns are installed.

12.5 Samples high in metal concentration (especially aluminum and iron) can coat the MSM resin and affect both the baseline and the peak response.

12.6 A series of three 200 mM oxalic acid “samples”, followed by three blanks, may be ran at the end of a batch to cleanse the entire system of metal contamination. If problems persist with suppressor, refer to section 12.1.

12.7 Augmenting the suppressor regenerant solution (8.7) to a total concentration of 1000 mM H_2SO_4 and 1-200 mM oxalic acid will prevent MSM contamination when running samples high in metal concentration.

12.8 **All maintenance performed on the instrument must be recorded in the maintenance logbook.**

13.0 METHOD PERFORMANCE

Method performance (accuracy and precision) is monitored through the routine analysis of negative and positive control samples. These control samples include method blanks (MB), blank spikes (BS), matrix spikes (MS), and matrix spike duplicates (MSD). The MB and BS are used to monitor overall method performance, while the MS and MSD are used to evaluate the method performance in a specific sample matrix.

Blank spike, matrix spike, and matrix spike duplicate samples are compared to method defined control limits. Control limits are stored in the LIMS. Additionally, blank spike accuracy is regularly evaluated for statistical trends that may be indicative of systematic analytical errors.

Filtered method blanks and blank spikes to act as QC check of the filters. Unfiltered method blanks and blank spikes are used to monitor overall method performance.

14.0 QC REQUIREMENTS

14.1 A method detection limit study must be completed following the procedure outlined in 40 CFR, Part 136, Appendix B, Rev. 2, 2016. Refer to SOP QA020, current revision. If instrument conditions (columns, etc.) are modified, then a new initial MDL must be done.

14.2 A method blank and a spike blank are required to be run with every batch of 20 samples. Additionally, a matrix spike and a matrix duplicate are required for every 10 samples. In some cases, a matrix spike duplicate may be required in place of a duplicate.

The method blank must contain <½ RL (absolute value) of each anion that is reported, and this sample must be run with each set of samples in a batch. If the blank contains more than the absolute value of <1/2 RL, then all samples must be reanalyzed. If no sample volume remains to be reanalyzed, then the data must be flagged. Refer to SOP QA043, current revision. The exception to this rule is when the samples to be reported contain greater than 10 times the method blank level. In addition, if all the samples are less than a client required limit and the method blank is also less than that limit, then the results can be reported as less than that limit.

Note: West Virginia state specific requirement for method blank must contain analyte at <MDL

14.2.1 The recovery of the spike blank must be within the limits of 90-110% recovery for each anion that is reported, and this sample must be run with each set of samples in a batch. If the recoveries are outside of this range, then all associated samples must be reanalyzed. If no sample volume remains to be reanalyzed, then the data must be flagged. Refer to SOP QA043, current revision.

14.2.2 The matrix spike is spiked with all anions of interest. Method limits of 90 -110 % recovery must be applied. If the recoveries are outside of this range, and all other method quality control is within limits, then matrix interference should be suspected.

14.2.3 For matrix duplicates control limits of 15% RPD must be applied for all sample values within the calibration range (up to 10 times the reporting limit). If the RPD values are outside of this range, and all other method quality control is within limits, then sample non-homogeneity should be suspected.

14.3 An external source standard (ICV) must be analyzed after every new calibration and its recovery must be within 10% of the true value. If the ICV is not within ±10%, a second ICV should be prepared and analyzed. If the ICV is still outside of the limits, sample analysis must be discontinued and the cause determined (preparation of ICV from third source, instrument recalibration, etc.) .

14.4 It is required that a new calibration be run a minimum of once per quarter. Calibrations standards may be varied from the one stated in this SOP depending on the levels of each anion that are to be reported. A minimum of 5 standards and a blank are required and a low standard must be at or below the reporting limit for each anion. A correlation coefficient of ≥ 0.995 is required. The percent relative error for the mid-point (See Table 1) and lowest calibration (See 14.5 below) standards must be within acceptable criteria.

14.4.1 A new calibration is required when standard retention times shift by more than 10% from the original calibration.

14.5 A low check at the reporting limit (CCV2) for each anion must be run after each calibration. Acceptance criteria is 50–150%.

14.6 Continuing Calibration Verification (CCV) Checks at or near the mid-level of the curve must be run at the beginning and the end of the run and after every 10 samples throughout the run. Every CCV must be followed by a continuing calibration blank (CCB). The CCV must have results within 90-110% of the true value. If the CCV results are outside of the acceptance criteria range, analyst must demonstrate acceptable performance with two CCVs analyzed immediately (started within 1 hour), with no samples between failing CCV and the two additional CCVs. The results for the CCB must be <1/2 RL for an analyte. If they are not, then all bracketed samples for that analyte must be reanalyzed.

14.7 Retention time windows must be established whenever a new column/guard column is installed in an instrument or whenever a major change has been made to an instrument. Retention time shift is checked weekly with a CCV to ensure it does not exceed 10%, and the data is stored on LAN in GenChem directory.

Retention time windows are established by injecting standard mix three times over the course of 24 hours and calculating the standard deviation of the retention times of each analyte. Plus or minus three times the standard deviation of the retention times is defined as the retention time window of that compound.

Peak identification is based on the retention time of an analyte in the standard (initial or continuing) being used as the mid-point of the retention time window. The retention time windows should be used as a guide for identifying compounds; however, the experience of the analyst should weigh heavily in the interpretation of the chromatograms. The analyst should monitor the retention times of known standard peaks throughout an instrument run as an indication of instrument performance.

Because calculated retention time windows are generally very tight (less than ± 0.10 minutes), the retention time windows for the data processing method are generally set wider than the calculated window. This is done to ensure that the software does not miss any potential “hits”. The analyst will then review these “hits” and determine if the retention times are close enough to the retention time of the target analyte to positively identify the peak or to require confirmation.

14.8 The Linear Calibration Range (LCR) is the concentration range the instrument response is linear and must be initially determined and verified every 6 months or whenever a significant change in the instrument is observed or expected. Initially, enough standards must be used to insure the curve is linear. The linearity verification must use at a minimum, a blank and 3 standards. The verification data must be within ±10% of the assigned values. If the data falls outside of this range, then the linearity of the instrument must be reestablished. If any portion of the curve is nonlinear, then sufficient standards must be used to clearly delineate the nonlinear portion of the curve.

NOTE: Samples with detections within 10% of highest calibration standard must be diluted.

14.9 ***Contingencies for handling out-of-control QC***. Upon certain circumstances data can be reported from batches with QC non-conformances. Such samples are to be qualified accordingly. Examples include:

- If the MB is contaminated but the samples are non-detect, then the source of contamination should be investigated and documented. The sample results reported with appropriate qualifiers and footnotes. If the MB is contaminated but the samples results are > 10 times the contamination level, the source of the contamination should be investigated and documented. The samples results may be reported with the appropriate qualifier. Refer to SOP QA043, current revision. *This must be approved by the department supervisor.* Samples with hits <10 times contamination are reprepped and reanalyzed. If there is insufficient sample to reanalyze, or if the sample is re-analyzed beyond hold time, the appropriate footnote and qualifiers should be added to the results. *This must be approved by the department supervisor*
- Similarly, if the recovery of LCS or CCV is high and the associated sample is non-detect, the data may be reportable with appropriate qualifiers and footnotes. If the recovery of LCS or CCV is below lower acceptance limit, the department supervisor shall review the data and determine what further corrective action is best for each particular sample. That may include reanalyzing the samples, re-prepping and/or reanalyzing the samples, or qualifying the results as estimated. Refer to SOP QA043, current revision. *This must be approved by the department supervisor.* If there is insufficient sample to reanalyze, or if the sample is re-analyzed beyond hold time, the appropriate footnote and qualifiers should be added to the results. *This must be approved by the department supervisor.*
- If the matrix spike recoveries are not within the established control limits, compare the recoveries to those of the LCS to assess method performance in clean QC matrix. Matrix spike recovery failures are not grounds for reanalysis but are an indication of the sample matrix effects

15.0 DOCUMENTATION REQUIREMENTS

15.1 All reagents must be recorded in a reagent logbook with manufacturers, lot numbers, and expiration dates. All reagent information must be cross referenced on the sample worksheet.

15.2 All instrument data must be exported to the LIMS system and a copy of the run log must be included in the logbook by the instrument.

15.3 A data package consisting of a manual run log, a LIMS run log, a calibration summary, batch quality control summary, and copies of all chromatograms must be turned into the area supervisor for each batch. The analyst should also complete the preliminary review in the LIMS system.

15.4 Refer to SOP QA029, current revision, for procedures and documentation that must be followed when peaks are manually integrated.

16.0 POLLUTION PREVENTION & WASTE MANAGEMENT

16.1 Users of this method must perform all procedural steps in a manner that controls the creation and/or escape of wastes or hazardous materials to the environment. The amounts of standards, reagents, and solvents must be limited to the amounts specified in this SOP. All safety practices designed to limit the escape of vapors, liquids or solids to the environment must be followed. All method users must be familiar with the waste management practices described in section 16.2.

16.2 Waste Management. Individuals performing this method must follow established waste management procedures as described in the waste management SOP, SAM108, current revision. This document describes the proper disposal of all waste materials generated during the testing of samples.

17.0 ADDITIONAL REFERENCES

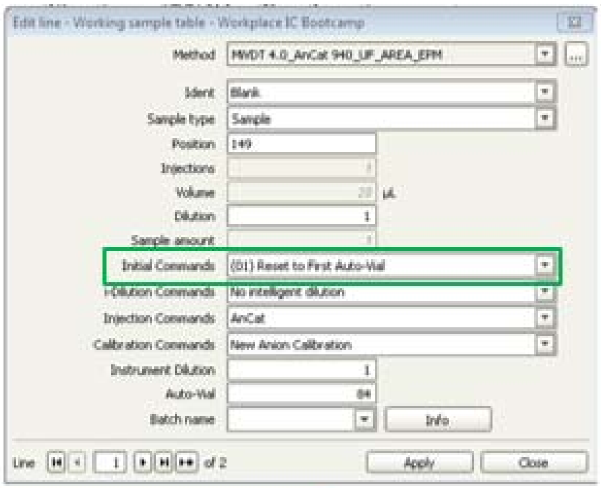
17.1 Metrohm Instrument and column manuals
17.2 SGS – Orlando SOPs: QA005, QA006, QA017, QA020, QA029, QA034, QA042, QA043, SAM108, current revisions.
17.3 TNI 2016 standards.
17.4 DoD QSM, 5-series, current revision
17.5 CFR 40 Part 136, Tables IB and II
17.6 Metrohm AG document number 8.110.8010 “*IC Anion Suppressors*”

ATTACHMENT A: Sample Table Control Guideline

Sample Table Control: Initial Commands (Info 1)

Info 1 field used to specify initial (pre-analysis) commands

- **(01)Reset to First Auto-Vial**
  - Resets the auto-vial position to the Common Variable (01) First Auto-Vial
  - Used after placing new, empty dilution vials on the autosampler
  - Also restarts the Sample Counter
- **(02) Restart sample prep**
  - Used if an error occurs during the previous sample run
  - Causes the sample dilution to be prepared again in new auto-vial
  - **Best practice is to run a blank rather than utilize this command!**
- **(03) Initial rinse**
  - Rinse of sample flow path prior to analysis
  - Use when contamination from a high sample is suspected



Method: MVDT 4.0_AnCat 940_UF_AREA_EPM
Ident: Blank
Sample type: Sample
Position: 149
Injections: 1
Volume: 20 µL
Dilution: 1
Sample amount: 1
Initial Commands: (01) Reset to First Auto-Vial
Dilution Commands: No intelligent dilution
Injection Commands: AnCat
Calibration Commands: New Anion Calibration
Instrument Dilution: 1
Auto-Vial: 84
Batch name:

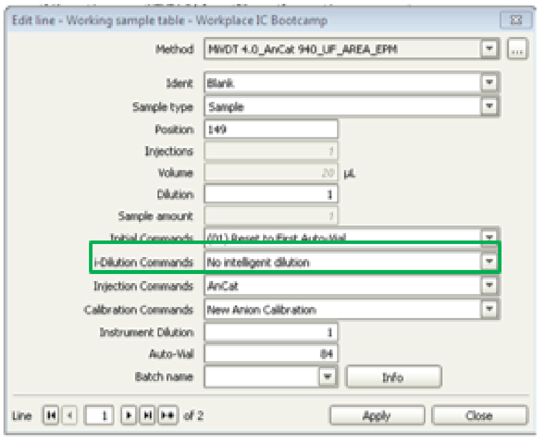
Troubleshooting Tip

- Be sure to avoid mistakenly using the "(01) Reset to First Auto-Vial" command.
- This could lead to dilutions being made in used auto-vials.

Sample Table Control: i-Dilution Commands (Info 2)

Info 2 field used to specify if a sample will be evaluated for an intelligent dilution

- **Blank (no entry)**
  - Sample will be evaluated for an intelligent dilution
- **"No intelligent dilution"**
  - Sample will NOT be evaluated for an intelligent dilution



Method	MVDT 4.0_AnCat 940_UF_AREA_EPM
Ident	Blank
Sample type	Sample
Position	149
Injections	1
Volume	20 µL
Dilution	1
Sample amount	1
Initial Commands	(01) Reset to First Auto-Vial
i-Dilution Commands	No intelligent dilution
Injection Commands	AnCat
Calibration Commands	New Anion Calibration
Instrument Dilution	1
Auto-Vial	84
Batch name	

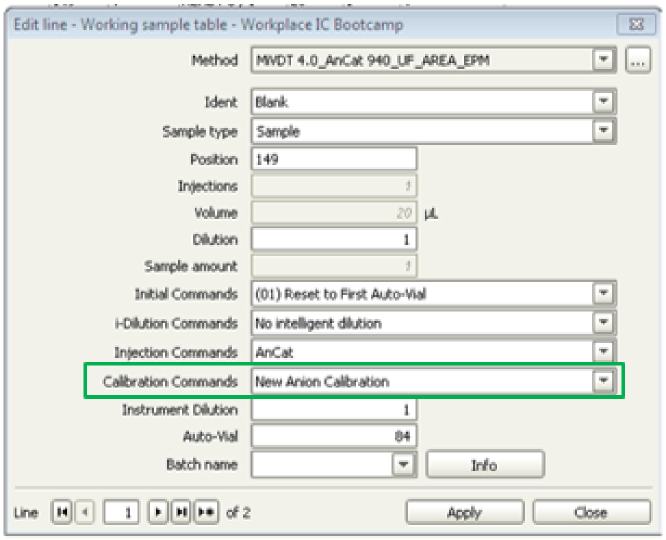
Sample Table Controls: Calibration Reset (Info 4)

Info 4 field used to specify when a new calibration is being performed

- **New Anion Calibration**
  - Resets Common Variable areas to zero for high standards

Troubleshooting Tip:

- Do not use calibration reset commands unless performing a new calibration.
  - Erroneous use will result in Common Variable areas being set to zero and will lead to incorrect intelligent dilutions.

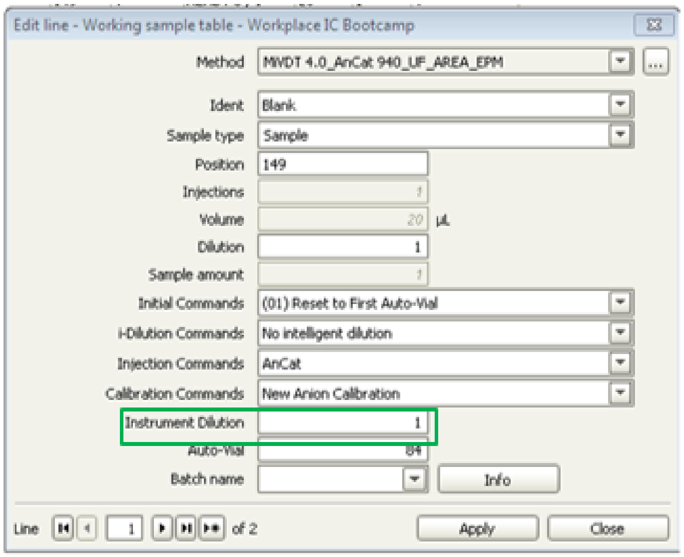


Method	MVDT 4.0_AnCat 940_UF_AREA_EPM
Ident	Blank
Sample type	Sample
Position	149
Injections	1
Volume	20 µL
Dilution	1
Sample amount	1
Initial Commands	(01) Reset to First Auto-Vial
i-Dilution Commands	No intelligent dilution
Injection Commands	AnCat
Calibration Commands	New Anion Calibration
Instrument Dilution	1
Auto-Vial	84
Batch name	

Sample Table Controls: Instrument Dilution (Value 1)

Value 1 field used to specify the dilution the instrument is to perform

- **1:100 is the maximum dilution!**



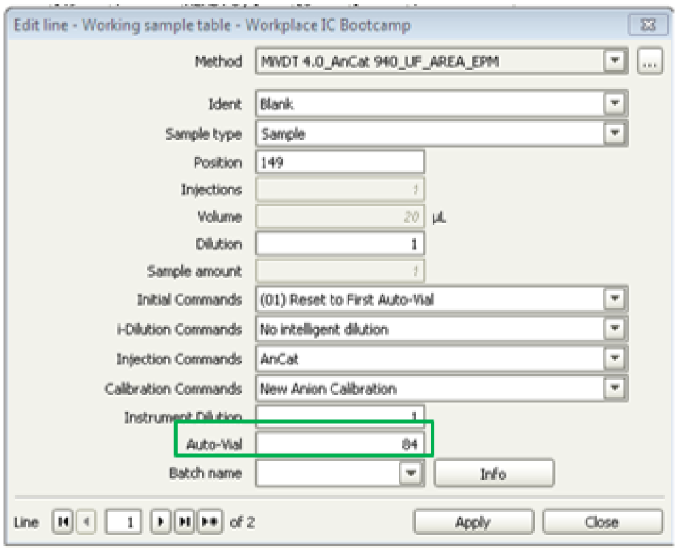
Edit line - Working sample table - Workplace IC Bootcamp

Method: MVDT 4.0_AnCat 940_UF_AREA_EPM
Ident: Blank
Sample type: Sample
Position: 149
Injections: 1
Volume: 20 µL
Dilution: 1
Sample amount: 1
Initial Commands: (01) Reset to First Auto-Vial
i-Dilution Commands: No intelligent dilution
Injection Commands: AnCat
Calibration Commands: New Anion Calibration
Instrument Dilution: 1
Auto-Vial: 84
Batch name:
Line 1 of 2

Sample Table Controls: Auto-Vial Position (Value 2)

Value 2 field used to serve as a reminder for which auto-vial positions to fill with clean, capped empty vials

- **This is not the actual position where dilutions will occur.**
- **It is a reminder to the user to load a sufficient number of empty vials on the sample processor.**
- **Actual current vial position can be found in the Configuration view under (03) Current Auto-Vial**
- **Numerical value must be between 84 – 148.**



Edit line - Working sample table - Workplace IC Bootcamp

Method: MVDT 4.0_AnCat 940_UF_AREA_EPM
Ident: Blank
Sample type: Sample
Position: 149
Injections: 1
Volume: 20 µL
Dilution: 1
Sample amount: 1
Initial Commands: (01) Reset to First Auto-Vial
i-Dilution Commands: No intelligent dilution
Injection Commands: AnCat
Calibration Commands: New Anion Calibration
Instrument Dilution: 1
Auto-Vial: 84
Batch name:
Line 1 of 2

ATTACHMENT B: CONDUCTIVITY SCREENING FOR UNKNOWN SAMPLES

Conductivity Screen	Dilution Factor
< 700 µS	No dilution
700 – 1000 µS	1:5
1001 – 3000 µS	1:10
3001 – 5000 µS	1:25
5001 – 8000 µS	1:50
8 – 10 mS	1:100
10 – 15 mS	1:200
>15 mS	1:500

Table 1 QC Criteria

Quality Control	Frequency	Acceptance Criteria	Corrective Action
Initial Calibration: r = coefficient of correlation	At least quarterly	≥0.995	Rerun calibration standards, and/or prepare new calibration standards and recalibrate the instrument, or document why the data are acceptable. See 14.4
Percent Relative Error (%RE)	Each initial calibration	50 – 150% of the lowest cal. standard's true value. 90 – 110% of the calibration standard at or near the mid-point's true value	Rerun calibration standards, and/or prepare new calibration standards and recalibrate the instrument.
Initial Calibration Verification standard (ICV)	One per calibration	90-110% of the standard's true value	Rerun standard, and/or prepare new standard, and/or recalibrate instrument, or document why the data are acceptable. See 14.3
Continuing Calibration Verification standard (CCV)	After initial calibration, every tenth sample, and at end of run	90-110% of the standard's true value	Rerun standard, and/or recalibrate instrument and reanalyze all samples run since the last acceptable CCV, or document why the data are acceptable. See 14.6
Low-level Standard (CCV2)	One per calibration	50-150% of the standard's true value	Rerun standards, and/or recalibrate instrument and reanalyze all samples associated with CCV2.
Continuing Calibration Blank (CCB)	After initial calibration, every tenth sample, and at the end of the run	< ½ RL	Stop the analysis, determine the source of contamination, rerun CCB and all samples following CCB outside acceptance criteria, or document why the data are acceptable.
Method blank (MB)	One per batch	< ½ RL; WV projects <MDL	Stop the analysis, determine the source of contamination, reanalyze, or document why the data are acceptable.
Retention time (RT)	Checked weekly	90-110% of the original calibration curve retention time window	Recondition column, if necessary, and/or recalibrate the instrument. If a sample peak has shifted significantly from the original RT and the ICV and CCV check samples are within the 10% RT window, verify the result with a spike on the sample. See 11.2.12 and 11.2.13.

Quality Control	Frequency	Acceptance Criteria	Corrective Action
Blank Spike (BS or LCS)	One per batch	90-110% of the standard's true value	Determine and correct the problem, reanalyze samples, if necessary, or document why data are acceptable.
MS/MSD	10% of matrix	90-110% of the standard's true value RPD ≤15	Determine and correct the problem, reanalyze samples and MS/MSD, or document why data are acceptable
Linear Calibration Range (LCR)	Semi-annually	±10% of the standard's true value	Rerun and/or prepare new series of standard, and/or recalibrate instrument

APPENDIX OF SIGNIFICANT CHANGES

Revision Date	Revision Number	Affected Section(s)	Revision Description
09/04/2021	01	Entire Document	Added applicable SOP references
09/04/2021	01	Entire Document	Updated MDL determination procedure to 40 CFR, part 136, Appendix B, Revision 2
09/04/2021	01	Entire Document	Changed PO4 to OPO4 for Ortho Phosphate
09/04/2021	01	References	Added Revision for SW-846; Moved 40 CFR reference to Additional References section
09/04/2021	01	4.0	Updated MDL definition; Updated Reagent Water definition to match TNI 2016 Standards; Added Linear Calibration Range definition
09/04/2021	01	5.0	Added gloves for Health & Safety PPE
09/04/2021	01	6.0	Revised sample temperature preservation to “a temperature above the freezing point of water to 6^0C”; removed H2SO4 preservation references
09/04/2021	01	07	Added balance calibration verification procedure
09/04/2021	01	8.0	Added additional requirements for reagents and standards to meet current regulations; Updated preparation of Combined Anion Working Stock Calibration and individual Anions; and CCV concentrations; Updated preparation of Stock Eluent
09/04/2021	01	10.0	Added use of wrist action shaker for sample and QC preparation
09/04/2021	01	11.0	Added Percent Relative Error; Added evaluation of absolute value for MB acceptance criteria; Removed MB QC acceptance criteria for WV
09/04/2021	01	14.0	Expanded Method Blank QC requirements; Revised calibration frequency from once per month to at least quarterly; Added Percent Relative Error
09/04/2021	01	17.0	Added CFR 40 Part 136 Table IB and II; Updated SOP references
09/04/2021	01	Appendix A	Changed title to Attachment A
09/04/2021	01	Attachment B	Conductivity Screening Table for sample dilution added
09/04/2021	01	Table 1	Added % Relative Error; Expanded frequency of CCV to include after initial calibration and at the end of the run; Revised corrective action for MB; Separated MB and CCB; Revised corrective actions for Retention Time

			shifts
09/04/2021	01	Appendix of Significant Changes	Added
09/04/2021	01	SOP Acknowledgement Form	Added
01/05/2023	02	Table 1	Updated RPD limit for MS/MSD
04/21/2023	03	14.0	Updated RPD limit for MS/MSD

DETERMINATION OF INORGANIC ANIONS BY ION CHROMATOGRAPHY

SOP Acknowledgement Form

I have read and understand this SOP. I will not knowingly deviate from this approved SOP without approval of the Department Supervisor, QA Officer, or Technical Manager. If I notice any discrepancies between this SOP and the routine procedure, I will notify the Department Supervisor so that either the SOP or procedure can be changed. Furthermore, I understand that this SOP is property of SGS North America Inc. – Orlando and may not be printed nor duplicated in any manner.

Internal SOPs referenced within this SOP: QA005, QA006, QA017, QA020, QA029, QA034, QA042, QA043, SAM108, current revisions

Print Name	**Signature**	**Date**

Print the SOP Acknowledgement Form, sign, and submit to the SGS Orlando QA department.

DIGESTION OF WATER SAMPLES FOR ICP/ICPMS ANALYSIS

Prepared by: David Metzgar III Date: 04/13/2022

Approved by: Svetlana Izosimova Date: 04/20/2022

Annual Review

Reviewed by: ______________________ Date: __________

Reviewed by: ______________________ Date: __________

Reviewed by: ______________________ Date: __________

Document Control

Issued to: QA Department - Digital Date: 04/20/2022

Issued to: Metals - Digital Date: * 04/20/2022

Issued to: ______________________ Date: __________

Issued to: ______________________ Date: __________

Issued to: ______________________ Date: __________

Issued to: ______________________ Date: __________

Effective 7 days after “*” date

CONTROLLED COPY
DO NOT DUPLICATE

TITLE: DIGESTION OF WATER SAMPLES FOR ICP ANALYSIS

REFERENCES:

TNI 2016
DoD QSM 5 Series
SW846 3010A
EPA 200.7, Revision 4.4, 1994
EPA 200.8, Revision 5.4, 1994
UCMR 5.0, Version 1, December 2020

1.0 SCOPE AND APPLICATION, SUMMARY

This method is applicable for the digestion of aqueous samples, TCLP extracts and wastes that contain small amounts of suspended solids. After digestion, the samples can be analyzed by ICP. The digestion methods described in this SOP are based upon SW846 method 3010A, EPA 200.7, revision 4.4, 1994 and EPA 200.8, revision 5.4, 1994 digestion methods.

Reduced volume versions of methods 200.7, Revision 4.4 1994 and method 200.8, Rev.5.4 1994 are in use by SGS - Orlando. This approach that uses the same reagents and molar ratios is acceptable by the regulatory agents provided it meets the quality control and performance requirements stated in the method. Method EPA 200.7 and EPA 200.8 have been modified within the flexibility allowed in 40CFR136.6.

SW-846 methods, with the exception of required method use for the analysis of method-defined parameters, are intended to be guidance methods which contain general information on how to perform an analytical procedure or technique which a laboratory can use as a basic starting point for generating its own detailed Standard Operating Procedure (SOP), either for its own general use or for a specific project application. The performance data included in this method are for guidance purposes only and are not intended to be and must not be used as absolute QC acceptance criteria for purposes of laboratory accreditation.

2.0 PRESERVATION AND BOTTLEWARE

All samples should be preserved with nitric acid to a pH of <2 at the time of collection. All sample pH are checked in sample receiving and within the metals department. Samples that are received with a pH >2 must be preserved to pH <2 and held for 24 hours prior to metals digestion to dissolve any metals that absorb to the container walls. Refer to SOP SAM101, current revision for further instruction.

Final pH of TCLP extracts are checked and recorded in SGS - Orlando Extractions Department. Please refer to TCLP (1311) fluid determination logbook and SPLP (1312) fluid determination logbook for further information. TCLP extracts received from SGS - Orlando Extractions Department are prepared as soon as possible, no longer than 24 hours from time of receipt. If precipitation is observed during the sample preparation process the sample(s) are immediately re-prepped on dilution until no precipitation is observed.

Samples received for dissolved metals analysis should be filtered and preserved to pH<2 as soon as possible and held for 24 hours prior to digestion. Refer to SGS - Orlando Sample Filtration Logbook for further information.

All bottleware used by SGS - Orlando is tested for cleanliness prior to shipping to clients. Analysis results must be < ½ the reporting limit to be acceptable. Refer to SOP SAM104, current revision for further instruction.

3.0 HOLDING TIME AND STORAGE

All samples should be digested and analyzed within 6 months of the time collection.

Aqueous samples do not require refrigeration.

4.0 REPORTING and METHOD DETECTION LIMITS

See analytical SOP MET100, current revision for further information.

5.0 INTERFERENCE

Organic substances in a matrix may cause interference if the sample is not digested rigorously enough. In addition, high levels of acids in the final digestate may cause interference in the analysis. This interference can be avoided by choosing the appropriate digestion method and by bringing the sample to an appropriate final volume. For a discussion of other interference, refer to specific analytical methods.

6.0 APPARATUS

The apparatus needed for this digestion procedure are listed below.

6.1 Automatic repipettor(s)

6.2 Fisher Brand 0.45 micron (um) filter or equivalent. Filter lots are checked for cleanliness through the Method Blank process. All Method Blank analytical results must be <1/2 the reporting limit to be acceptable, if not, the contaminated lot must be identified and removed from laboratory use. Samples filtered through the contaminated filters must be re-filtered through acceptable filters.

6.3 Environmental Express watch glasses or equivalent.

6.4 Thermometer(s)- capable of measuring a temperature of at least 125^{0}C, and checked against NIST traceable thermometers. Refer to SOP QA002, current revision for further information.

6.5 Environmental Express Hot Block or equivalent capable of maintaining a temperature of 90-95°C.

6.6 Environmental Express digestion vessels or equivalent, 65ml capacity. Each Lot of digestion tubes comes with a Certificate of Analysis which demonstrates cleanliness as well as volume accuracy at graduations. If alternate digestion tubes are used and they do not come with a certificate of cleanliness then the lot is checked prior to usage and data kept on file. Please refer to Digestion Tube Certificate Logbook for further information. Tube Lots are also checked through the Method Blank process. All Method Blank analytical results must be < ½ reporting limit to be acceptable, if not, the contaminated lot must be identified and removed from laboratory use. Re-digestion is required for all samples prepared with the contaminated tube lot.

6.7 Fisher Brand disposable 10 ml syringes or equivalent. Syringe lots are checked for cleanliness through the Method Blank process. All Method Blank results must be < ½ reporting limit to be acceptable, if not, the contaminated lot must be identified and removed from laboratory use. Samples filtered through the contaminated syringes must be re-filtered through acceptable syringes.

6.8 Eppendorf Pipette (s) - Pipette (s) are checked daily for accuracy and to ensure they are in good working condition prior to use. Volumes are checked at 100% of maximum volume (nominal volume). Pipettes are checked within the metals department and results are stored electronically in the “Pipette Calibration Log”. Refer to SOP QA006, current revision for further information regarding pipette calibration. BIAS: mean must be within 2% of nominal volume. Precision: RSD must be ≤ 1% of nominal volume based on three replicates.

6.9 Class A volumetric flask (s)

6.10 Class A volumetric pipette (s)

6.11 Class A graduated cylinder (s)

7.0 REAGENTS

All chemicals listed below are trace metal grade unless otherwise specified. These standards and reagents must be accompanied by the Certificate of Analysis (CoA). The CoA is examined for accuracy and completeness of the information, including verification of the reagent/standard normality/concentration. For further details refer to SOP QA017, current revision. Refer to Acid Certificate of Analysis logbook for Certificates of Analysis and compliance with the specifications of the grade listed.

7.1 Hydrochloric acid. Fisher Trace metal grade or equivalent

7.2 Nitric acid. Fisher Trace metal grade or equivalent

7.3 Reagent Water – Water that has been generated by any method which shall meet method specified requirements. TNI 2016 definition. Reagent water is used exclusively for laboratory purposes. Refer to SOP QA037, current revision for more information regarding testing and monitoring.

7.4 Metals spiking solutions:

Commercially purchased 100ppm Inorganic Ventures Ag stock spiking solution (catalog MSAG-100PPM or equivalent)

Commercially purchased Environmental Express Multi-element spiking solution (catalog # CLP-SS or equivalent) made with 5% HNO_3 and a trace of HF.

Commercially purchased Inorganic Ventures 5000 mg/l Mineral solution (catalog # Multi-B or equivalent)

100ppm Mo, Sr, Sn, Ti prepared spiking solution. Please refer to electronic standard preparation logbook for all pertinent information.

Multi element ICPMS prepared spiking solution. Please refer to electronic standard preparation logbook for all pertinent information.

8.0 PROCEDURE

SW846-3010A

8.1 Shake sample vigorously to ensure thorough mixing. Measure out 50 ml of each sample into a labeled digestion vessel. The sample may be measured by using a Class A graduated cylinder or by using the calibrated digestion tube. Make sure that the sample identifications are accurately recorded on the digestion vessels and in the electronic sample digestion log. In addition to the samples, a matrix spike (MS), matrix spike duplicate (MSD), duplicate, blank spike and a method blank should be set up with each batch of 20 samples. A serial dilution, as well as a post digestion spike are batched in LIMS and performed at the analytical bench. For the method blank and blank spike, 50 ml of DI water should be used. Refer to Table 1 and 2 for the spiking solution levels to use for each MS, MSD and blank spike.

8.1.1 When preparing TCLP samples use 5.0mls initial volume of leachate and bring to a final volume of 50mls using DI water. Also prepare an additional leachate blank and leachate blank spike from the extraction fluid used for the samples. See section 8.7 and 8.8 of current MET SOP 100 for acceptance criteria.

8.1.2 When preparing filtered samples for dissolved metals, an additional method blank must be prepared. This is performed to ensure there is no cross contamination from the filter media into the samples. The method blank must be filtered through the same filter media as the samples. See section 8.7 of current METSOP 100 for acceptance criteria.

8.2 Pre heat the Hot Block to 90 to 95^{o}C.

Add 1.5 ml of concentrated nitric acid to all quality control and samples.

8.3 Place the labeled digestion vessels into the heating apparatus and cover with elevated or ribbed watch glasses. Heat the samples at a gentle reflux for 2 hours.

Allow samples to cool.

8.4 Uncover all samples and matrix QC. Add an additional 1.5-ml of concentrated nitric acid to all quality control and samples. Continue heating, adding additional acid if necessary, until the digestion is complete, generally indicated when the digestate is light in color or does not change in appearance with continued refluxing.

Allow samples to cool.

8.5 Add 2.5 ml of concentrated HCL to each sample and reflux for an additional 15 minutes. Allow samples to cool. Rinse digestion vessel walls with DI water.

8.6 Bring the samples to a final volume of 50.0 ml with DI water, cap and shake. The samples are now ready for analysis by ICP. If the sample contains particulate matter, it should be filtered along with the method blank and blank spike through a 0.45um syringe filter before analysis at the analytical bench.

Method EPA200.7 / 200.8 Digestion Procedure

8.7 Shake sample vigorously to ensure thorough mixing. Measure out 50 ml of each sample into a labeled digestion vessel. The sample may be measured by using a Class A graduated cylinder or by using the calibrated digestion tube. Make sure that the sample identifications are accurately recorded on the digestion vessels and in the electronic sample digestion log. In addition to the samples, a matrix spike (MS), matrix spike duplicate (MSD), duplicate, blank spike and a method blank should be set up with each batch of 20 samples. A serial dilution, as well as a post digestion spike are batched in LIMS and performed at the analytical bench. For the method blank and blank spike, 50 ml of DI water should be used. Refer to Table 1 and 2 for the spiking solution levels to use for each MS, MSD and blank spike.

For proper heating adjust the temperature control of the hot block such that an uncovered digestion vessel containing 50 mL of water placed in the center of the hot block can be maintained at a temperature approximately but no higher than 85°C. (Once the digestion vessel is covered with a watch glass the temperature of the water will rise to approximately 95°C.)

8.7.1 Pre heat hot block to a temperature of 90-95^0 C. Add 0.5 mL concentrated nitric acid and 0.25mL of concentrated hydrochloric acid to all samples and matrix QC digestion vessels containing the measured volume of sample. Place the samples along with all associated matrix QC on the hot block for solution evaporation.

8.7.2 Gently heat the samples for 2 hours, reducing volume to approximately 10-20 ml. DO NOT BOIL.

8.7.3 Cover the digestion vessels with watch glasses and gently reflux for an additional 30 minutes.

Allow samples to cool.

8.7.4 Bring the samples to a final volume of 50.0 ml with DI water, cap and shake. The samples are now ready for analysis by ICP or ICPMS. If the sample contains particulate matter, it should be filtered along with the method blank and blank spike through a 0.45um syringe filter before analysis at the analytical bench.

9 QC REQUIREMENTS

For each digestion batch of 20 samples, a serial dilution (performed at analytical bench), a post digestion spike (performed at the analytical bench), a matrix spike, a matrix spike duplicate, a duplicate, a blank spike (LCS), and a method blank should be prepared. Re-digestion is suggested for QC that does not meet the SGS - Orlando QC limits. The appropriate lab supervisor or lab manager will notify the analyst of samples that need re-digestion. Please refer to TABLE 1 in this SOP for spiking volumes and concentrations. Refer to scheduling sheets and/or project specific QAPP for further information regarding client specific QC requirements.

10 GLASSWARE CLEANING

All glassware should be washed with soap and tap water, rinsed with 5% nitric acid solution, and then rinsed at least 3 times with DI water. Refer to SOP GN196, current revision for further information regarding glassware cleaning.

11 DOCUMENTATION REQUIREMENTS

All digestion information should be documented in the Sample Digestion Logbook. The information required includes the sample identification (including the sample bottle number), the initial sample volume, and the final sample volume, the acids used (including lot number and manufacturer), the spiking solutions used, the digestion vessel lot number, the observed temperature, corrected temperature, the thermometer ID, analyst’s signature, and the date of digestion. The analyst should write additional information such as unusual sample characteristics in the comment section.

12 SAFETY

12.1 The analyst should follow normal safety procedures as outlined in the SGS Health and Safety Program and SGS Orlando SOP QA033 (Laboratory Safety Procedure), current revision. which includes the use of safety glasses and lab coats. Gloves should be worn. In addition, all acids are corrosive and should be handled with care. Flush spills with plenty of water. If acids contact any part of the body, flush with water and contact the supervisor.

12.2 The toxicity or carcinogenicity of each reagent used in this method has not been precisely determined; however, each chemical should be treated as a potential health hazard. Exposure to these reagents should be reduced to the lowest possible level. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of data handling sheets should be made available to all personnel involved in these analyses.

13 POLLUTION PREVENTION AND WASTE MANAGEMENT

13.1 Pollution Prevention

Users of this method must perform all procedural steps in a manner that controls the creation and/or escape of wastes or hazardous materials to the environment. The amounts of standards, reagents and solvents must be limited to the amounts specified in this SOP. All safety practices designed to limit the escape of vapors, liquids or solids must be followed. All method users must be familiar with the waste management practices described in Section 13.2.

13.2 Waste Management

Individuals performing this method must follow established waste management procedures as described in the Sample and Laboratory Waste Disposal SOP SAM108, current revision. This document describes the proper disposal of all waste materials generated during the testing of samples.

14.0 GENERIC DEFINITIONS

14.1 Batch: A group of samples which are similar with respect to matrix and the testing procedures being employed and which are processed as a unit. A sample batch is limited to a maximum of 20 samples or 24 hours whichever comes first.

14.2 Blank Spike (BS): An analyte-free matrix spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. Blank Spike Recoveries are used to document laboratory performance for a given method. This may also be called a Laboratory Control Sample (LCS).

14.3 Continuing Calibration Verification (CCV): A check standard used to verify instrument calibration throughout an analytical run. A CCV must be analyzed at the beginning of the analytical run, after every 10 samples, and at the end of the run.

14.4 Holding Time: The maximum times that samples may be held prior to preparation and/or analysis and still be considered valid.

14.5 Initial Calibration (ICAL): A series of standards used to establish the working range of a particular instrument and detector. The low point should be at a level equal to or below the reporting level.

14.6 Initial Calibration Verification (ICV): A standard from a source different than that used for the initial calibration. A different vendor should be used whenever possible. The ICV is used to verify the validity of an Initial Calibration. This may also be called a QC check standard.

14.7 Matrix Spike (MS): A sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The matrix spike recoveries are used to document the performance of a method in a given sample matrix.

14.8 Matrix Spike Duplicate (MSD): A replicate sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The matrix spike recoveries are used to document the precision and performance of a method in a given sample matrix.

14.9 Method Blank (MB): An analyte-free matrix to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank is processed simultaneously with the samples through all the steps of the analytical procedure. The method blank is used to document contamination resulting from the analytical process.

14.10 Sample Duplicate (DUP): A replicate sample which is used to document the precision of a method in a given sample matrix.

14.11 Preservation: Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical integrity of the sample.

15.0 METHOD PERFORMANCE

Method performance is monitored through the routine analysis of negative and positive control samples. These control samples include method blanks (MB), blank spikes (BS), matrix spikes (MS), and matrix spike duplicates (MSD). The MB and BS are used to monitor overall method performance, while the MS and MSD are used to evaluate the method performance in a specific sample matrix.

Blank spike, matrix spike, and matrix spike duplicate samples are compared to method defined control limits. Statistical control limits are stored in the LIMS for QA purposes only. Additionally, blank spike accuracy is regularly evaluated for statistical trends that may be indicative of systematic analytical errors.

16.0 Hot Block Maintenance

Clean surface area of hot block periodically to prevent sample and reagent build up on the surface of the block. If the hot block cannot maintain a temperature between 90-95 degree C or the user experiences any other type of mechanical or electronic error a service representative will need to be contacted. Any hot block that is not functioning properly must be tagged as “Out of Service”.

Table 1: ICP Metals Spiking Levels
(Suggested levels, may vary depending on instrumentation used.)
Blank Spike, Matrix Spike, Matrix Spike Duplicate

ELEMENT	INITIAL CONC (ppm)	VOLUME USED (ml)	FINAL CONC (mg/l)	FINAL VOL. (ml)
Ba	200	0.50	2.0	50
Be	5	0.50	.05	50
Cd	5	0.50	.05	50
Cr	20	0.50	.20	50
Cu	25	0.50	.25	50
Co	50	0.50	0.50	50
Mn	50	0.50	0.50	50
V	50	0.50	0.50	50
Zn	50	0.50	0.50	50
As	200	0.50	2.0	50
Se	200	0.50	2.0	50
Pb	50	0.50	0.50	50
Tl	200	0.50	2.0	50
Sb	50	0.50	0.50	50
**Mo	100	0.25	0.50	50
**Sn	100	0.25	0.50	50
*Al	200/5000	0.5/0.25	27	50
*Fe	200/5000	0.5/0.25	26	50
*Mg	5000	0.25	25	50
*Ca	5000	0.25	25	50
*K	5000	0.25	25	50
*Na	5000	0.25	25	50
Ag	5	0.50	0.05	50
Ni	50	0.50	0.50	50
**Sr	100	0.25	0.50	50
**Ti	100	0.25	0.50	50

(*) Al, Fe, Mg, Ca, K, Na are from Multi-B (or equivalent)

(**) Mo, Sn, Sr, Ti are prepared from stock standards.

Remainder of elements from CLP-SS or equivalent

Table 2: ICPMS Metals Spiking Levels
(Suggested levels, may vary depending on instrumentation used.)
Blank Spike, Matrix Spike, Matrix Spike Duplicate

ELEMENT	INITIAL CONC (ppm)	VOLUME USED (ml)	FINAL CONC (mg/l)	FINAL VOL. (ml)
Ba	10	1.0	0.20	50
Be	10	1.0	0.20	50
Cd	10	1.0	0.20	50
Cr	10	1.0	0.20	50
Cu	10	1.0	0.20	50
Co	10	1.0	0.20	50
Mn	10	1.0	0.20	50
V	10	1.0	0.20	50
Zn	10	1.0	0.20	50
As	10	1.0	0.20	50
Se	10	1.0	0.20	50
Pb	10	1.0	0.20	50
Tl	10	1.0	0.20	50
Sb	10	1.0	0.20	50
Mo	10	1.0	0.20	50
Sn	10	1.0	0.20	50
*Al	5000	0.20	20	50
*Fe	5000	0.20	20	50
*Mg	5000	0.20	20	50
*Ca	5000	0.20	20	50
*K	5000	0.20	20	50
*Na	5000	0.20	20	50
**Ag	100	0.05	0.10	50
Ni	10	1.0	0.20	50
Sr	10	1.0	0.20	50
Ti	10	1.0	0.20	50

(*) Al, Fe, Mg, Ca, K, Na are from Multi-B (or equivalent)

(**) Ag from MSAG-100PPM or equivalent

Remainder of elements from ICPMS spiking solution.

REVISION HISTORY

Revision Date	Revision Number	Affected Section(s)	Revision Description
12/2020	17	“Revised Sections”	Added Revision History and removed Revised Sections. No other revisions necessary
4/13/2022	18	References	Added TNI 2016 and QSM 5 Series and UCMR 5
4/13/2022	18	1	Updated 200.7 1983 to EPA 200.7, rev 4.4 1994
4/13/2022	18	2	reformatted
4/13/2022	18	6.6	Added “If alternate digestion tubes are used and they do not come with a certificate of cleanliness then the lot is checked prior to usage and data kept on file.”
4/13/2022	18	7	Removed reference to ASTM water
4/13/2022	18	7.3	Added Reagent water
4/13/2022	18	8.1	Added “A serial dilution, as well as a post digestion spike are batched in LIMS and performed at the analytical bench.
4/13/2022	18	8.7	Added “A serial dilution, as well as a post digestion spike are batched in LIMS and performed at the analytical bench.
4/13/2022	18	8.7.2	Added “reducing volume to approximately 10-20 mls”
4/13/2022	18	8.7.3	Added “Cover the digestion vessels with watch glasses and gently reflux for an additional 30 minutes.”
4/13/2022	18	12	Update entire section
4/13/2022	18	Table 2	Remove soil spiking criteria
4/13/2022	18	General	Added SOP acknowledgement form with QA/SAM references

DIGESTION OF WATER SAMPLES FOR ICP/ICPMS ANALYSIS
SOP Acknowledgement Form

I have read and understand this SOP. I will not knowingly deviate from this approved SOP without approval of the Department Supervisor, QA Officer, or Technical Manager. If I notice any discrepancies between this SOP and the routine procedure, I will notify the Department Supervisor so that either the SOP or procedure can be changed. Furthermore, I understand that this SOP is property of SGS North America Inc. – Orlando and may not be printed nor duplicated in any manner.

Internal SOPs referenced within this SOP: QA006, QA017, QA033, QA037, QA002, SAM101, SAM104, SAM108, MET100, GN196

Print Name	**Signature**	**Date**

Print the SOP Acknowledgement Form, sign, and submit to the SGS Orlando QA department

COLD VAPOR ANALYSIS OF MERCURY FOR WATER SAMPLES

Prepared by: David Metzgar III Date: 04/07/2022

Approved by: Svetlana Izosimova Date: 04/21/2022

Annual Review

Reviewed by: Svetlana Izosimova Date: ______

Reviewed by: ______ Date: ______

Reviewed by: ______ Date: ______

Document Control

Issued to: QA Department - Digital Date: 04/21/2022

Issued to: Metals - Digital Date: * 04/21/2022

Issued to: ______ Date: ______

Issued to: ______ Date: ______

Issued to: ______ Date: ______

Issued to: ______ Date: ______

Effective 7 days after "*" date

CONTROLLED COPY
DO NOT DUPLICATE

TITLE: COLD VAPOR ANALYSIS OF MERCURY FOR WATER SAMPLES

REFERENCES:

TNI 2016 Standards
DoD QSM 5.0 - Series
EPA 245.1 Rev.3, 1994
SW-846 7470A
WV 47CSR32

INSTRUMENT SERIAL #: 2004 (HG4), 2019 (HG5)

WAVELENGTH: 253.7 nm

1.0 SCOPE AND APPLICATION, SUMMARY

1.1 The method outlined in this SOP is based on EPA method 245.1 and SW846 7470A for waters. The types of samples that can be analyzed include drinking, surface and saline waters, as well as domestic and industrial wastes.

1.2 The mercury is reduced to the elemental state and aerated from the solution in a closed system. The mercury vapor passes through a cell in the light path of an atomic spectrophotometer, where the absorbance is measured as a function of mercury concentration.

Note: Please refer to current version of DoD QSM 5 for quality control criteria.

2.0 PRESERVATION AND BOTTLEWARE

All samples should be preserved with nitric acid to a pH of <2 at the time of collection. All sample pH are checked in sample receiving and within the metals department. Samples that are received with a pH >2 must be preserved to pH <2 and held for 24 hours prior to metals digestion to dissolve any metals that absorb to the container walls. Refer to SOP SAM101, current revision for further instruction.

Samples received for dissolved metals analysis should be filtered and preserved to pH<2 as soon as possible and held for 24 hours prior to digestion. Refer to SGS - Orlando Sample Filtration Logbook for further information.

All soil samples must be stored in a refrigerator at $\leq$ 6°C upon receipt. Refer to SOP SAM101, current revision for further instruction.

All bottle ware used by SGS - Orlando is tested for cleanliness prior to shipping to clients. Analysis results must be less than one half the reporting limit to be acceptable. Refer to SOP SAM104, current revision for further instruction.

3.0 HOLDING TIME AND STORAGE

All samples should be prepared and analyzed within 28 days of the date of collection.

Aqueous samples do not require refrigeration.

4.0 REPORTING and METHOD DETECTION LIMITS

4.1 Reporting Limit. The reporting limit for this method has been established at 0.0005 mg/l.

4.2 Method Detection Limit: MDL is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is distinguishable from method blank results. Experimentally determine MDLs using the procedure specified in 40 CFR, Part 136, Appendix B, Rev. 2. For further details on the procedure refer to SOP QA020, current revision

4.3 Compounds detected at concentrations between the RL and MDL are quantitated and qualified as estimated values and reported with either a “J” or “I” qualifier. Some program or project specifications may require that no values below the RL be reported.

5.0 INTERFERENCES

Possible interference from sulfide is eliminated by the addition of potassium permanganate. Concentrations of sulfide as sodium sulfide as high as 20 mg/l do not interfere with mercury recoveries when following this method. Copper concentrations > 10 mg/l may also interfere with mercury recoveries. Samples that are high in chloride such as seawater, brine and industrial effluent may require as much as 12.5 ml of additional permanganate.

Note: When chloride concentrations are high, hydroxylamine sulfate and stannous sulfate should be used in place of corresponding chlorides.

Finally, certain volatile organic materials will also absorb at this wavelength and can interfere. It can be determined if this type of interference is present by doing a preliminary run without reagents.

6.0 APPARATUS

6.1 A Leeman HYDRA AA II automated analyzer is used for all analysis. Currently there are two Hydra AA's in service at SGS - Orlando. Refer to the instrument manual for further details on this instrumentation.

6.2 Automatic repipettor (s).

6.3 Fisher Brand 0.45 micron (um) filter or equivalent. Filter lots are checked for cleanliness through the Method Blank process. All Method Blank analytical results must be <1/2 reporting limit to be acceptable, if not, the contaminated lot must be identified and removed from laboratory use. Samples filtered through the contaminated filters must be re-filtered through acceptable filters.

6.4 Fisher Brand disposable 10 ml syringes or equivalent. Syringe lots are checked for cleanliness through the Method Blank process. All Method Blank results must be < ½ reporting limit to be acceptable, if not, the contaminated lot must be identified and removed from laboratory use. Samples filtered through the contaminated syringes must be re-filtered through acceptable syringes.

6.5 Environmental Express Hot Block or equivalent capable of maintaining 90-95 ^{o}C.

6.6 Environmental Express digestion vessels or equivalent, 65ml capacity. Each Lot of digestion tubes comes with a Certificate of Analysis which demonstrates cleanliness as well as volume accuracy. If alternate digestion tubes are used and they do not come with a certificate of cleanliness then the lot is checked prior to usage and data kept on file. Please refer to Digestion Tube Certificate Logbook for further information. Tube Lots are also checked through the Method Blank process. All Method Blank analytical results must be < ½ reporting limit to be acceptable, if not, the contaminated lot must be identified and removed from laboratory use. Re-digestion is required for all samples prepared with the contaminated tube lot.

6.7 Class A volumetric pipette (s), flask (s), and cylinder (s)

6.8 Thermometer(s), capable of measuring a temperature of at least 125 ^{o}C, checked against NIST traceable thermometers. Refer to SOP QA002, current revision for further information.

6.9 Eppendorf Pipette (s) - Pipette (s) are checked daily for accuracy and to ensure they are in good working condition prior to use. Volumes are checked at 100% of maximum volume (nominal volume). Pipettes are checked within the metals department and results are stored electronically in the "Pipette Calibration Log". Refer to SOP QA006, current revision for further information regarding pipette calibration. BIAS: mean must be within 2% of nominal volume. Precision: RSD must be $\leq$ 1% of nominal volume based on three replicates.

6.10 Top Loader Balance (used to prepare reagents) – Capable of accurately weighing 0.01 g. Refer to SOP QA005, current revision for further information.

6.11 Data System

Microsoft Windows 7 Professional
Instrument software – HG4 - Leeman Labs Envy 1.9 sp1
Instrument software – HG5 - Leeman Labs Envy 2.0 sp0

6.11.1 A computer system interfaced to the Leeman Hydraa II that allows for the continuous acquisition and storage of all data obtained throughout the duration of the analytical run sequence.

6.11.2 Data is archived to a backup server for long term storage.

7.0 REAGENTS

All chemicals listed below are trace metal grade unless otherwise specified. These standards and reagents must be accompanied by the Certificate of Analysis (CoA). The CoA is examined for accuracy and completeness of the information, including verification of the reagent/standard normality/concentration. For further details refer to SOP QA017, current revision. Refer to Acid Certificate of Analysis electronic logbook for Certificates of Analysis and compliance with the specifications of the grade listed. Refer to the Metals Department Electronic Standard Prep Logbook for the make-up and concentrations of standards and stock solutions being used within this SOP. Some of the information included in the logbook is as follows: standard name, elements in mix, manufacturer, lot number, parent expiration date, acid matrix, stock concentration, volume of standard added, total volume, final prepared concentration, prep date, initials, MET number, and prepared standard expiration date. Standards and prepared reagents must be prepared every 6 months or before stock standard expiration date, whichever comes first**.** Refer to section 8.0 of this SOP for concentration levels of standards used. Unless otherwise approved, the calibration curve must be determined by a blank and a series of five non-zero standards representing the elements of interest.

Note: All reagents/standards can be scaled up or down proportionately if different final volumes are required.

7.1 Sulfuric acid, concentrated, trace metal grade

7.2 Nitric acid, concentrated, trace metal grade

7.3 Reagent Water – Water that has been generated by any method which shall meet method specified requirements. TNI 2016 definition. Reagent water is used exclusively for laboratory purposes. Refer to SOP QA037, current revision for more information regarding testing and monitoring.

7.4 Stannous chloride, reagent grade. To 400 ml of DI water, add 50 ml of concentrated Hydrochloric acid, and 50 g of stannous chloride. Dilute to 500 ml with DI water. Stannous sulfate may be used in place of stannous chloride. Stannous chloride is prepared daily. Lot number is recorded in Hg Digestion logbook.

7.5 Sodium chloride-hydroxylamine hydrochloride, reagent grade. Add 120 g of sodium chloride and 120 g of hydroxylamine hydrochloride to 1 liter of DI water. Mix well; hydroxylamine sulfate may be used in place of hydroxylamine hydrochloride.

7.6 Potassium permanganate, reagent grade. Add 50 g of potassium permanganate to 1 liter of DI water and mix well.

Caution: Potassium permanganate is a strong oxidizing agent. Handle with care.

7.7 Potassium persulfate, reagent grade. Add 50.0 g of potassium persulfate to 1 liter of DI water and mix well.

Caution: Potassium persulfate is a strong oxidizing agent. Handle with care.

7.8 2 percent HCl Carrier Solution. 40 mls concentrated HCl, diluted to 2 liters with DI water. 2 percent HCL carrier solution is prepared daily. Lot number is recorded in Hg Digestion logbook.

7.9 10 percent HCL rinse solution. Add 100mls of concentrated HCL to final volume of 1 liter of DI water.

7.10 Mercury working standards. Mercury standard solutions are made from a purchased stock solution of 1000 ppm mercury.

7.10.1 10 ppm Hg solution. (Used to prepare 100ppb Mercury solution) Using a 10 ml class A volumetric pipette, add 10 ml of 1000 ppm stock to a 1.00 liter class A volumetric flask containing approximately 750 ml of DI water and 10 ml of concentrated nitric acid. Dilute to volume with DI water and mix well. This 10ppm standard must be prepared every six months.

7.10.2 100 ppb Hg solution. (Used to prepare calibration curve, CCV, CRI). Using a 10 ml class A volumetric pipette, add 10 ml of 10 ppm Hg solution to a 1.00 liter class A volumetric flask containing approximately 750 ml of DI water and 10 ml of concentrated nitric acid. Dilute to volume with DI water and mix well. This 100ppb standard must be prepared every month.

7.10.3 Second source working solutions are prepared at the same concentrations as the calibration standards listed above in sections 7.8.1 and 7.8.2 except they must be from a second source.

7.10.4 Daily working standards used in section 8.0 are prepared and digested daily using 100ppb standard solutions.

8.0 WATER DIGESTION AND ANALYSIS PROCEDURE

Below is a step-by-step procedure for the digestion and analysis of water samples for mercury.

8.1 Make up the standard curve as shown below. Clearly label each digestion vessel with the standard's ID. The standard ID's should be recorded in the Mercury Digestion Logbook.

ml of 100 ppb Hg solution	ml of DI water	Total µg/L of Hg
0.0	50	0.0
0.10	50	0.20
0.50	50	1.0
1.50	50	3.0
2.50	50	5.0
3.00	50	6.0

Dilute to the 50ml mark on the digestion vessel with DI water.

8.2 Make up the quality control samples as shown below. Make sure to clearly label each digestion vessel.

Sample ID	ml of 100ppb Hg solution	ml of DI water	Total µg/L of Hg
*Spike Blank	1.5	50	3.0
CCV	1.5	50	3.0
Low Check (CRI)	0.10	50	0.20
Method Blank	0.0	50	0.0
*ICV	1.5	50	3.0

Dilute to the 50ml mark on the digestion vessel with DI water.

Sample ID	ml of 100 ppb Hg solution	ml of sample	Total µg/L of Hg
*Matrix Spike	1.5	50	3.0 + sample
*Matrix Spike Dup	1.5	50	3.0 + sample
Duplicate		50	sample

Dilute to the 50ml mark on the digestion vessel with DI water.
*Use second source 100ppb solution.

8.3 Shake sample vigorously to ensure thorough mixing. Measure out 50 ml of each sample into a labeled digestion vessel. The sample may be measured by using a Class A graduated cylinder or by using the calibrated digestion tube. If no information is available about the level of mercury in the samples to be analyzed set up a 50 ml sample size. If information is available, select a sample size that will result in an analysis value near the mid-range of the curve. For TCLP / SPLP samples, use a 5 ml initial volume. Record the volume used in the Mercury Digestion Logbook.

8.4 To all samples, QC and standards add the following reagents:

- 1.25 ml of concentrated nitric acid
- 2.5 ml of concentrated sulfuric acid
- 7.5 ml of permanganate solution
- 4.0 ml of persulfate solution

Swirl the samples well after each addition of reagent. More potassium permanganate solution may be required for some samples. Enough should be added so that the purple color persists for at least 15 minutes. Ensure that equal amounts of potassium permanganate are added to the standards and blanks.

8.5 Pre-heat the Hot Block to 90-95 degree C. Place the sample vessels in the Hot Block. Heat the samples for 2 hours, remove and cool to room temperature. Allow samples to stand quietly without manual agitation.

8.6 While the samples are digesting, begin setting up the Leeman HYDRA AA II mercury analyzer following the steps outlined below. Further details are available in the instrument manual.

8.6.1 Turn the Argon gas on. Check that the vent line is properly connected.

8.6.2 Inspect all pump tubing and replace if necessary. Put the tubing on the cassettes and attach to the pump head, making sure the cassette adjusters are properly adjusted to provide a smooth flow of sample and reagents. Place the fresh stannous chloride solution in the bottle. Fill the rinse bottle with 2 percent HCL carrier solution. Connect stannous chloride and HCL rinse lines.

8.6.3 Double click on the Envoy icon on the desktop. This will open the Envoy mercury analysis software. Click on the green and black arrow icon. This will start the pump, turn on the gas, and turn on the lamp.

8.6.4 Locate the “Sequence” tab at the bottom of the Envoy software page. Now click on “sequence” at the top of the page and click “new”. Type in the run sequence starting with the MB. After typing in the entire days run sequence click on the “Update” button. Click on “sequence” at the top of the page and choose “save”. Type in run sequence name as follows: Instrument-month-day-matrix-run number. (i.e. h40606w1).

8.6.5 Locate “Analysis” tab at bottom of Envoy page. Now click on “Analysis” at the top of the page and click “new”. Enter analysis dataset as follows: Instrument-month-day-matrix-run number (i.e. h40606w1).

8.6.6 Add 3 ml of hydroxylamine hydrochloride solution to each standard and sample and swirl until the solution has been completely decolorized before analyzing. Bring samples to a final volume of 50mls using DI water. If the sample (s) contain particulate matter, it should be filtered (performed at the analytical bench), along with the method blank and blank spike through a 0.45 um syringe filter before analysis. Samples are now ready for analysis.

8.6.7 Calibration is performed by analyzing a series of 5 standards and a blank. All calibration curves must be determined from a linear calibration prepared in the normal manner using the established analytical procedure for the instrument. Refer to instrument manual for further detail. A correlation coefficient of **≥0.995** must be achieved, if not, analysis must be terminated, the problem corrected, and instrument re-calibrated. Calibration data is printed and included with each analytical data package. Click on the “Run sequence” icon. Instrument will start calibration. Once the calibration is complete the instrument will automatically accept the curve if correlation coefficient ≥0.995. Before continuing perform manual verification of the low and mid standard for percent relative error, see section 9.14 for more information. Then proceed to start the analysis sequence with the High standard, ICV, ICB, CRI, CCV, and CCB. The calibration curve and all initial QC are compared to check tables set up in the software. If any standard fails the set criteria it will be flagged on the screen as to alert the analyst. The instrument will continue the analysis of the run sequence if all QC criteria has been met.

8.6.8 After analysis has been completed flush the entire system with 10% HCL, then DI water, and then allow to pump dry. Unclamp all tubing, turn off gas and lamp.

8.6.9 Raw data generation (PDF File)

Open the “PDF Creator” icon located on the desktop. Click on the green light, it will turn red. Go to the Envoy software. Click on the “Method” tab and then locate that days calibration curve. Click on print to PDF creator. Now go to the “Analysis” tab, click on “report” and “clear all.” Click on “Load” and choose “Accutest” profile. Select all samples to be reported. Choose “report” as output. Next click on “Printer” and send to PDF creator. Leave the report title blank and click “OK”. Now go back to the “PDF Creator” which should still be open on the desktop and click on “Document”, “combine all.” Click on the red light which should now turn green. Close the PDF creator. Go to the “Pdf shortcut” icon located on the desktop and rename .PDF to MAxxxx.pdf. Right click on MAxxxx.pdf, copy, then paste to the “Lims Data” icon on the desktop. Open the pdf file (MAxxxx.pdf) and print to metals printer. This will generate the raw data that will be included in the run package. Now close the pdf file and archive.

8.6.10 LIMS data generation

Choose “CSV” as output under the “Analysis” tab. Type in analysis dataset (h40606w1), no extension. Go to the “Export” shortcut located on the desktop. Locate analysis dataset (h40606w1.csv), right click on file and open with wordpad. Change Blank, 0.2ppb, 1.0ppb, 3.0ppb, 5.0ppb, and 6.0ppb to STD1 (STD1_1 for 245.1, STD1_2 for 7470A), STD2, STD3, STD4, STD5, and STD6. Remove all percent recoveries from the file and the save and close the file. Right click on the analysis dataset, copy/paste to “Lims Data” icon on desktop. If the run contains any errors an “error report” will be generated to the metals printer. Correct any errors and re-send the file. Archive run sequence (.SEQ) and analysis dataset (.CSV) when done.

9.0 QUALITY CONTROL

All QC calculations should be done as outlined in the method. Please refer to scheduling sheets and/or project specific QAPP for further information regarding client specific QC requirements. Check with area supervisor or lab manager for any non-compliant quality control for further information.

9.1 Method Blank – An acceptable method blank or reagent blank must be analyzed with every batch of samples processed. The method blank must be less than one half the reporting limit. If the method blank is greater than one half the reporting limit, the samples associated with the contaminated blank shall be evaluated as to the best corrective action for each particular sample. This may include reanalyzing the samples, re-digesting and reanalyzing the samples, or qualifying the results with a “B” or “V” qualifier. All samples associated with an out of compliance method blank shall be qualified and footnoted in LIMS as well as in the case/run narrative.

9.2 High Standard Check (for method 245.1 only) – The high calibration standard must be analyzed after the initial calibration has been performed. The results of the high standard check must agree within 5 percent of the true value for the analysis to be valid. If the high standard check fails criteria, a new HSTD or initial calibration must be performed and all samples must be re-analyzed.

9.3 Initial Calibration Verification. Also referred as QCS – An initial calibration verification (ICV) sample must be analyzed after the initial calibration has been performed. This sample must be prepared at or near the midpoint of the initial calibration from a reference material independent from the initial calibration solution. The results of the ICV must agree within 10 percent of the true value for the analysis to be valid. If the ICV fails, a new ICV or initial calibration must be performed and all samples must be re-analyzed with an acceptable ICV.

9.4 Continuing Calibration Verification. Also referred to as IPC – If more than 10 samples are to be analyzed in a single day, a Continuing Calibration Verification sample prepared at or near the mid point of the initial calibration must be analyzed after every 10th sample and at the end of the analytical run. The results of the CCV analysis must be within 20 percent of the true value to be considered valid. For method 245.1 the results of the initial CCV must be within 5 percent of the true value for the analysis to be valid. All subsequent CCV’s must be within 10 percent of the true value to be considered valid. If the CCV fails, all samples analyzed after the first passing CCV must be reanalyzed.

9.5 Continuing Calibration Blank/Initial Calibration Blank – Analyze the Initial calibration blank solution at the beginning of each run and the continuing calibration blank after every tenth sample and at the end of the sample run. The ICB/CCB must be less than one half the reporting limit to be considered valid. The instrument blank may be failing the criteria due to contamination or instrument drift. Samples associated with the failing blank shall be evaluated as to the best corrective action for each particular sample. This may include reanalyzing the samples bracketed by the failing blank or qualifying the results with a “B” or “V” qualifier or raising the reporting limit for all samples to greater than two times the background concentration.

9.6 CRIA. Also referred to as LLCCV, LOQ, LLOQ – A standard prepared at the low calibration concentration should be prepared and analyzed at the beginning of each analytical run. The CRIA should agree within 20 percent of the true value to be acceptable. If the initial CRIA does not meet the acceptance criteria, the samples must be reanalyzed.

9.7 Blank Spike – A blank spike (BSP) or Laboratory Control Spike (LCS) should be prepared using DI water spiked at the midpoint of the calibration curve. The blank spike must be within 20 percent of the true value for the analysis to be considered valid. For method 245.1 the results of the BSP must be within 15 percent of the true value for the analysis to be valid. If the blank spike exceeds the acceptance criteria, the samples must be re-digested and reanalyzed. A blank spike is required for every 20 field samples or for each analysis batch. Statistical control limits are generated for LCS's for QA purposes only. Refer to section 15.0 of this SOP for further detail.

9.8 Duplicate - The laboratory must digest a duplicate for a minimum of 1 in 20 samples. The relative percent difference (RPD) between the duplicate and the sample must be assessed and must be $\leq$ 20 percent for sample results at or above the reporting limit. If the RPD is outside the 20 percent criteria the results must be qualified in LIMS. RPD's are also calculated in LIMS for sample results below the reporting limit. RPD's outside the 20 percent criteria are not considered failing and LIMS automatically footnotes these as "RPD acceptable due to low duplicate and sample concentrations."

9.9 Matrix Spike/Matrix Spike Duplicate/MSA – At least on Matrix Spike/Matrix Spike Duplicate pair must be prepared and analyzed with every 20 field samples. The MS/MSD recovery must agree within 30 percent of the true value for method 245.1 and within 20 percent of the true value for method 7470A. Relative standard deviation (RSD) for the MSD should be $\leq$ 20 percent. If the results of the MS/MSD are outside the acceptance criteria, the data should be footnoted as possible matrix effect. In certain circumstances the Method of Standard Additions (MSA) may be needed by some project specific requirements. SGS - Orlando may perform an MSA when sample matrix is so complex that viscosity, surface tension, and components cannot be accurately matched with standards. If an MSA is not performed the results may be footnoted in LIMS. SGS - Orlando will use a single addition method as described in SW846-7000B.

9.10 When sample concentrations exceed the upper limit of the calibration curve, samples shall be diluted back into the calibration range and reanalyzed.

9.11 When preparing TCLP/SPLP samples, prepare an additional leachate blank and leachate blank spike from the extraction fluid used to extract the samples. See section 9.1 and 9.7 for acceptance criteria.

9.12 When preparing dissolved metals, an additional method blank must be prepared. The method blank must be filtered through the same filter media as the samples and then digested as usual. This is performed to ensure there is no cross contamination from the filter media into the samples. See section 9.1 for acceptance criteria.

9.13 Serial Dilution - For one sample per preparation batch, or whenever matrix interferences are suspected for a batch of samples, a serial dilution should be prepared. For the serial dilution, a 1:5 dilution should be made on the sample. The results of the 1:5 dilution should agree within 10 percent of the true value as long as the sample and the dilution result are greater than 10 times the method detection limit and/or greater than 50 times the IDL. If the dilution is not within 10 percent then a footnote must be entered into LIMS.

9.13 For each digestion batch of 20 samples, a serial dilution (performed at the analytical bench), a matrix spike (MS), a matrix spike duplicate (MSD), a duplicate (DUP), a blank spike (LCS), and a method blank should be prepared. Re-digestion is suggested for QC that does not meet the SGS - Orlando QC limits. The appropriate lab supervisor or lab manager will notify the analyst of samples that need re-digestion.

9.14 Percent Relative Error

The laboratory shall use and document a measure of relative error in the calibration;

i. For calibrations evaluated using an average response, the determination of the relative standard deviation (RSD) is the measure of the relative error.

ii. For calibrations evaluated using correlation coefficient or coefficient of determination, the laboratory shall evaluate relative error by either:

a. Measurement of the Relative Error (%RE)

Relative error is calculated using the following equation:

$$\% \text{ Relative Error} = \frac{x'_i - x_i}{x_i} \times 100$$

X_i = True value for the calibration standard
X'_i = Measured concentration of the calibration standard

This calculation shall be performed for two calibration levels: the standard at or near the mid-point of the initial calibration and the standard at the lowest level.

The Relative Error at both of these levels shall meet the criteria specified in the method. If no criteria for the lowest calibration standard is specified in the method, the criteria and the procedure for deriving the criteria shall be specified in the SOP.

SGS Orlando has established the % Relative Error as follows:

LLCCV must be within 20%.

MidPoint must be within 10%

10.0 DOCUMENTATION REQUIREMENTS

All digestion information should be documented in the Electronic Sample Digestion Logbook. The information required includes the sample identification (including the sample bottle number), the initial sample volume, and the final sample volume, the acids used (including lot number and manufacturer), the spiking solutions used, the digestion vessel lot number, the observed temperature, corrected temperature, the thermometer ID, analyst's signature, the date of digestion, digestion start time, and digestion end time. The analyst should write additional information such as unusual sample characteristics and samples that need to be filtered (dissolved analysis) in the comment section. All raw data is printed to .PDF format and archived to a backup server for long term storage.

11.0 SAFETY

11.1 The analyst should follow normal safety procedures as outlined in the SGS Health and Safety Program and SGS Orlando SOP QA033 (Laboratory Safety Procedure), current revision. which includes the use of safety glasses and lab coats. Gloves should be worn. In addition, all acids are corrosive and should be handled with care. Flush spills with plenty of water. If acids contact any part of the body, flush with water and contact the supervisor.

11.2 The toxicity or carcinogenicity of each reagent used in this method has not been precisely determined; however, each chemical should be treated as a potential health hazard. Exposure to these reagents should be reduced to the lowest possible level. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of data handling sheets should be made available to all personnel involved in these analyses.

12.0 CALCULATIONS

Below are the calculations, which should be used for soil samples. The concentration of the sample in µg should be obtained from the linear calibration curve.

$$\textbf{Final concentration in mg/kg} = \frac{\textbf{Concentration of sample in µg}}{\textbf{(Sample wt in g)(\%solids/100)}}$$

Matrix Spike and Matrix Spike Duplicate Recovery:

$$\frac{\textbf{(Spiked Sample Result - Sample Result)}}{\textbf{Amount Spiked}} \times 100 = \textbf{matrix spike recovery}$$

Matrix Duplicate/Matrix Spike Duplicate Relative Percent Difference:

$$\frac{\textbf{(|Sample Result - Duplicate Result|)} \times 100}{\textbf{(Sample Result + Duplicate Result)/2}} = \textbf{Duplicate RPD}$$

13.0 POLLUTION PREVENTION AND WASTE MANAGEMENT

13.1 Pollution Prevention

Users of this method must perform all procedural steps in a manner that controls the creation and/or escape of wastes or hazardous materials to the environment. The amounts of standards, reagents and solvents must be limited to the amounts specified in this SOP. All safety practices designed to limit the escape of vapors, liquids or solids must be followed. All method users must be familiar with the waste management practices described in Section 13.2.

13.2 Waste Management

Individuals performing this method must follow established waste management procedures as described in the Sample and Laboratory Waste Disposal SOP SAM108, current revision. This document describes the proper disposal of all waste materials generated during the testing of samples.

14.0 GENERIC DEFINITIONS

14.1 Batch: A group of samples which are similar with respect to matrix and the testing procedures being employed and which are processed as a unit. A sample batch is limited to a maximum of 20 samples or 24 hours whichever comes first.

14.2 Blank Spike (BS): An analyte-free matrix spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. Blank Spike Recoveries are used to document laboratory performance for a given method. This may also be called a Laboratory Control Sample (LCS).

14.3 Continuing Calibration Verification (CCV): A check standard used to verify instrument calibration throughout an analytical run. A CCV must be analyzed at the beginning of the analytical run, after every 10 samples, and at the end of the run.

14.4 Holding Time: The maximum times that samples may be held prior to preparation and/or analysis and still be considered valid.

14.5 Initial Calibration (ICAL): A series of standards used to establish the working range of a particular instrument and detector. The low point should be at a level equal to or below the reporting level.

14.6 Initial Calibration Verification (ICV): A standard from a source different than that used for the initial calibration. A different vendor should be used whenever possible. The ICV is used to verify the validity of an Initial Calibration. This may also be called a QC check standard.

14.7 Matrix Spike (MS): A sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The matrix spike recoveries are used to document the performance of a method in a given sample matrix.

14.8 Matrix Spike Duplicate (MSD): A replicate sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The matrix spike recoveries are used to document the precision and performance of a method in a given sample matrix.

14.9 Method Blank (MB): An analyte-free matrix to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank is processed simultaneously with the samples through all the steps of the analytical procedure. The method blank is used to document contamination resulting from the analytical process.

14.10 Sample Duplicate (DUP): A replicate sample which is used to document the precision of a method in a given sample matrix.

14.11 Preservation: Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical integrity of the sample.

15.0 METHOD PERFORMANCE

Method performance is monitored through the routine analysis of negative and positive control samples. These control samples include method blanks (MB), blank spikes (BS), matrix spikes (MS), and matrix spike duplicates (MSD). The MB and BS are used to monitor overall method performance, while the MS and MSD are used to evaluate the method performance in a specific sample matrix.

Blank spike, matrix spike, and matrix spike duplicate samples are compared to method defined control limits. Statistical control limits are stored in the LIMS for QA purposes only. Additionally, blank spike accuracy is regularly evaluated for statistical trends that may be indicative of systematic analytical errors

16.0 GLASSWARE CLEANING

All glassware should be washed with soap and tap water, rinsed with 5 percent nitric acid solution, and then rinsed at least three times with DI water. Refer to SOP GN196, current revision for further information regarding glassware cleaning.

17.0 INSTRUMENT MAINTENANCE

Recommended periodic maintenance includes the items outlined below. All maintenance must be recorded in the instrument maintenance log.

17.1 Change the pump tubing weekly or as needed.

17.2 Clean the optical cell and lenses once per week or as needed.

17.3 Change the sampler tip as needed.

17.4 Inspect the liquid/gas separator, mixing coil, and all tubing connections once per week and replace as needed.

QC Criteria Summary

Quality Control	Frequency	Acceptance Criteria	Corrective Action
Initial Calibration: r = coefficient of correlation	Daily	≥0.995	Rerun calibration standards, and/or prepare new calibration standards and recalibrate the instrument, or document why the data are acceptable.
Percent Relative Error (%RE)	Each initial calibration	80 – 120 % of the lowest cal. standard's true value. 90-110% of the calibration standard at or near the mid-point's true value	Rerun calibration standards, and/or prepare new calibration standards and recalibrate the instrument.
Initial Calibration Verification standard (ICV)	One per calibration	90 – 110% of the standard's true value	Rerun standard, and/or prepare new standard, and/or recalibrate instrument, or document why the data are acceptable.
Continuing Calibration Verification standard (CCV)	After initial calibration, every tenth sample, and at end.	245.1 Initial 95-105% Subsequent 90-110% 7470A 80-120% DoD 90-110%	Rerun standard, and/or recalibrate instrument and reanalyze all samples run since the last acceptable CCV, or document why the data are acceptable.
Blanks (MB)(ICB)(CCB)	(MB) One per batch (ICB) After initial calibration (CCB) After initial calibration, every 10th sample, and at the end.	< ½RL	Reanalyze, and/or stop the run and determine the source of contamination, or document why the data are acceptable.
Blank Spike (BS or LCS)	One per batch	245.1: 85-115% 7470A: 80-120%	Determine and correct the problem, reanalyze samples, if necessary, or document why data are acceptable. For DoD, assess against DoD criteria.

Quality Control	Frequency	Acceptance Criteria	Corrective Action
Sample RSD	NA	Elements >5x RL, RSD<5%	Reanalyze sample, or document why the data are acceptable.
High Standard Readback 245.1	After initial calibration	95-105% of true value	Rerun standard, and/or prepare new standard, and/or recalibrate instrument, or document why the data are acceptable.
MS/MSD/DUP	5% of matrix	245.1:70-130% 7470A: 80-120% %RPD ≤20%	If the results are outside these criteria then matrix interference should be suspected, and the proper footnote entered into LIMS. For DoD, assess against DoD criteria.
Linear Calibration Range (LCR)	NA	May not exceed highest calibration standard	Dilute sample result into working range
Low level CCV (CRIA)	One per calibration	80-120% of the standard's true value.	Rerun standard, and/or prepare new standard, and/or recalibrate instrument, or document why the data are acceptable.
Serial Dilution (SDL)	One per batch	The results of the 1:5 dilution shall agree within 20 percent of the true value as long as the analyte concentration is within the linear range of the instrument and sufficiently high (minimally, a factor of 25 times greater than the RL).	If the results are outside these criteria then matrix interference should be suspected, and the proper footnote entered into LIMS.
Interferences	NA	NA	See Section 5 for guidance

REVISION HISTORY

Revision Date	Revision Number	Affected Section(s)	Revision Description
12/2020	13	"Revised Sections"	Added Revision History and removed Revised Sections. Sec. 9.1 added detail and removed references to WV blank evaluation.
4/7/2022	14	Summary	Added detail
4/7/2022	14	References	Added TNI 2016 and DoD QSM 5
4/7/2022	14	4.2-4.3	Revised MDL procedure
4/7/2022	14	9.14	Added section % relative error
4/7/2022	14	7.3	Added section reagent water
4/7/2022	14	9.3	Updated ICV criteria for 245.1 to the same as 7470
4/7/2022	14	9.13	Updated batch size for 245.1
4/7/2022	14	General	Added QC Summary
4/7/2022	14	General	Added SOP Acknowledgement Form
4/7/2022	14	6.6	Added detail to alternate digestion tubes.
4/7/2022	14	7	Added "Note" section
4/7/2022	14	8.6.7	Added percent relative error checks for low and mid standards
4/7/2022	14	11	Revised entire section

COLD VAPOR ANALYSIS OF MERCURY FOR WATER SAMPLES

SOP Acknowledgement Form

I have read and understand this SOP. I will not knowingly deviate from this approved SOP without approval of the Department Supervisor, QA Officer, or Technical Manager. If I notice any discrepancies between this SOP and the routine procedure, I will notify the Department Supervisor so that either the SOP or procedure can be changed. Furthermore, I understand that this SOP is property of SGS North America Inc. – Orlando and may not be printed nor duplicated in any manner.

Internal SOPs referenced within this SOP: QA017, QA020, QA006, QA033, QA037, QA002, QA005, SAM101, SAM104, SAM108

Print Name	**Signature**	**Date**

Print the SOP Acknowledgement Form, sign, and submit to the SGS Orlando QA department.

METALS BY INDUCTIVELY COUPLED PLASMA – MASS SPECTROMETRY (ICP-MS)

Prepared by:	Dave Metzgar	Date:	04/06/2022
Approved by:	Svetlana Izosimova	Date:	04/20/2022

Annual Review

Reviewed by:		Date:	
Reviewed by:		Date:	
Reviewed by:		Date:	

Document Control

Issued to:	QA Department - Digital	Date:	04/20/2022
Issued to:	Metals Department - Digital	Date: *	04/20/2022
Issued to:		Date:	
Issued to:		Date:	
Issued to:		Date:	
Issued to:		Date:	

Effective 7 days after "*" date

CONTROLLED COPY
DO NOT DUPLICATE

TITLE: METALS BY INDUCTIVELY COUPLED PLASMA – MASS SPECTROMETRY (ICP-MS)

REFERENCES:

TNI 2016 Standards
DoD QSM 5.0 - Series
SW846 6020B, Revision 2, July 2014.
EPA200.8, Revision 5.4, 1994.

Note: Refer to scheduling sheets and/or project specific QAPP for further information regarding client specific QC requirements. Also check with metals supervisor for additional information. Please refer to current version of DoD QSM 5 for quality control criteria.

Main Instrument: Agilent 7700x, serial # JP12151709
Auto-sampler: CETAC ASX500, serial # US091320A520

1.0 SCOPE AND APPLICATION

1.1 This method is applicable for the determination of total and dissolved metals in water samples and in waste extracts or in solid or aqueous digests. Please refer to table 1 for a list of reportable elements.

2.0 SUMMARY

2.1 Samples are prepared for analysis by digestion. Please refer to method specific digestion SOP's within the metals department for more information. The prepared samples are introduced into a radiofrequency plasma by pneumatic nebulization. There the energy transfer processes cause desolvation, atomization, and ionization. The ions are extracted from the plasma through a differentially pumped vacuum interface and separated on the basis of their mass to charge ratio by a quadrupole mass spectrometer. The ions transmitted through the quadrupole are detected by an electron multiplier and the ion information is processed by a data handling system.

3.0 REPORTING LIMIT(RL)

3.1 Reporting limits (RL) are based on the extraction procedure. Reporting limits may vary depending on matrix complications, volumes and by client needs, but the reporting limits must always be verified with a low check which meets the criteria outlined in this SOP. Solid matrices are reported on a dry weight basis. Refer to table 1 of this SOP for SGS - Orlando typical reporting limits. Refer to scheduling sheets and/or project specific QAPP for further information regarding client specific reporting limits.

3.2 Method Detection Limit: MDL is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is distinguishable from method blank results. Experimentally determine MDLs using the procedure specified in 40 CFR, Part 136, Appendix B, Rev. 2. For further details on the procedure refer to SOP QA020, current revision

3.3 Lower limit of quantitation check sample (LLOQ). The lower limit of quantitation check (LLQC) sample should be analyzed after establishing the lower laboratory reporting limits and on a quarterly basis to demonstrate the desired detection capability. The LLQC sample is carried through the entire preparation and analytical procedure. Lower limits of quantitation are verified when all analytes in the LLQC sample are detected within 20 percent of their true value.

3.4 Compounds detected at concentrations between the RL and MDL are quantitated and qualified as estimated values and reported with either a “J” or “I” qualifier. Some program or project specifications may require that no values below the RL be reported.

3.5 Instrument Detection Limits (IDL). IDL’s should be completed upon initial instrument installation. SGS - Orlando does not report to IDL.

4.0 GENERIC DEFINITIONS

BATCH. A group of 20 samples or less that behaves similarly with respect to the sampling or the testing procedures being employed and which are processed as a unit within a 24 hour period. For QC purposes, if the number of samples in a group is greater than 20, then each group of 20 samples or less will all be handled as a separate batch.

CALIBRATION CHECK STANDARD. (CCV) calibration check standard is a mid-range calibration standard.

EXTERNAL CHECK STANDARD. (ICV) The external check standard is a standard from a separate source than the calibration curve that is used to verify the accuracy of the calibration standards.

SPIKE BLANK OR LAB CONTROL SAMPLE. Digest and analyze a laboratory control sample or spike blank with each set of samples. A minimum of one lab control sample or spike blank is required for every 20 sample batch.

MATRIX: The component or substrate (e.g., water, soil) which contains the analyte of interest.

MATRIX DUPLICATE: A duplicate sample is digested at a minimum of 1 in 20 samples. They are used to document the precision and bias of a method in a given sample matrix.

MATRIX SPIKE: The laboratory must add a known amount of each analyte to a minimum of 1 in 20 samples.

MATRIX SPIKE DUPLICATES: Intralaboratory split samples spiked with identical concentrations of target analyte(s). The spiking occurs prior to sample preparation and analysis. They are used to document the precision and bias of a method in a given sample matrix.

METHOD BLANK. The laboratory must digest and analyze a method blank with each set of samples. A minimum of one method blank is required for every 20 sample batch

REAGENT GRADE. Analytical reagent (AR) grade, ACS reagent grade, and reagent grade are synonymous terms for reagents which conform to the current specifications of the Committee on Analytical Reagents of the American Chemical Society.

STANDARD ADDITION. The practice of adding a known amount of an analyte to a sample immediately prior to analysis. It is typically used to evaluate interferences.

STANDARD CURVE: A plot of concentrations of known analyte standards versus the instrument response to the analyte. Calibration standards are prepared by successively diluting a standard solution to produce working standards which cover the working range of the instrument.

5.0 HEALTH & SAFETY

5.1 The analyst should follow normal safety procedures as outlined in the SGS Health and Safety Program and SGS Orlando SOP QA033 (Laboratory Safety Procedure), current revision. which includes the use of safety glasses and lab coats. Gloves should be worn. In addition, all acids are corrosive and should be handled with care. Flush spills with plenty of water. If acids contact any part of the body, flush with water and contact the supervisor.

5.2 The toxicity or carcinogenicity of each reagent used in this method has not been precisely determined; however, each chemical should be treated as a potential health hazard. Exposure to these reagents should be reduced to the lowest possible level. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of data handling sheets should be made available to all personnel involved in these analyses.

6.0 SAMPLE COLLECTION, PRESERVATION & HOLDING TIME

All samples should be preserved with nitric acid to a pH of <2 at the time of collection. All sample pH are checked in sample receiving and within the metals department. Samples that are received with a pH >2 must be preserved to pH <2 and held for 24 hours prior to metals digestion to dissolve any metals that absorb to the container walls. Refer to SOP SAM101, current revision for further instruction.

Samples received for dissolved metals analysis should be filtered and preserved to pH<2 as soon as possible and held for 24 hours prior to digestion. Refer to SGS - Orlando Sample Filtration Logbook for further information.

All soil samples must be stored in a refrigerator at ≤ 6°C upon receipt. Refer to SOP SAM101, current revision for further instruction.

All bottle ware used by SGS - Orlando is tested for cleanliness prior to shipping to clients. Analysis results must be less than one half the reporting limit to be acceptable. Refer to SOP SAM104, current revision for further instruction.

7.0 INTERFERENCES

7.1 Several types of interferences can cause inaccuracies in trace metals determinations by ICP-MS. These interferences are discussed below.

7.2 Isobaric elemental interferences are caused by isotopes of different elements which form singly or doubly charged ions of the same nominal mass-to-charge ratio and which cannot be resolved by the mass spectrometer in use. If isobaric interferences are present in the ion being analyzed, then the data must be corrected by measuring the signal from another isotope of the interfering element and subtracting the appropriate signal ratio from the element of interest.

7.3 Abundance sensitivity is a property that defines the degree to which the wings of a mass peak contribute to adjacent masses and is affected by ion energy and quadrupole operating pressure. Wing overlap interferences may result when a small ion peak is being measured next to a large one. Spectrometer resolution should be adjusted to minimize these interferences.

7.4 Isobaric polyatomic ion interferences are caused by ions consisting of more than one atom which have the same nominal mass-to-charge ratio as the isotope of interest, and which cannot be resolved by the mass spectrometer in use. Refer to method 200.8, and 6020B for lists of common interferences and correction equations to be applied. If these interferences cannot be avoided by the use of different isotopes, then correction equations should be applied to the data. Alternatively, collision/reaction cell technology can be applied to physically and chemically remove interferences.

7.5 Physical interferences can occur during the transfer of the solution to the nebulizer (viscosity effects).

7.6 Memory interferences can be caused by buildup on the sampler and skimmer cones, and from buildup of sample material in the torch and spray chamber. Some elements, such as mercury, can suffer from severe memory effects. In that case, gold is added to the rise solution to decrease the Hg rinse out time.

7.7 Interference correction equation procedure.

Interference correction equations are used to correct interference with target elements due to other elements or formation of polyatomic ions. Specify the elements related to the interference to be corrected. Isotope masses and isotope ratios are displayed in Mass table. Select the check boxes for the masses for which correction equations are set. Equations are displayed in the Equation table. Select the elements for which the correction equations are set. Select the masses for which the correction equations are set. Select positive or negative sign for the factor, enter masses in the Mass field and enter the factors of the correction equations in the Multiplier field. “OK” applies to settings and the specified interference correction equation is displayed in the “Select Elements on Periodic Table” dialog box.

8.0 APPARATUS

8.1 Currently in use is an Aglilent 7700x ICP-MS with collision/reaction cell capacity and HMI (High matrix interface) and the associated autosampler.

8.2 Data system

8.2.1 Microsoft Windows 7 Professional Version 2009

8.2.2 Agilent Masshunter, Version B.01.03, Build 393.17, Patch 2, 2014

8.2.3 Computer system interfaced with Agilent ICP-MS that allows continuous data acquisition and storage of all data obtained throughout the duration of the analytical run sequence. Data is backed up and archived for long-term storage

8.3 Class A volumetric glassware as needed.

8.4 Instrument autosampler tubes.

8.5 Polypropylene bottles for standard storage. These bottles must also be cleaned as outlined above.

8.6 Eppendorf Pipette (s) - Pipette (s) are checked daily for accuracy and to ensure they are in good working condition prior to use. Volumes are checked at 100% of maximum volume (nominal volume). Pipettes are checked within the metals department and results are stored electronically in the “Pipette Calibration Log”. Refer to SOP QA006, current revision for further information regarding pipette calibration. BIAS: mean must be within 2% of nominal volume. Precision: RSD must be $\leq$1% of nominal volume based on three replicates.

8.7 Fisher Brand 0.45 micron (um) filter or equivalent. Filter lots are checked for cleanliness through the Method Blank process. All Method Blank analytical results must be less than one half the reporting limit to be acceptable, if not, the contaminated lot must be identified and removed from laboratory use. Samples filtered through the contaminated filters must be re-filtered through acceptable filters.

8.8 Fisher Brand disposable 10 ml syringes or equivalent. Syringe lots are checked for cleanliness through the Method Blank process. All Method Blank results must be less than one half the reporting limit to be acceptable, if not, the contaminated lot must be identified and removed from laboratory use. Samples filtered through the contaminated syringes must be re-filtered through acceptable syringes.

8.9 Polypropylene auto sampler tubes.

Note: All glassware must be washed with soap and tap water and then soaked in a 10% nitric acid bath for several hours. It must then be rinsed at least 3 times with distilled, deionized water.

9.0 REAGENTS AND STANDARDS

Please refer to electronic standard logbook for detailed information regarding standard preparation.

Note: All reagents can be scaled up or down proportionately if different final volumes are required. All chemicals listed below are reagent grade unless otherwise specified.

9.1 Reagent Water – Water that has been generated by any method which shall meet method specified requirements. TNI 2016 definition. Reagent water is used exclusively for laboratory purposes. Refer to SOP QA037, current revision for more information regarding testing and monitoring.

9.2 Hydrochloric acid, trace metals grade.

9.3 Nitric acid, trace metals grade. Note – ultra trace grade may be required if lower detection limits than normal are needed.

9.4 Standard stock solutions available from Inorganic Ventures, Ultra Scientific, VHG Laboratories or equivalent. Note: All standards must be ICP-MS quality standards or must be demonstrated to be free of interferences at the levels of use. Standards should come labeled with an expiration date and certificate of concentrations from the manufacturer. The certificate of concentrations is examined for accuracy and completeness of the information, including verification of the reagent/standard normality/concentration. If both of these items are not received, then the manufacturer should be contacted before use of the standard. For further details refer to SOP QA017, current revision.

9.5 Calibration Standards: These can be made up by diluting the stock solutions to the appropriate concentrations. Fresh calibration standards should be prepared a minimum of every two weeks. They must be monitored weekly for stability.

9.5.1 Standards and blanks should be made in a low acid matrix. Concentrations of 1 to 2 percent nitric acid and 0 to 0.5 percent hydrochloric acid are suggested, although any acid concentration that provides good analytical results may be used. High chloride concentrations may cause interferences so chloride concentrations should be limited. HCl may be omitted if silver and antimony are not elements of interest.

9.5.2 Refer to the electronic standard prep logbook for the make-up and concentrations of standards and stock solutions being used to calibrate the ICP-MS. Suggested standard levels are shown in Table 2.

9.6 Aglient P/A Factor and Tuning/Performance Check Solution. Mix 1.0 ml of PA Tuning 1 solution and 1.0 ml of PA Tuning 2 solution (available from Aglient, part number 5188-6524) and bring to 100 ml final volume. This final solution contains 200 ppb of As, Be, Cd, Zn; 100 ppb of Mg, Ni, and Pb; 50 ppb of Al, Ba, Bi, Co, Cr, Cu, In, Li^6, Lu, Mn, Na, Sc, Sr, Th, Tl, U, and V; and 25 ppb of Y and Yb; 100 ppb of Ge, Mo, Pd, Ru, Sb, Sn ; and 50 ppb of Ir and Ti.

9.7 Tuning Standard, Agilent ICP-MS. This solution is used to verify mass calibration and thermal stability and must contain a mix of elements representing all of the mass regions of interest. Elements include 1 ppb Ce, Co, Li, Mg, Tl, and Y.

9.8 Internal Standards. Internal standards are added to all calibration standards, quality control, and samples during analysis, normally using a second channel of the peristaltic pump and a mixing manifold. The internal standard solution is recommended to contain Sc, Y, In, Tb, and Bi.

9.8.1 For the Aglient instrument, a solution containing 1 ppm of Li, Sc, Lu, In, Tb, Bi, Te and Ge in 1 % nitric is recommended. Refer to Table 3.

9.9 Calibration/Rinse Blank. The calibration blank is used to establish the analytical calibration curve and the rinse blank is used to flush the instrument between samples in order to reduce memory interferences.

9.10 Continuing Calibration Verification Check (CCV). The metals should be at concentrations near the middle of the calibration curve. (Note: This check is run after the calibration, after every 10 samples or every 2 hours during an analysis run, whichever is more frequent, and at the end of the sample run.) CCV should be prepared from the same source as the calibration standards. Refer to Table 2 for suggested concentrations for the CCV.

9.11 Matrix Spike and Spike Blank Solution. Suggested levels for the final concentrations of the spike are shown in Table 4.

9.12 Lab Control Solution. This solution is prepared by adding either mixed or single element metal solutions to a fixed final volume. Suggested levels for the final concentrations of the spike are shown in Table 4.

9.13 Interference Element Check Solutions or spectral interference check solutions (SIC). The purpose of the ICSA and ICSAB solutions is to demonstrate the magnitude of interferences and provide an adequate test of any corrections. It is recommended that the following solutions be purchased commercially.

9.13.1 ICSA Solution. The ICSA solution contains only the interfering elements. The recommended concentrations are shown below. The ICSA solution must be made fresh weekly.

Al	100 mg/L
Ca	100 mg/L
Fe	100 mg/L
Mg	100 mg/L
Na	100 mg/L
P	100 mg/L
K	100 mg/L
S	100 mg/L
C	200 mg/L
Cl	1000 mg/L
Mo	2.00 mg/L
Ti	2.00mg/L

9.13.2 ICSAB Solution. The ICSAB solution contains both the interferents and the analytes of interest. The recommended concentrations are shown below. The ICSAB solution must be made fresh weekly.

Al	100 mg/L
Ca	100 mg/L
Fe	100 mg/L
Mg	100 mg/L
Na	100 mg/L
P	100 mg/L
K	100 mg/L
S	100 mg/L
C	200 mg/L
Cl	1000 mg/L
Mo	2.00 mg/L
Ti	2.00mg/L
As	0.020 mg/l
Cd	0.020 mg/l
Cr	0.020 mg/l
Co	0.020 mg/l
Cu	0.020 mg/l
Mn	0.020 mg/l
Ni	0.020 mg/l
Ag	0.020 mg/l
Zn	0.020 mg/l

9.14 Initial Calibration Verification (ICV) or Quality Control Sample (QCS). The metals in this solution should be at final concentrations that are at the mid-point of the calibration curve. Please see Table 2 for suggested levels. The ICV sample must be from an independent source from the calibration standards.

9.15 CRIA Standards. The CRIA standard must contain the elements of interest at (or below) the reporting limit for each element. The CRIA levels are shown in Table 1. This should be prepared by diluting calibration standard(s) to the reporting limit level for each element.

9.16 Liquid Argon or Argon Gas (99.999% purity). Argon is provided by Air Gas in micro bulk tank. No lab monitoring of the tank is normally necessary.

9.17 Helium Gas. Required for running the reaction cell on the Agilent 7700X.

10.0 INITIAL INSTRUMENT SET-UP PROCEDURE FOR THE AGILENT 7700X ICP-MS

Refer to section 11 and the QC Summary page for more information regarding QC criteria.

10.1 A general procedure on how to operate the Agilent 7700X ICP-MS is given below. Refer to the operation manual for further details.

10.2 Before bringing up the instrument, make sure that the lines, the torch, the nebulizer, and the spray chamber are clean, and that there are no leaks in the torch area.

10.3 Turn the vacuum pump and the heat exchanger on and verify that the liquid argon is turned on and the helium gas is turned on.

10.4 Connect the pump tubing and engage the peristaltic pump.

10.5 Put a new solution of acid rinse into the rinse reservoir. (Note: the composition of the rinse solution may be periodically changed to minimize sample introduction problems and sample carryover.) Make sure that sufficient internal standard solution is present.

10.6 Open the ICP-MS Mass Hunter software. Click on the instrument and open the instrument control panel. Click the plasma on. The instrument will automatically go through the start-up cycle. Then let the instrument warm up for at least 30 minutes.

10.7 Tune the instrument on a daily basis. Tuning must always be done after moving the position of the torch or the cones. Tuning can be done either manually or by following autotune procedures. It is recommended that autotune procedures be followed initially and then manual tuning be done as a second step. The purpose of tuning is to optimize the instrument for the highest sensitivity while obtaining low levels of oxides and doubly charged species. After the tune is complete, make sure to save the optimized parameters.

10.7.1 Open the ICP-MS top software, click on the instrument, and open the ICP-MS tuning page.

10.7.2 Click file and open the 6020B_200.8 Method .b file. Keep the internal standard line in a solution of 1% nitric acid and 0.5% hydrochloric acid. Place the carrier line into the 1 ppb tuning solution. (see 9.7). On the tuning page, click start under the tune window to see the counts and RSD values. Do not start the tune process until the count and mean have similar readings and the RSD is < 5%. The counts per second values should be > 40000 for all masses. Click stop under tune window.

10.7.3 Before starting auto tune and printing tune report, create a new batch folder from existing method 6020B_200.8.b. Save new batch using format "xaMMDDm1".

10.7.4 On the tuning page, click Autotune, type the date (MMDDYYM1) on the popup window and click OK. This will perform the tuning of the instrument. Verify acceptable mass calibration by monitoring the peak width measurement at 5% of peak maximum for Co_59, Y_89, and Tl_205. If the peak widths are outside of the range of 0.65 to 0.85 and the masses are off by more than 0.1 amu, then redo the mass calibration. After all criteria is met, print the report and include with raw data. The tune report is automatically stored in the batch folder.

10.8 Before calibrating, run and print out a performance test. This must include the following items.

10.8.1 Relative standard deviations of the absolute signals must be less than 5 percent for all monitored masses. This includes Li_7, Y_89, and Tl_205. If these criteria are not met, correct the problem and then repeat the stability test. Print the results of this test and store with the raw data for the run.

10.9 Before starting sample analysis, set up the internal standards. Internal standards are added to all calibration standards, quality control, and samples during analysis, normally using a second channel of the peristaltic pump and a mixing manifold. Refer to Table 3 and Section 9.8 for additional information.

10.10 To start running samples, add samples to sequence and click "Add to Queue". Unpause once ready to start analysis.

10.11 Calibrate the instrument using a minimum of a calibration blank and three non-zero standards that bracket the desired sample concentration range. Currently SGS- Orlando employs a curve consisting of a blank and 6 non-zero standards. The lowest non-zero standard must be at or lower than the RL levels for all the elements**.** (Note: The calibration standards may be included in the autosampler program or they may be run separately.) A correlation coefficient **of 0.998 or better** must be obtained using a first order (linear) curve fit. A minimum of three replicate integrations are required for all data acquisitions.

10.11.1 In between each analysis of a separate standard or sample, a rinse blank must be run through the lines of the sample introduction system. Each sample or standard should be aspirated for a minimum of 30 seconds prior to the acquisition of data to allow equilibrium to be established.

10.12 After the instrument is properly calibrated, begin by analyzing the ICV solution.

10.13 An ICB may be run after the ICV but is not required for this method. If it is run, then all elements must be less than ½ the reporting limit for each element

10.14 Run the CRIA solution right after the ICV and ICB.

10.15 Then analyze the continuing calibration verification (CCV) and continuing calibration blank (CCB) check standards.

10.16 After the initial QC is completed and before any samples are analyzed, the ICSA and ICSAB solutions (SIC solutions) must be analyzed.

10.16.1 If the run is longer than 12 hours, a second ICSA, ICSAB pair must be analyzed before the next 12 hours is started.

10.16.2 If mass changes are made for the analysis of an element, all QC criteria must be met for the new mass and it must be verified that appropriate correction factors are in place.

10.16.3 The Agilent 7700X includes collision/reaction cell technology. The instrument is tuned in regular (non-cell) mode and in helium (collision/reaction) cell mode. This technology is used to minimize interferences during analysis. If this technology is not applied, then correction factors for interferences must be added into the method.

10.17 After the initial analytical quality control has been analyzed, the samples and the preparation batch quality control should be analyzed. This includes the method blank, blank spike, duplicate, serial dilution, post digestion spike, matrix spike, and matrix spike duplicate. Depending on the type of digestion and the sample matrix, samples and the associated QC should normally be diluted by a factor of from 2 to 5 before analysis. This dilution factor should be indicated in the sample ID file on the instrument.

10.18 Each sample analysis must be a minimum of 3 integrations. For samples containing levels of elements greater than approximately 5 times the reporting limits, the relative standard deviations for the replicates should be less than 10%. If not, reanalyze the sample. If, upon reanalysis, the RSDs are acceptable, then report the data from the reanalysis. If RSD's are not acceptable on reanalysis, then the results for that element may, on the reviewer's discretion, be footnoted that there are possible analytical problems indicated by a high RSD between replicates. In some cases, an additional dilution analysis may be needed. Check with the area supervisor or manager for additional information.

10.19 The internal standard levels must be monitored for all samples and quality control. If the internal standard is not within 70%-120% of the internal standard level for the initial calibration blank, then the sample must be diluted to bring the internal standard to within the correct range. If the internal standard is still outside of the range after the initial dilution, then additional dilutions must be done until the internal standard is within the appropriate range.

If an internal standard is present in a sample, then do not use that internal standard. For example, Y is sometimes seen in real samples. If the Y recoveries are high relative to the other internal standards, then do not use the Y internal standard.

10.20 For readings that exceed the linear range for a given element, a dilution is required. For method 6020B, after calibration the laboratory may choose to analyze a standard at a higher concentration than the high standard used in the calibration curve. The standard must recover within 10 percent of the true value, and if successful, establishes the linear range. The linear range standards must be analyzed in the same instrument run as the calibration they are associated with but may be analyzed anywhere in the run. After a high reading, the following samples must be examined for possible carryover. A verification may be necessary by rinsing the lines with an acid solution and then re-reading the sample.

10.21 Indicate dilution factors for samples using “df” followed by the dilution factor after the sample ID. There should be a space between the sample number and the df.

10.22 Between each sample, flush the nebulizer and solution uptake system with a blank rinse solution for a minimum of 30 seconds or for the required period of time to ensure that analyte memory effects are not occurring. (60 seconds is recommended for normal methods excluding Hg and B. Longer times may be needed when Hg and B are being analyzed.)

10.23 Analyze the continuing calibration verification (CCV) solution and the continuing calibration blank (CCB) after every ten samples and at the end of the sample run.

10.24 The CRIA must be analyzed at the beginning of each analytical run.

10.24.1 It is recommended that the CRIA check be run bracketing every 4 to 8 hour period of analysis. It may be run as frequently as every 10 samples if the supervisory staff deems that this is necessary.

10.25 After the run is completed, convert the data file to a CSV format using the option on the results screen. First save the file on the local drive using the file naming system described below. Update the run in the LIMS and enter the run name into the workgroup using lower case characters. Then copy the data from the local drive to the LIMS drive.

10.25.1 The file should be named as followed- initial instrument indicator (xa), date (MMDD), year, and sequential run number for that day (M1). For example, the first run from 12/17/02 would be designated xa121702m1.csv.

10.26 Calculations are done in the LIMS using the calculations shown below.

10.26.1 Calculation for aqueous samples.

$$\text{original sample concentration of metal } (\mu g/l) = \frac{(\text{conc. in the digestate } (\mu g/l)) \times (\text{final digestate volume (ml)})}{(\text{Initial sample volume (ml)})}$$

10.26.2 Calculation for solid samples.

$$\text{original sample concentration of metal (mg/kg)} = \frac{(\text{conc. in the digestate } (\mu g/l)) \times (\text{final digestate volume (ml)})}{(\text{Initial sample weight (g)}) \times (\%\text{sol}/100)}$$

10.27 At the end of the analysis day the ICP-MS must be brought down using the following sequence.

10.21.1 Rinse the tip in a solution of 1 percent nitric acid and 0.5 percent hydrochloric acid for 10 minutes and in DI water for 20 minutes. (Note: a stronger acid solution may be needed depending on the matrix of the samples that were analyzed.)

10.21.2 Turn off the plasma using off button.

10.21.3 Release the tension on the pump tubing.

10.21.4 Turn off the cool flow and the printer.

11.0 QC REQUIREMENTS

Note: Refer to scheduling sheets and/or project specific QAPP for further information regarding client specific QC requirements. Also check with metals supervisor for additional information.

11.1 This section outlines the QA/QC requirements necessary to meet the method 6020B.

11.2 Instrument Detection Limits (IDLs). IDLs must be established for all analytes. Please refer to specific method for instructions on performing IDL studies.

11.3 Lower Limit of Quantitation (LLOQ) check standard. LLOQ is the lowest point of quantitation. The LLOQ is initially verified by the analysis of 7 replicate samples, spiked at the LLOQ and processed through all preparation and analysis steps of the method. The mean recovery should be within +/- 35 percent of the true value with an RSD $\leq$ 20 percent.

Ongoing Lower limit of quantitation (LLOQ) check sample. The lower limit of quantitation check sample should be analyzed on a quarterly basis to demonstrate the desired detection capability. The LLOQ sample is carried through the entire preparation and analytical procedure.

11.4 LLQC (Lower Limit of Quantitation Check Sample) or LOQ Verification sample. A sample must be digested and analyzed initially and on an as needed basis to verify the quantitation limits for the method. Recoveries of this check must be within 70 to 130% of the true value, 80 to 120% for method 6020B. If recoveries are outside of this level, then the reporting limit (LLOQ) must be increased to a level that can be verified.

11.5 Linear Calibration ranges. The upper limit of the linear dynamic range needs to be established for each wavelength used by determining the signal responses from a minimum of three, preferably five, different concentration standards across the linear range. The linear calibration range which may be used for the analysis of samples should be judged by the analyst from the resulting data. The data, calculations and rationale for the choice of range made must be documented and kept on file. A standard at the upper limit must be prepared, analyzed and quantitated against the normal calibration curve. The calculated value should be within ±10% of the true value. Linear calibration ranges should be determined whenever there is a significant change in instrument response. They must be done at least every six months. For any readings that exceed the linear range for a given element, a dilution is required. In addition, if there are significant interferences generated from elements above the linear range, than these elements must also be diluted so that accurate interfering element corrections can be applied.

For method 6020B, after calibration the laboratory may choose to analyze a standard at a higher concentration than the high standard used in the calibration curve. The standard must recover within 10 percent of the true value, and if successful, establishes the linear range. The linear range standards must be analyzed in the same instrument run as the calibration they are associated with but may be analyzed anywhere in the run. Normal linear range values by element are shown in Table 2.

11.6 Initial Calibration Verification (ICV) or Quality Control Sample (QCS) and Initial Calibration Blank (ICB). After every new calibration, an ICV must be analyzed. The analysis of the ICV may be followed by the analysis of the ICB, although this is not required by the method.

11.6.1 For the ICV, all elements to be reported must be within 10 percent of the true value and the replicates that exceed 5 times the reporting limit should have a relative standard deviation of less than 5 percent. The ICV must be from a different source than the calibration standards and must be near the mid-point of the calibration curve. If the ICV does not meet criteria, then the problem must be identified and corrected before samples can be run and reported for the element(s) that are outside of criteria. Correction of the problem can be verified by rerunning the check standard and showing that it meets QC criteria.

11.6.2 For the ICB, all elements to be reported must be less than 1/2 the reporting limit. If the ICB is outside of criteria, then the problem must be identified and corrected before samples can be run and reported for the element(s) that are outside of criteria. Correction of the problem can be verified by rerunning the check standard and showing that it meets QC criteria. Analysis of a CCB before running any reportable samples can be used to verify that the system meets calibration blank requirements.

11.7 Continuing Calibration Verification (CCV), also referred to as IPC, and Continuing Calibration Blank (CCB). Analyze the continuing calibration verification solution and the continuing calibration blank after every tenth sample and at the end of the sample run.

11.7.1 For the CCV, all elements to be reported must be within 10 percent of the true value and the replicates that are greater than 5 times the reporting limit should have a relative standard deviation of less than 5 percent. The CCV should be made from the same source as the calibration standards at a concentration near the mid-level of the calibration curve. If an element does not meet the recovery criteria of the CCV, then no samples can be reported for that element in the area bracketed by the CCV.

11.7.2 For the CCB, all elements to be reported must be less than ½ the reporting limit. If an element does not meet this criteria, then no samples can be reported for that element in the area bracketed by the CCB.

11.8 Interference Check Standards. After the initial QC is completed and before any samples are analyzed, the ICSA and ICSAB solutions (SIC solutions) must be analyzed. The method does not give specific criteria for the ICSA and ICSAB, but in house criteria should be applied. For all the spiked elements, the analyzed results must be within 20 percent of the true results. For unspiked elements, the interfering element solution should contain less than the absolute value of 2 times the reporting limit for each element. If these criteria are not met, then samples with significant interferences cannot be reported until the correction factors are optimized and the ICSA and ICSAB are within specifications.

11.8.1 If the run is longer than 12 hours, a second ICSA, ICSAB pair must be analyzed before the next 12 hours is started.

11.8.2 If mass changes are made for the analysis of an element, all QC criteria must be met for the new mass and it must be verified that appropriate correction factors are in place.

11.9 CRIA. Also referred to as LLCCV, LOQ, LLOQ. The CRIA standard containing the elements of interest at (or below) the reporting level for each element. The CRIA must be analyzed at the beginning of each analysis batch. The acceptance criteria for the CRIA check is 70 to 130% for method 200.8 and 80-120% for method 6020B. If an element does not meet this criteria, then all bracketed samples for that element in the concentration range between the CRIA and the CCV must be reanalyzed. Samples containing concentrations higher than the CCV may be reported as long as CCV criteria are met.

11.9.1 More frequent CRIA checks may be analyzed during the course of the run if system stability at the low end of the calibration is questionable.

11.9.2 It is recommended that the CRIA check be analyzed every 4 to 8 hour period of analysis. It may be run as frequently as every 10 samples if the supervisory staff deems that this is necessary.

11.10 Method Blank. The laboratory must digest and analyze a method blank with each set of samples. A minimum of one method blank is required for every 20 sample batch.

11.10.1 The default SOP limit for the method blank is that is must be less than one half of the reporting limit.

11.10.2 In addition, the blank is considered acceptable if it is less than 10% of the regulatory limit, or less than 10% of the lowest sample concentration for each analyte in a given preparation batch, whichever is greater. Samples associated with the contaminated blank shall be evaluated as to the best corrective action for each particular sample. This may include reanalyzing the samples, re-digesting and reanalyzing the samples, qualifying the results with a “B” or “V” qualifier, or raising the reporting limit to greater than two times the background concentration. All samples associated with an out of compliance method blank shall be qualified and footnoted in LIMS as well as the case/run narrative.

11.11 Lab Control Sample. Also referred to as Spike Blank. The laboratory must digest and analyze a laboratory control sample or spike blank with each set of samples. A minimum of one lab control sample or spike blank is required for every 20 sample batch. The laboratory should assess laboratory performance of the LCS against recovery limits of 80 to 120 percent for method 6020B. Recovery must be within 85 to 115 percent for method 200.8. In house LCS limits may also be generated to support these default limits. If the LCS is outside of the control limits for a given element, all samples must be redigested and reanalyzed for that element.

11.11.1 If solid lab controls are used, then the manufacturer's limits should be applied.

11.12 Matrix Spike. The laboratory must add a known amount of each analyte to a minimum of 1 in 20 samples. The matrix spike recovery is calculated as shown below. Recoveries should be assessed against default limits of 80 to 120 percent for method 6020B. Recovery must be within 70 to 130 percent for 200.8. In house limits may be generated for this method for informational purposes only. If a matrix spike is out of control, then the results should be flagged with the appropriate footnote and it is recommended that a post-digest spike be analyzed for the out of control element(s). If the matrix spike amount is less than one fourth of the sample amount, then the sample cannot be assessed against the control limits and should be footnoted to that effect. Note: Both the matrix spike amount and the sample amount are calculated to the IDL for any given element. Any value less than the IDL is treated as zero.

((Spiked Sample Result - Sample Result) / Amount Spiked) x 100 = matrix spike recovery

11.12.1 If a post-digest spike is required, the sample should be spiked with approximately 2 times the sample level or two times the reporting limits, whichever is greater. Limits of 80 to 120 percent are normally applied. The post-digest spike recovery must be footnoted on the matrix spike recovery or otherwise noted in the quality control summary report.

11.13 Matrix Spike Duplicate (MSD) or Matrix duplicate (DUP). The laboratory must digest a matrix spike duplicate or matrix duplicate sample for a minimum of 1 in 20 samples. The relative percent difference (RPD) between the MSD and the MS or between the DUP and the sample should be assessed. The RPD is calculated as shown below. The control limit for the duplicate RPD is method defined as 20%. If the sample and the duplicate results are less than 5 times the reporting limits and are within a range of ± the reporting limit, then the duplicate is considered to be in control. Note: Both the duplicate amount and the sample amount are calculated to the IDL for any given element. Any value less than the IDL is treated as zero.

11.13.1 If an MSD or duplicate is out of control, then the data should be checked carefully to confirm that the high RPD for a given element is not a result of an analytical problem. If an analytical problem is suspected, the MSD or duplicate must be reanalyzed for confirmation. If the initial and reanalysis are in agreement, within 20%, then the high RPD is a result of preparation or sample issues and further analysis of the initial preparation is not required. If the initial and reanalysis are not in agreement due to an analytical problem, then any affected samples in the associated batch should also be reanalyzed for that element.

11.13.2 If more than 50% of the elements in a sample have levels of at least 5 times the reporting limit and have a high RPD, then the MSD or duplicate should be re-digested for confirmation, unless the sample matrix is such that the non-homogeneity of the sample is visually apparent. If the results confirm, the results from the original MSD or duplicate should be flagged as indicative of possible sample non-homogeneity. If the results do not confirm, then the whole batch should be re-digested and reanalyzed.

11.13.3 If 50% or less of the elements in a sample have levels of at least 5 times the reporting limit and have a high RPD, then the high RPD should be footnoted as indicating possible sample non-homogeneity unless other problems are suspected. If problems are suspected, the reviewer will initiate re-digestion and reanalysis of the batch.

11.13.4 The calculations used to calculate RPD are shown below.

$$\frac{(|\text{MS Result - MSD Result}|) \times 100}{(\text{MS Result + MSD Result})/2} = \text{MSD RPD}$$

$$\frac{(|\text{Sample Result - Duplicate Result}|) \times 100}{(\text{Sample Result + Duplicate Result})/2} = \text{Duplicate RPD}$$

11.14 Serial Dilution. A serial dilution is required on a frequency of one in 20 samples. It is normally done on the same sample as is used for the matrix spike. If the analyte concentration is within the linear dynamic range of the instrument and sufficiently high (minimally a factor of at least 100 times greater than the concentration in the reagent blank), then an analysis of a fivefold (1+4) dilution must agree to within ±10% of the original determination. If not, an interference effect must be suspected and the serial dilution result for the element with the suspected interference must be footnoted. The serial dilution is calculated as shown below.

$$\frac{100 \times ((\text{Sample result – Serial dilution result}))}{\text{Sample result}} = \text{Serial dilution percent difference}$$

11.14.1 Results of less than the IDL are treated as 0. The concentration in the reagent blank is normally < 3 times the IDL, so the factor of 100 times the concentration in the reagent blank (listed above) so the limits should be applied to sample concentrations of greater than 300 times the IDL.

11.15 Percent Relative Error

The laboratory shall use and document a measure of relative error in the calibration;

i. For calibrations evaluated using an average response, the determination of the relative standard deviation (RSD) is the measure of the relative error.

ii. For calibrations evaluated using correlation coefficient or coefficient of determination, the laboratory shall evaluate relative error by either:

a. Measurement of the Relative Error (%RE)

Relative error is calculated using the following equation:

$$\% \text{ Relative Error} = \frac{x'_i - x_i}{x_i} \times 100$$

X_i = True value for the calibration standard
X'_i = Measured concentration of the calibration standard

This calculation shall be performed for two calibration levels: the standard at or near the mid-point of the initial calibration and the standard at the lowest level.

The Relative Error at both of these levels shall meet the criteria specified in the method. If no criteria for the lowest calibration standard is specified in the method, the criteria and the procedure for deriving the criteria shall be specified in the SOP.

SGS Orlando has established the % Relative Error as follows:

LLCCV must be within 20%.

MidPoint must be within 10%.

12.0 DOCUMENTATION REQUIREMENTS

12.1 If samples or QC checks require reanalysis, a brief explanation of the reason must be documented on the run log. All instrument data should be exported to the LIMS system.

12.2 The Electronic Standard Preparation Logbook must be completed for all standard preparations. All information requested must be completed. The SGS - Orlando Lot Number must be cross-referenced on the standard vial.

12.3 The Instrument Maintenance Logbook must be completed when any type of maintenance is performed on the instrument. Each instrument has a separate log.

12.4 The correction factors from each method must be printed out each time a change is made and stored in a notebook in the lab. Each time the correction factors are modified, a new printout must be obtained.

12.5 Any corrections to laboratory data must be done using a single line through the error. The initials of the person and date of correction must appear next to the correction.

12.6 Supervisory (or peer) personnel must routinely review (approximately once per month) all laboratory logbooks to ensure that information is being recorded properly. Additionally, the maintenance of the logbooks and the accuracy of the recorded information should also be verified during this review.

13.0 INSTRUMENT MAINTENANCE and TROUBLESHOOTING

Recommended periodic maintenance includes the items outlined below.

13.1 Change the pump tubing weekly or as needed.

13.2 Clean the nebulizer, torch, and injector tube every two to four weeks or more often as needed.

13.3 Change the sampler tip as needed (every one to two months).

13.4 Clean the recirculating pump lines as needed.

Record all maintenance in the Maintenance logbook. Repairs by manufacturer representative and outside contractors must be documented in this logbook as well.

14.0 POLLUTION PREVENTION & WASTE MANAGEMENT

14.1 Users of this method must perform all procedural steps in a manner that controls the creation and/or escape of wastes or hazardous materials to the environment. The amounts of standards, reagents, and solvents must be limited to the amounts specified in this SOP. All safety practices designed to limit the escape of vapors, liquids or solids to the environment must be followed. All method users must be familiar with the waste management practices described in section 14.2

14.2 Waste Management. Individuals performing this method must follow established waste management procedures as described in the waste management SOP, SAM108, current revision. This document describes the proper disposal of all waste materials generated during the testing of samples as follows:

14.2.1 Non hazardous aqueous wastes.

14.2.2 Hazardous aqueous wastes

14.2.3 Chlorinated organic solvents

14.2.4 Non-chlorinated organic solvents

14.2.5 Hazardous solid wastes

14.2.6 Non-hazardous solid wastes

15.0 METHOD PERFORMANCE

Method performance (accuracy and precision) is monitored through the routine analysis of negative and positive control samples. These control samples include method blanks (MB), blank spikes (BS), matrix spikes (MS), and matrix spike duplicates (MSD). The MB and BS are used to monitor overall method performance, while the MS and MSD are used to evaluate the method performance in a specific sample matrix.

Blank spike, matrix spike, and matrix spike duplicate samples are compared to method defined control limits. Control limits are stored in the LIMS. Additionally, blank spike accuracy is regularly evaluated for statistical trends that may be indicative of systematic analytical errors.
Filtered method blanks and blank spikes to act as QC check of the filters. Unfiltered method blanks and blank spikes are used to monitor overall method performance.

QC Criteria Summary

Quality Control	Frequency	Acceptance Criteria	Corrective Action
Initial Calibration: r = coefficient of correlation	Daily	≥0.998	Rerun calibration standards, and/or prepare new calibration standards and recalibrate the instrument, or document why the data are acceptable.
Percent Relative Error (%RE)	Each initial calibration	80 – 120 % of the lowest cal. standard's true value. 90-110% of the calibration standard at or near the mid-point's true value	Rerun calibration standards, and/or prepare new calibration standards and recalibrate the instrument.
Initial Calibration Verification standard (ICV)	One per calibration	90 – 110% of the standard's true value	Rerun standard, and/or prepare new standard, and/or recalibrate instrument, or document why the data are acceptable.
Continuing Calibration Verification standard (CCV)	After initial calibration, every tenth sample, and at end.	90 - 110% of the standard's true value	Rerun standard, and/or recalibrate instrument and reanalyze all samples run since the last acceptable CCV, or document why the data are acceptable.
Blanks (MB)(ICB)(CCB)	(MB) One per batch (ICB) After initial calibration (CCB) After initial calibration, every 10th sample, and at the end.	< ½RL	Reanalyze, and/or stop the run and determine the source of contamination, or document why the data are acceptable.
Blank Spike (BS or LCS)	One per batch	85-115% 200.8 80-120% 6020B	Determine and correct the problem, reanalyze samples, if necessary, or document why data are acceptable. For DoD, assess against DoD criteria.
Sample RSD	NA	Elements >5x RL, RSD<5%	Reanalyze sample, or document why the data are acceptable.

Quality Control	Frequency	Acceptance Criteria	Corrective Action
High Standard Readback	NA	NA	NA
MS/MSD/DUP	5% of matrix	70-130%, 200.8 80-120%, 6020B %RPD <u><</u>20%	If the results are outside these criteria then matrix interference should be suspected, and the proper footnote entered into LIMS. For DoD, assess against DoD criteria.
Linear Calibration Range (LCR)	Every 6 months	± 10% of the standard's true value	See section 11.5 for more detail
Low level CCV (CRIA)	One per calibration	70-130% 200.8 80-120% 6020B	Rerun standard, and/or prepare new standard, and/or recalibrate instrument, or document why the data are acceptable.
ICSA and ICSAB	One per calibration	Concentration measured for any target analyte must be < 2 x RL. For spiked elements, results must be within 20% of standard's true value.	Rerun standard, and/or prepare new standard, and/or recalibrate instrument, or document why the data are acceptable.
Serial Dilution (SDL)	One per batch	The results of the 1:5 dilution shall agree within 10 percent of the true value as long as the analyte concentration is within the linear range of the instrument and sufficiently high (minimally, a factor of 25 times greater than the RL).	If the results are outside these criteria then matrix interference should be suspected, and the proper footnote entered into LIMS.

Quality Control	Frequency	Acceptance Criteria	Corrective Action
Internal Standard	All samples and standards	70-120% referenced against ICB	Dilute sample until internal standard are within range. Footnote data accordingly in LIMS.

Table 1
Elements, Masses, and Reporting Limit for Agilent ICP-MS

Mass and Element	Associated Tune (1 = no gas, 2= helium, 3= optimized helium) (this may vary)	CRIA Check (ug/L)	Normal Digested Aqueous Sample Reporting (ug/l) DF 2	Normal Digested Solid Sample Reporting Limit (mg/kg) DF5	Comments
9Be	2	1.0	2.0	0.5	
11B	2	NA	NA	NA	
23Na	2	100	200	25	
24Mg	2	100	200	25	
27Al	2	100	200	25	
39K	2	100	200	25	
44Ca	2	100	200	25	
47Ti	2	1.0	2.0	0.5	
51V	2	1.0	2.0	0.5	
52Cr	2	1.0	2.0	0.5	
55Mn	2	1.0	2.0	0.5	
56Fe	2	100	200	25	
59Co	2	1.0	2.0	0.5	
60Ni	2	1.0	2.0	0.5	
63Cu	2	1.0	2.0	0.5	
66Zn	2	1.0	2.0	0.5	
75As	2	1.0	2.0	0.5	
78Se	2	1.0	2.0	0.5	
88Sr	2	1.0	2.0	0.5	
95Mo	2	1.0	2.0	0.5	
107Ag	2	1.0	2.0	0.5	
111Cd	2	1.0	2.0	0.5	
118Sn	2	1.0	2.0	0.5	
121Sb	2	1.0	2.0	0.5	
137Ba	2	1.0	2.0	0.5	
205Tl	2	1.0	2.0	0.5	
208Pb	2	1.0	2.0	0.5	

Table 2:
Recommended Standard Concentration Levels; ICV/CCV Levels; Normal Linear Ranges in (ug/L)

Mass and Element	StdA	StdB	StdC	StdD	StdE	StdF	StdG				NORMAL LINEAR RANGE	ICV	CCV
6Li	0	NA	NA	NA	NA	NA	NA				1000	NA	NA
9Be	0	0.5	1.0	10.0	50.0	100.0	200				1000	100	100
11B	0	0.5	1.0	10.0	50.0	100.0	200				NA	100	100
23Na	0	50	100	1000	5000	10000	20000				100000	10000	10000
24Mg	0	50	100	1000	5000	10000	20000				100000	10000	10000
27Al	0	50	100	1000	5000	10000	20000				100000	100	100
39K	0	50	100	1000	5000	10000	20000				100000	10000	10000
44Ca	0	50	100	1000	5000	10000	20000				100000	10000	10000
47Ti	0	0.5	1.0	10.0	50.0	100.0	200				1000	100	100
51V	0	0.5	1.0	10.0	50.0	100.0	200				1000	100	100
52Cr	0	0.5	1.0	10.0	50.0	100.0	200				1000	100	100
55Mn	0	0.5	1.0	10.0	50.0	100.0	200				1000	100	100
56Fe	0	50	100	1000	5000	10000	20000				100000	10000	10000
59Co	0	0.5	1.0	10.0	50.0	100.0	200				1000	100	100
60Ni	0	0.5	1.0	10.0	50.0	100.0	200				1000	100	100
63Cu	0	0.5	1.0	10.0	50.0	100.0	200				1000	100	100
66Zn	0	0.5	1.0	10.0	50.0	100.0	200				1000	100	100
75As	0	0.5	1.0	10.0	50.0	100.0	200				1000	100	100
78Se	0	0.5	1.0	10.0	50.0	100.0	200				1000	100	100
88Sr	0	0.5	1.0	10.0	50.0	100.0	200				1000	100	100
95Mo	0	0.5	1.0	10.0	50.0	100.0	200				1000	100	100
107Ag	0	0.5	1.0	10.0	50.0	100.0					1000	50	50
111Cd	0	0.5	1.0	10.0	50.0	100.0	200				1000	100	100
118Sn	0	0.5	1.0	10.0	50.0	100.0	200				1000	100	100
121Sb	0	0.5	1.0	10.0	50.0	100.0	200				1000	100	100
137Ba	0	0.5	1.0	10.0	50.0	100.0	200				1000	100	100
205Tl	0	0.5	1.0	10.0	50.0	100.0	200				1000	100	100
208Pb	0	0.5	1.0	10.0	50.0	100.0	200				1000	100	100

Table 3
Internal Standard Masses and Tune Mode

Mass and Element (this may vary)	Associated Tune for Aglient only (1 = no gas, 2= helium, 3= optimized helium) (this may vary)	Comments
6Li	2	
45Sc	2	
72, 74 Ge	2	
115 In	2	
125 Te	2	
159 Tb	2	
175 Lu	2	
209 Bi	2	

Table 4
MS, MSD and Blank Spike Concentrations

Element	Soils Final Concentration in mg/kg	Aqueous Final Concentration in μg/l	
Ag	2.5	50	
Al	500	10000	
As	5	100	
B	NA	NA	
Ba	5	100	
Be	5	100	
Ca	500	10000	
Cd	5	100	
Co	5	100	
Cr	5	100	
Cu	5	100	
Fe	500	10000	
K	500	10000	
Mg	500	10000	
Mn	5	100	
Mo	5	100	
Na	500	10000	
Ni	5	100	
Pb	5	100	
Sb	5	100	
Se	5	100	
Tl	5	100	
V	5	100	
Zn	5	100	
Sn	5	100	
Sr	5	100	
Ti	5	100	
Pd	NA	NA	

REVISION HISTORY

Revision Date	Revision Number	Affected Section(s)	Revision Description
12/2020	04	“Revised Sections”	Added Revision History and removed Revised Sections. Sec. 11.10.2 added detail “All samples associated with an out of compliance method blank shall be qualified and footnoted in LIMS as well as the case/run narrative.” METHOD BLANK in Definitions – removed reference to WV blank evaluation.
4/7/2022	05	9.5.1	Added acid matrix concentration information
4/7/2022	05	General	Removed all references to acid matrix makeup with the exception of section 9.5.1
4/7/2022	05	10.11	Update calibration information
4/7/2022	05	References	Added TNI, removed 6020A
4/7/2022	05	3	Added detail
4/7/2022	05	4.2-4.3	Updated MDL procedure
4/7/2022	05	5	Updated health and safety
4/7/2022	05	6	Updated preservation
4/7/2022	05	8	Added auto-sampler tubes
4/7/2022	05	9.1	Added reagent water
4/7/2022	05	General	Changed CRI to CRIA
4/7/2022	05	10.11	Updated calibration curve information
4/7/2022	05	10	Removed QC criteria references, they are located in section 11, Quality Control
4/7/2022	05	10.12.1 – 10.12.2	Removed, moved to sections 10.13 and 10.14
4/7/2022	05	10.17	Added matrix QC
4/7/2022	05	11.9.1	Re-worded

4/7/2022	05	11.12.1	Removed serial dilution reference
4/7/2022	05	12.2	Added “Electronic”
4/7/2022	05	Table 2	Added low standard
4/7/2022	05	General	Added SOP acknowledgement form
4/7/2022	05	8	Added section 8.6-8.9
4/7/2022	05	General	Added QC Summary
4/7/2022	05	11.15	Added % relative error

METALS BY INDUCTIVELY COUPLED PLASMA – MASS SPECTROMETRY (ICP-MS)

SOP Acknowledgement Form

I have read and understand this SOP. I will not knowingly deviate from this approved SOP without approval of the Department Supervisor, QA Officer, or Technical Manager. If I notice any discrepancies between this SOP and the routine procedure, I will notify the Department Supervisor so that either the SOP or procedure can be changed. Furthermore, I understand that this SOP is property of SGS North America Inc. – Orlando and may not be printed nor duplicated in any manner.

Internal SOPs referenced within this SOP: QA020, QA006, QA017, QA033, QA037, SAM101, SAM104, SAM108

Print Name	Signature	Date

Print the SOP Acknowledgement Form, sign, and submit to the SGS Orlando QA department

ANALYSIS OF VOLATILE ORGANICS BY GC/MS

Prepared by: Norm Farmer Date: 03/08/2022

Approved by: Chelsea Vandenburg Date: 03/14/2022

Annual Review

Reviewed by: ______________________ Date: __________

Reviewed by: ______________________ Date: __________

Reviewed by: ______________________ Date: __________

Document Control

Issued to: QA Department Date: 03/15/2022

Issued to: MS Volatile Department - digital Date: * 03/15/2022

Issued to: ______________________ Date: __________

Issued to: ______________________ Date: __________

Issued to: ______________________ Date: __________

Issued to: ______________________ Date: __________

Effective 7 days after "*" date

CONTROLLED COPY
DO NOT DUPLICATE

TITLE: ANALYSIS OF VOLATILE ORGANICS BY GC/MS

REFERENCES: SW846 8260D

REVISED SECTIONS: 1.1.6, 6.3, 6.6, 7.2, 7.3 and 12.0

1.0 SCOPE AND APPLICATION, SUMMARY

1.1 Scope and Application

1.1.1 This method is used to determine the concentrations of various volatile organic compounds in water and solid matrices utilizing a gas chromatograph equipped with a mass spectrometer detector. Routine compounds can be found in Table 1.

1.1.2 The Lower Limit of Quantitation (LLOQ) or Reporting limits (RL) are based on the sample amount and the lowest calibration standard. LLOQs may vary depending on matrix complications and sample volumes. LLOQs for this method are in the range of 1.0-5.0 ug/l for aqueous samples and 5-25 ug/kg for solid samples. Solid matrices are reported on a dry weight basis.

1.1.3 The Method Detection Limit (MDL) for each analyte is evaluated on an annual basis for each matrix and instrument. MDLs are pooled for each matrix, and the final pooled MDLs are verified. The verified MDLs are stored in the LIMS and should be at least 2 to 3 times lower than the LLOQ. Exceptions may be made on a case by case basis; however, at no point shall the MDL be higher than the reported LLOQ.

1.1.4 The LLOQ for each analyte is evaluated on an annual basis for each matrix and instrument. The LLOQ verifications are prepared by spiking a clean matrix at 0.5 to 2 times the current LLOQ level. This LLOQ verification is carried through the same preparation and analytical procedures as the samples. Recovery of the analytes should be within the established limits. The DOD QSM requirements for Limit of Detection (LOD) and Limit of Quantitation (LOQ) verifications are different. See SOP QA020 for complete requirements for MDL, LOD, LOQ, and LLOQ.

1.1.5 Compounds detected at concentrations between the LLOQ and MDL are quantitated and qualified as estimated values and reported with either a “J” or “I” qualifier. Some program or project specifications may require that no values below the LLOQ be reported.

1.1.6 For DOD projects refer to QSM 5.1, Table B-4; QSM 5.3 or QSM 5.4 Table B-4 for additional method requirements and data qualifying guidance.

1.2 Summary

1.2.1 This method is adapted from SW846 method 8260D.

1.2.2 Samples are received, stored, and analyzed within the appropriate holding times.

1.2.3 Sample preparation is performed in accordance with SGS Orlando SOP OP020 and OP021.

1.2.4 The samples are analyzed on a gas chromatograph equipped with mass spectrometer detector.

1.2.5 The peaks detected are identified by comparison to characteristic ions and retention times specific to the known target list of compounds.

1.2.6 Additional unknown peaks with a response > 10% of the closest internal standard may be processed through a library search with comparison to a NIST database of approximately 129,000 compound spectra. An estimated concentration is quantitated by assuming a response factor of 1.

1.2.7 Manual integrations are performed in accordance with SOP QA029.

2.0 PRESERVATION AND HOLDING TIME

2.1 Preservation

Aqueous Samples:

2.1.1 Samples should be preserved to a pH < 2. The pH must be checked and recorded immediately after the sample analysis. If the sample is not preserved to a pH < 2, it must be noted on the report.

2.1.2 If 2-chloroethyl vinyl ether is a compound of concern, the sample should not be preserved. If acrolein and acrylonitrile are compounds of concern, the sample should be adjusted to a pH 4-5 in the field. These analytes may also be analyzed from an unpreserved sample.

2.1.3 The samples must be stored in capped vials, with minimum headspace, at ≤ 6 °C in an area free of solvent fumes. The size of any bubble caused by degassing upon cooling should not exceed 5-6mm.

Solid Samples:

2.1.4 Special 40ml vials for purge-and-trap of solid samples, as well as the collection and preservation options are described in OP020.

2.1.5 Low level soil samples are preserved by storing them in sealed VOA vials at temperatures between –10 °C to –20 °C. High level soil samples are preserved by storing them in methanol at a ratio of 1 gram of soil to 1ml of methanol.

2.2 Holding Time

2.2.1 Aqueous samples are to be analyzed within 14 days of collection, unless otherwise specified by the contract. Samples that are not preserved must be analyzed within 7 days of collection; however, the preservation deficiency must be noted in the report.

2.2.2 Samples that are preserved to pH 4-5 for the analysis of acrolein and acrylonitrile must be analyzed with 7 days of collection.

2.2.3 Solid and waste samples must be analyzed within 14 days of collection.

3.0 INTERFERENCES

3.1 Data from all blanks, samples, and spikes must be evaluated for interferences.

3.2 Impurities in the purge gas, organic compounds out-gassing from the plumbing ahead of the trap, and solvent vapors in the laboratory account for the majority of contamination problems. The analytical system must be demonstrated to be free from contamination under the conditions of the analysis by running laboratory blanks. The use of non-TFE tubing, non-TFE thread sealants, or flow controllers with rubber components in the purging device should be avoided.

3.3 Samples can be contaminated by diffusion of volatile organics (particularly methylene chloride and fluorocarbons) through the septum seal into the sample during shipment and storage. A trip blank can serve as a check on such contamination.

3.4 Contamination by carry-over can occur whenever high level and low-level samples are sequentially analyzed. Whenever an unusually concentrated sample is encountered, it should be followed by an analysis of reagent water to check for carry-over.

3.5 Acidification with HCl or bisulfate solution may cause the loss of 2-chloroethyl vinyl ether, acrolein, and acrylonitrile.

3.6 Soils and sediment that contain limestone ($CaCO_3$) may react with the sodium bisulfate and effervesce. The effervescing can result in significant losses of volatile organics.

3.7 Certain naturally occurring compounds (humic acids, etc.) will decompose when exposed to the bisulfate solution and form ketones, notably acetone. The amount of acetone formed is extremely matrix dependent but may be produced in significant concentrations.

3.8 The purge efficiency of select fuel oxygenates may be improved by using a heated purge. These fuel oxygenates generally include: methyl tert butyl ether (MTBE), ethyl tert butyl ether (ETBE), tert amyl methyl ether (TAME), di-isopropyl ether (DIPE), tert amyl ethyl ether (TAEE), tert amyl alcohol (TAA), tert butyl alcohol (TBA) and ethanol (ETOH).

3.8.1 MTBE may be converted to TBA under acidic preservation and elevated purging temperatures.

3.8.2 If samples containing MTBE, TAME, ETBE or other fuel ethers have been preserved with hydrochloric acid and will be analyzed by purging at elevated temperatures, these samples must be adjusted to pH >10 with tri-sodium phosphate dodecahydrate (TSP) prior to initiation of the analysis.

3.8.3 Dibromofluoromethane (surrogate) may degrade and fail low in samples with a basic pH.

3.8.4 Tert butyl formate (TBF) may degrade at elevated purge temperatures.

4.0 DEFINITIONS

4.1 Batch: A group of samples which are similar with respect to matrix and the testing procedures being employed and which are processed as a unit. A sample batch is limited to a maximum of 20 samples or samples loaded on an instrument within the same 12-hour shift, whichever comes first.

4.2 Blank Spike (BS): An analyte-free matrix spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. Blank Spike recoveries are used to document laboratory performance for a given method. This may also be called a Laboratory Control Sample (LCS).

4.3 Continuing Calibration Verification (CCV): A check standard used to verify instrument calibration throughout an analytical run. For all MS methods, a CCV must be analyzed at the beginning of each analytical run. For DoD QSM 5.x projects, an additional CCV must be analyzed at the end of the run.

4.4 Holding Time: The maximum times that samples may be held prior to preparation and/or analysis and still be considered valid.

4.5 Internal Standards: An organic compound which is similar to the target analyte(s) in chemical composition and behavior, but which is not normally found in environmental samples. Internal standards for mass spec methods are often deuterated forms of target analytes. Internal standards are used to compensate for retention time and response shifts during an analytical run.

4.6 Initial Calibration (ICAL): A series of standards used to establish the working range of a particular instrument and detector. The low point must be at a level equal to or below the reporting level.

4.7 Initial Calibration Verification (ICV): A standard from a source different than that used for the initial calibration. A different vendor must be used whenever possible. The ICV is used to verify the validity of an Initial Calibration. This may also be called a QC check standard.

4.8 Matrix Spike (MS): A sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The matrix spike recoveries are used to document the bias of a method in a given sample matrix.

4.9 Matrix Spike Duplicate (MSD): A replicate sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The matrix spike duplicate recoveries are used to document the precision and bias of a method in a given sample matrix.

4.10 Method Blank (MB): An analyte-free matrix to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank is processed simultaneously with the samples through all the steps of the analytical procedure. The method blank is used to document contamination resulting from the analytical process.

4.11 Sample Duplicate (DUP): A replicate sample which is used to document the precision of a method in a given sample matrix.

4.12 Preservation: Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical integrity of the sample.

4.13 Surrogate: An organic compound which is similar to the target analyte(s) in chemical composition and behavior, but which is not normally found in environmental samples. Surrogates are used to measure the purge efficiency.

4.14 Trip Blank: A sample of analyte-free matrix taken from the laboratory to the sampling site and returned to the laboratory unopened. A trip blank is used to document contamination attributable to shipping and field handling procedures. This type of blank is useful in documenting contamination of volatile organic samples.

5.0 REAGENTS

5.1 Reagent water – distilled or deionized water free of interferences

5.2 Methanol – purge-and-trap grade or equivalent

5.3 Hydrochloric acid (HCl) – ACS reagent grade or equivalent

5.4 Sodium Bisulfate Solution – free of interferences

5.5 Tri-sodium phosphate dodecahydrate (TSP) – ACS reagent grade or equivalent

5.6 Inert Gas – UHP Helium or UHP Nitrogen

5.7 Volatile stock standards – Various mixes, traceable to Certificate of Analysis

5.8 4-Bromofluorobenzene (BFB) – instrument tuning mix

5.9 Surrogate standards –

Dibromofluoromethane	1,2-Dichloroethane-d_4
Toluene-d_8	4-Bromofluorobenzene

5.10 Internal standards –

Fluorobenzene	Chlorobenzene-d_5
1,4-Dichlorobenzene-d_4	Tert-Butyl Alcohol-d_{10} (optional)

6.0 APPARATUS

6.1 Gas Chromatograph – Agilent Technologies 6890 or 7890

6.1.1 Gas Chromatograph

The analytical system that is complete with a temperature programmable gas chromatograph and all required accessories, analytical columns, and gases.

6.1.2 The injection port is designed for split-splitless injection with capillary columns. The injection port must have an appropriate interface for sample introduction.

6.2 Mass Spectrometer– Agilent Technologies 5973 or 5975

The mass spectrometer must be capable of scanning from 35-300 amu every second or less utilizing 70-volt (nominal) electron energy in the electron impact ionization mode. It must also be capable of producing a mass spectrum that meets all the criteria in section 7.5.1.1 when injecting 50 ng of Bromofluorobenzene (BFB).

6.3 Purge and Trap – OI Analytical 4660 with OI Analytical 4552/4551A or EST Evolution/Evolution2 with EST Centurion.

6.3.1 The following autosampler models are used for purging, trapping, and desorbing the sample onto GC column.

- O.I. Model 4660 sample concentrator with 4552 Water/Soil multisampler
- O.I. Model 4660 sample concentrator with 4551A Water multisampler
- EST Evolution sample concentrator with Centurion Water/Soil multisampler

6.3.2 The sample purge vessel must be designed to accept 5 or 10ml samples with a water column at least 3 cm deep.

6.3.3 The multisampler is equipped with a heater capable of maintaining the purge chamber at 40 °C to improve purging efficiency. The heater is to be used for soil and sediment analysis.

6.3.4 The desorber must be capable of rapidly heating the trap to the manufacturer recommended desorb temperature.

6.4 Data System – Agilent Technologies MS Chemstation rev. DA 02.0x, DA 03.0x or EA02.0x.

6.4.1 A computer system interfaced to the mass spectrometer that allows for the continuous acquisition and storage of all mass spectral data obtained throughout the duration of the chromatographic program.

6.4.2 The computer utilizes software that allows searching any GC/MS data file for ions of a specific mass and that can plot such ion abundances versus time or scan number. This type of plot is defined as an Extracted Ion Current Profile (EICP).

6.4.3 The software must allow for integrating the abundances in any EICP between specific time or scan number limits. Characteristic ions for each analyte are listed in Table 3.

6.4.4 The most recent version of the EPA/NIST mass spectral library should be available. Current NIST database contains approximately 129,000 compound spectra.

6.4.5 Data is archived to a backup server for long term storage.

6.5 Trap – OI #10 or equivalent: Tenax, Silica Gel, and Carbon Molecular Sieve.
Trap – Vocarb 3000 (K) or equivalent: Carbopack B, Carboxen 1000, Carboxen 1001

The trap should be conditioned according to the manufacturer ‘s recommendations.

6.6 Columns – RTX-VMS or equivalent: 20m X 0.18mm 1.0um
– RTX-VMS or equivalent: 40m X 0.18mm 1.0um

6.7 Gas-tight syringes and class “A” volumetric glassware for dilutions of standards and samples.

7.0 PROCEDURE

7.1 Standards Preparation

Standards are prepared from commercially available certified reference standards. All standards must be logged in the Volatile Standards Logbook. All standards shall be traceable to their original source. The standards must be stored at temperatures between –10 °C and –20 °C, or as recommended by the manufacturer. Calibration levels, spike and surrogate concentrations, preparation information, and vendor part numbers can be found in the MSVOA STD Summary in the Active SOP directory.

7.1.1 Stock Standard Solutions

Stock standards are available from several commercial vendors. All vendors must supply a "Certificate of Analysis" with the standard. The certificate will be retained by the lab. Hold time for unopened stock standards is until the vendor's expiration date. Once opened, the hold time is reduced to six months (one month for gases) or the vendor's expiration date (whichever is shorter).

7.1.2 Intermediate Standard Solutions

Intermediate standards are prepared by quantitative dilution of the stock standard with methanol. The hold time for intermediate standards is one month (one week for gases) or the vendor's expiration date (whichever is shorter). Intermediate standards may need to be remade if comparison to other standards indicates analyte degradation or concentration changes.

7.1.3 Calibration Standards

Calibration standards for the volatile organics are prepared at a minimum of five concentration levels through quantitative dilutions of the intermediate standard. The low standard is at a concentration at or below the LLOQ and the remaining standards define the working range of the detector.

Calibration standard concentrations are verified by the analysis of an initial calibration verification (ICV) standard.

7.2 Instrument Conditions

Gas Chromatograph/ Mass Spectrometer

Carrier gas flow (Helium)	0.8-1.0 ml/min
Transfer line temperature	220 - 280 °C
Analyzer temperature	150 °C

Oven program – 45 °C for 2.5 minutes (RTX-VMS 40m)
10 °C/min to 80 °C for 0 minutes
15 °C/min to 185 °C for 0 minutes
30 °C/min to 240 °C for 2.5 minutes

Oven program – 35 °C for 2.5 minutes (RTX-VMS 40m)
4 °C/min to 60 °C for 0 minutes
25 °C/min to 220 °C for 0 minutes
30 °C/min to 240 °C for 1.2 minutes

Oven program – 35 °C for 1.0 minutes (RTX-VMS 20m)
10 °C/min to 80 °C for 0 minutes
18.5 °C/min to 150 °C for 0 minutes
30 °C/min to 220 °C for 1.0 minutes

GC conditions are optimized for each instrument. Actual conditions may vary slightly from those listed above.

7.3 Purge and Trap Device conditions

	OI Autosampler	**EST Autosampler**
Purge Gas	He of N2	He of N2
Purge Flow	35-40 ml/min	35-40 ml/min
Sample Temp.	Ambient - 40 C	Ambient - 45 C
Trap Temp.	< 25 C	< 35 C
Purge Time	6 or 11 min	6 or 11 min
Desorb Time / Temp	0.5-2.0 min @ 190 C	0.5-2.0 min @ 250 C
Bake Time / Temp	4-6 min @ 210 C	4-6 min @ 260 C

Purge and Trap conditions are optimized for each instrument. Actual conditions may vary slightly from those listed above

7.4 Sample Preparation

7.4.1 Water Samples

A 5ml aliquot of sample is loaded onto the purge-and-trap device and purged for either 6 or 11 minutes depending on the system. Detailed procedures are described in SOP OP021.

7.4.2 Solid Samples

A 5-gram aliquot of sample is loaded onto the purge-and-trap device. 5mls of reagent water is added along with internal standards and surrogates. Depending on the system, the sample is then purged for either 6 or 11 minutes while heated to 40°C and mechanically agitated. Detailed procedures are described in SOP OP020.

Alternatively, a methanol aliquot from the sample is loaded onto the purge-and-trap device. 5mls of reagent water is added along with internal standards and surrogates. The sample is then purged for either 6 or 11 minutes depending on the system. Detailed procedures are described in SOP OP020 and OP021.

7.5 Gas Chromatographic Analysis

Instrument calibration consists of two major sections:

Initial Calibration Procedures
Continuing Calibration Verification

7.5.1 Initial Calibration Procedures

Before samples can be run, the GC/MS system must be tuned, the injection port inertness must be verified, and the instrument must be calibrated.

7.5.1.1 Tune Verification (BFB)

The instrument must be hardware tuned per manufacturer's instructions. Verify the instrument tune by injecting 50ng of BFB solution onto the instrument. The BFB standard may also be purged. The resulting BFB spectra must meet the criteria in the following table.

BFB KEY IONS AND ION ABUNDANCE CRITERIA

Mass	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	<2% of mass 174
174	>50% of mass 95
175	5-9 % of mass 174
176	>95% and <101% of mass 174
177	5-9% of mass 176

Note: Criteria in this Table is tighter than that specified in SW846 8260D.

Evaluate the tune spectrum using three mass scans from the chromatographic peak and a subtraction of instrument background. This procedure is performed automatically by the MS Chemstation software by running “autofind” on the BFB peak.

Select the scans at the peak apex and one to each side of the apex. Calculate an average of the mass abundances from the three scans.

Background subtraction is required. Select a single scan in the chromatogram that is absent of any interfering compound peak and no more than 20 scans prior to the elution of BFB. The background subtraction must be designed only to eliminate column bleed or instrument background ions. Do not subtract part of the tuning compound peak.

Alternatively, the average spectra over the entire peak may be used.

All subsequent tune evaluations must use the same procedure that was used for the Initial Calibration.

If the criteria are not achieved, the analyst must retune the mass spectrometer and repeat the test until all criteria are met.

Analysis must not begin until the tuning criteria are met. The injection time of the acceptable tune analysis is considered the start of the 12-hour clock. The same mass spec settings must be used for the calibration standards and samples that were used for the tune evaluation standard.

7.5.1.2 Internal Standard Calibration

A minimum 5-point calibration curve is created for the volatile organic compounds and surrogates using an internal standard technique. SGS Orlando routinely performs a 7-point calibration to maximize the calibration range.

NOTE: West Virginia requires that samples preserved with sodium bisulfate be analyzed against a calibration curve that was also preserved with sodium bisulfate. In this instance, 2-chloroethyl vinyl ether and acrolein will not be reportable.

Historically, many analytical methods have relied on linear models of the calibration relationship, where the instrument response is directly proportional to the amount of a target compound. The linear model has many advantages including simplicity and ease of use. However, given the advent of new detection techniques and because many methods cannot be optimized for all the analytes to which they may be applied, the analyst is increasingly likely to encounter situations where the linear model neither applies nor is appropriate. The option of using non-linear calibration may be necessary to address specific instrumental techniques. However, it is not EPA's intent to allow non-linear calibration to compensate for detector saturation or avoid proper instrument maintenance.

NOTE: Because of this concern, select programs including SC DHEC do not support the use of non-linear regressions.

The low point may be omitted from the calibration table for any compound with an LLOQ set at the level two standard. Additionally, the high point may be omitted for any compound that exhibits poor linearity at the upper end of the calibration range.

An entire level may be omitted provided that a minimum of 5 points remain. There must be technical justification to omit an entire level. This must be documented in the run log.

Response factors (RF) for each analyte are determined as follows:

$RF = (A_{analyte} \times C_{istd})/(A_{istd} \times C_{analyte})$

$A_{analyte}$ = area of the analyte
A_{istd} = area of the internal standard
$C_{analyte}$ = concentration of the analyte
C_{istd} = concentration of the internal standard.

The mean RF and standard deviation of the RF are determined for each analyte. The percent relative standard deviation (%RSD) of the response factors is calculated for each analyte as follows:

%RSD = (Standard Deviation of RF X 100) / Mean RF

If the %RSD $\leq$ 20%, linearity through the origin can be assumed and the mean RF can be used to quantitate target analytes in the samples. **The %RSD should be $\leq$ 15% for any DoD QSM projects.**

Alternatively, a calibration curve of response vs. amount can be plotted. This method allows for the use of average response factors, linear regressions, and non-linear regressions. Linear regressions may be unweighted or weighted as 1/x or $1/x^2$. If the correlation coefficient (r) is $\geq$0.995 ($r^2 \geq 0.990$) then the curve can be used to quantitate target analytes in the samples. Regardless of which calibration model is chosen, the laboratory should visually inspect the curve plots to see how the individual calibration points compare to the plot.

Linear Curve Fit $y = ax + b$

y = response ratio x = concentration ratio

a = linear term b = constant term

Quadratic Curve Fit $y = ax^2 + bx + c$

y = response ratio x = concentration ratio

a = quadratic term b = linear term c = constant term

Either of the two techniques described below may also be used to determine whether the calibration function meets acceptable criteria. These involve refitting the calibration data back to the model. Both % Error and Relative Standard Error (RSE) evaluate the difference between the measured and the true amounts or concentrations used to create the model.

Use % Error to evaluate the difference between the measured and the true amounts or concentrations used to create the model.

Calculation of the % Error

% ERR = (xi-x'i) / xi * 100

x'i = Measured amount of analyte at calibration level i, in mass or concentration units.

xi = True amount of analyte at calibration level i, in mass or concentration units.

Percent error between the calculated and expected amounts of an analyte must be ≤ ±30% for all standards (70-130% of True Value), except the lowest point which must be ≤ ±50% for all standards (50-150% of True Value).

Alternatively, the Relative Standard Error (RSE) may be used to evaluate the difference between the measured and the true amounts or concentrations.

Calculation of Relative Standard Error (%RSE)

$$RSE = 100 \times \sqrt{\sum_{i=1}^{n} \left[\frac{x_i' - x_i}{x_i}\right]^2 \Big/ (n-p)}$$

x'i = Measured amount of analyte at calibration level i, in mass or concentration units.

xi = True amount of analyte at calibration level i, in mass or concentration units.

p = Number of terms in the fitting equation.
(average = 1, linear = 2, quadratic = 3)

n = Number of calibration points.

The %RSE acceptance limit criterion is ≤20% for good performing compounds and ≤30% for poor performing (PP) compounds.

Table 2 contains minimum RFs that may be used as guidance in determining whether the system is behaving properly and as a check to see if calibration standards are prepared correctly. Because the minimum RFs in Table 2 were determined using specific ions and instrument conditions that may vary, it is neither expected nor required that all analytes meet these minimum RFs. The information in this table is provided as guidance only. The signal to noise ratio at the LLOQ may be a better indication of instrument performance and sensitivity. For a target analyte whose RF <0.01 (response of peak is <1/100 the response of the IS), it is recommended to increase its concentration in relation to other analytes to make the response more comparable.

If more than 10% of the compounds included with the initial calibration exceed the 20% RSD limit and do not meet the minimum correlation coefficient (0.99) for alternate curve fits, then the chromatographic system is considered too reactive for analysis to begin. Adjust moisture control parameters, replace analytical trap or column, replace moisture trap or adjust desorb time, and then repeat the calibration procedure.

7.5.1.3 Initial Calibration Verification (ICV)

The validity of the initial calibration curve must be verified through the analysis of an initial calibration verification (ICV) standard. The ICV must be prepared from a second source at a mid-range concentration.

The %D for all normal analytes of interest should be ≤ 30%, the %D for all poor performing (PP) analytes of interest should be ≤ 40%. (These analytes are identified in Table 1) If the %D > 30% (>40% for PP, quantitative sample analyses should not proceed for those analytes that do not meet the ICV criteria. However, analyses may continue for those analytes that do not meet the criteria with an understanding that these results could be used for screening purposes and would be considered estimated values. Generally, if a reportable analyte is detected in a sample and the %D for that analyte was greater than 30% (>40% for PP) in the ICV, the sample will need to be reanalyzed on a system with a passing ICV for that analyte.

NOTE: For any DoD QSM project, the %D for all target compounds should be ≤ 20%. If samples must be analyzed with an analyte of interest having a %D > 20%, then the data must be qualified accordingly.

If the ICV does not meet criteria, a fresh standard must be prepared. If this ICV meets criteria, proceed with sample analysis. If the ICV still does not meet criteria, analyze an ICV prepared from a third source or different lot. Determine which two standards agree. Make fresh calibration standards and an ICV from the two sources that agree. Recalibrate the instrument.

7.5.2 Continuing Calibration Verification (CCV)

7.5.2.1 8260D does not require BFB to be evaluated on a daily basis; however, select programs that SGS Orlando participates in do; therefore, this will continue to be a requirement. Inject 2ul of the tune evaluation mix at the beginning of each 12-hour shift. This may also be accomplished by purging a blank that contains BFB. Evaluate the resultant peaks against the criteria in section 7.5.1.1. The injection time of this standard starts the 12-hour window.

When the analyst is running an unattended second 12-hour window, they may opt to purge the BFB standard. This can be performed by purging an additional blank (which contains BFB) just prior to the second CCV.

7.5.2.2 Analyze a continuing calibration check standard. The CCV must be at or below the mid-point of the calibration curve.

7.5.2.3 Table 2 contains minimum RFs from 8260D and SOM 2.3 that may be used as guidance in determining whether the system is behaving properly and as a check to see if calibration standards are prepared correctly. Because the minimum RFs in Table 2 were determined using specific ions and instrument conditions that may vary, it is neither expected nor required that all analytes meet these minimum RFs.

7.5.2.4 The %D for all analytes of interest should be ≤ 20%; however, the large number of analytes in this method presents a substantial probability that a few of the analytes will fall outside of this range.

If less than 20 percent of the analytes have a %D > 20% but ≤ 50% then the analysis of samples may still proceed provided that the following criteria is met.

The CCV exceeds the upper limit (+20%) and the analyte is not expected to be present in the samples.

The CCV exceeds the lower limit (-20%) but not more than -50% and the analyte is not expected to be present in the samples. An additional check standard at the LLOQ must be analyzed and the analytes in question be detected and meet all of the qualitative identification criteria.

However, if a reportable analyte is detected in a sample and the %D for that analyte was greater than 20% in the CCV, the sample will need to be reanalyzed on a system with a passing CCV for that analyte, or the data must be qualified.

NOTE: For any DoD QSM project, the %D for all target compounds should be ≤ 20%. If samples must be reported with an analyte of interest having a %D > 20%, then the data must be qualified accordingly, regardless of whether the analyte was detected or not.

7.5.2.5 The criteria in 7.5.2.3 and 7.5.2.4 must be met for the continuing calibration to be considered valid. Only analytes that are being reported for a given sample must meet the criteria in 7.5.2.3 and 7.5.2.4.

If the first continuing calibration verification does not meet criteria, a second standard may be injected. If the second standard does not meet criteria, the system must be recalibrated. If the second standard meets criteria then the system is considered in control and results may be reported.

Rationale for second standard such as instrument maintenance, clipped column, remade standard, etc. must be documented in the run log or maintenance log. Reanalysis of second standard without valid rationale may require the analysis of a third standard (in which case both the second and third standard would have to pass).

NOTE: For any DoD QSM project, if the second standard meets criteria, then a third standard must be analyzed. If the third standard also meets criteria then the system is considered in control and results may be reported.

If the |%D| is greater than 20%, then documented corrective action is necessary. This may include recalibrating the instrument and reanalyzing the samples, performing instrument maintenance to correct the problem and reanalyzing the samples, or qualifying the data. Under certain circumstances, the data may be reported, i.e., the CCV failed high, the associated QC passed, and the samples were ND.

NOTE: For any DoD QSM project, if samples must be reported with a target analyte having a %D > 20%, then the data must be qualified accordingly, regardless of whether the analyte was detected or not.

NOTE: Any target analytes that are detected in the samples must have an acceptable initial calibration curve and acceptable CCV standards; otherwise, the samples must be reanalyzed, or the data must be qualified.

7.5.2.6 For DoD QSM 5.x compliance, an additional CCV must be analyzed at the end of each run. The closing CCV must be within the 12-hour Tune window.

The %D for all target compounds in this CCV should be ≤ 50%. If the %D > %50 for any target compound, then the samples must be reanalyzed at least once at the appropriate dilution. If the %D > %50 for the analytes in the reanalysis, the department supervisor shall review the data and determine what further action is necessary. This may include reanalyzing the samples at a higher dilution or qualifying the data.

NOTE: If samples are ND and an analyte in the CCV fails high, then the sample does not need to be reanalyzed.

7.5.2.7 If any of the internal standard response changes by more than a factor of two (-50% to +100%) or retention time changes by more than 10 seconds from the midpoint standard of the last initial calibration or from the daily CCV, the mass spectrometer must be inspected for malfunctions and corrections made, as appropriate. Corrective action may include re-calibration (initial Calibration) of the instrument.

7.5.3 Sample Analysis

7.5.3.1 Samples are analyzed in a set referred to as an analysis sequence or batch. A batch consists of the following:

Tune Evaluation Mix
Initial Calibration Standards (or CCV)
QC Samples
Samples

7.5.3.2 One microliter (OI) or five microliter (EST) of internal standard/ surrogate solution is added to every 5ml of sample in the sparge vessel. Generally, 5ml of sample are transferred to the sparge vessel.

7.5.3.3 After purging, the system will automatically reverse flow and rapidly heat the trap to desorb the sample analytes onto the GC column.

7.5.3.4 Qualitative identification

The target compounds shall be identified by analysts with competent knowledge in the interpretation of mass spectra by comparison of the sample mass spectrum to the mass spectrum of a standard of the suspected compound. The criteria required for a positive identification are:

The intensities of the characteristic ions of a compound maximize in the same scan or within one scan of each other. Selection of a peak by a data system target compound search routine where the search is based on the presence of a target chromatographic peak containing ions specific for the target compound at a compound-specific retention time will be accepted as meeting this criterion.

The sample component must elute at the same relative retention time (RRT) as the daily standard. The RRT of sample component must be within ± 0.06 RRT units of the standard.

All ions present in the standard mass spectra at a relative intensity greater than 10% (major abundant ion in the spectrum equals 100%) must be present in the sample spectrum.

The relative intensities of these ions must agree within ± 30% between the daily standard and sample spectra, (e.g., for an ion with an abundance of 50% in the standard spectra, the corresponding sample abundance must be between 20 and 80%).

Structural isomers that produce very similar mass spectra must be identified as individual isomers if they have sufficiently different GC retention times. Sufficient GC resolution is achieved if the height of the valley between two isomer peaks is less than 25% of sum of the two peak heights. Otherwise, structural isomers are identified as isomeric pairs.

If peak identification is prevented by the presence of interferences, the sample must be diluted so that the interference does not mask any analytes.

7.5.3.5 Quantitative analysis

When a target compound has been identified, concentration will be based on the integrated area of the quantitation ion, which is normally the base peak.

The sample matrix may produce an interference with the primary ion. This may be characterized by an excessive background signal of the same ion, which distorts the peak shape beyond a definitive integration. The interference could also, severely inhibit the response of the internal standard ion.

If the analyte response exceeds the linear range of the system, the extract must be diluted and reanalyzed. It is recommended that samples be diluted so that the response falls into the middle of the calibration curve.

7.5.3.6 Library search for tentatively identified compounds

If a library search is requested, the analyst should perform a forward library search of the NIST mass spectral library to tentatively identify 10 to 20 non-target compounds.

Guidelines for making tentative identification are:

These compounds should have a response greater than 10% of the nearest internal standard. The response is obtained from the Total Ion Chromatogram.

The search is to include a spectral printout of the best library match for a particular substance. The results are to be interpreted by the analyst.

Relative intensities of major ions in the reference spectrum (ions >10% of the most abundant ion) must be present in the sample spectrum.

The relative intensities of the major ions must agree within ±20%.

Ions present in the sample spectrum but not in the reference spectrum must be reviewed for possible background contamination or presence of co-eluting compounds.

Ions present in the reference spectrum but not in the sample spectrum must be verified by performing further manual background subtraction to eliminate the interference created by co-eluting peaks and/or matrix interference.

Quantitation of the tentatively identified compounds is obtained from the total ion chromatogram based on a response factor of 1 from the nearest internal standard and is to be tabulated on the library search summary data sheet.

7.6 Maintenance and Trouble Shooting

7.6.1 Refer to SOP GC001 for routine instrument maintenance and trouble shooting.

7.6.2 All instrument maintenance must be documented in the appropriate "Instrument Repair and Maintenance" log. The log will include such items as problem, action taken, correction verification, date, and analyst.

7.6.3 Repairs performed by outside vendors must also be documented in the log. The analyst or Department Supervisor responsible for the instrument must complete the log if the repair technician does not.

7.6.4 PC and software changes must be documented in the "Instrument Repair and Maintenance" log. Software changes may require additional validation.

8.0 METHOD PERFORMANCE

Method performance is monitored through the routine analysis of negative and positive control samples. These control samples include method blanks (MB), blank spikes (BS), matrix spikes (MS), and matrix spike duplicates (MSD). The MB and BS are used to monitor overall method performance, while the MS and MSD are used to evaluate the method performance in a specific sample matrix.

Blank spike, matrix spike, and matrix spike duplicate samples are compared to statistically generated control limits. These control limits are reviewed and updated annually. Control limits are stored in the LIMS. Additionally, blank spike accuracy is regularly evaluated for statistical trends that may be indicative of systematic analytical errors.

9.0 QUALITY ASSURANCE / QUALITY CONTROL

Accuracy and matrix bias are monitored by the use of surrogates and by the analysis of a QC set that is prepared with each batch (maximum of 20 samples) of samples. The QC set consists of a method blank (MB), blank spike (BS), matrix spike (MS), and matrix spike duplicate (MSD).

9.1 Internal Standards

9.1.1 Fluorobenzene, Chlorobenzene-d_5, 1,4-Dichlorobenzene-d_4, and Tert Butyl Alcohol-d_{10} (optional) are used as internal standards for this method. The response of the internal standard in all subsequent runs must be within a factor of two (-50% to +100%) of the internal standard response in the opening CCV for each sequence. On days that an initial calibration is performed, the internal standard responses must be compared to the internal standard responses for the mid-point standard. The response for Tert Butyl Alcohol-d_{10} need only be monitored if target analytes are being reported that reference that particular internal standard.

9.1.2 If the internal standard responses are not within limits, the following are required.

9.1.2.1 Check to be sure that there are no errors in calculations, integrations, or internal standards solutions. If errors are found, recalculate the data accordingly.

9.1.2.2 Check instrument performance. If an instrument performance problem is identified, correct the problem and reanalyze the sample. If the recovery is high due to interfering peaks, it may be possible to get a more accurate recovery by analyzing the sample on a different column type.

9.1.2.3 If no problem is found, prepare a second aliquot of sample and reanalyze the sample. If there is insufficient sample for reanalysis, footnote this on the report.

9.1.2.4 If upon reanalysis, the responses are still not within limits, the problem is considered matrix interference. The sample may need to be diluted or the results qualified.

9.1.3 Historical data has shown that when soils are preserved with sodium bisulfate the 4th internal standard (Tert Butyl Alcohol-d_{10}) will very often fail high. If the analytes that reference Tert Butyl Alcohol-d_{10} are non-detect, then the sample does not need to be reanalyzed; however, they must be footnoted with “Associated internal standard response outside of control limits.

9.2 Surrogates

9.2.1 Dibromofluoromethane, 1,2-Dichloroethane-d_4, Toluene-d_8, and 4-Bromofluorobenzene are used as the surrogate standards to monitor the efficiency of the purge-and-trap system.

A known amount of surrogate standard is added to each sample including the QC set prior to purging. The percent recovery for each surrogate is calculated as follows:

% Recovery = (Sample Amount / Amount Spiked) X 100

The percent recovery must fall within the established control limits for all surrogates for the results to be acceptable.

9.2.2 If any surrogate recovery is not within the established control limits, the following are required.

9.2.2.1 Check to be sure that there are no errors in calculations, dilutions, integrations, surrogate solutions or internal standard solutions. If errors are found, recalculate the data accordingly.

9.2.2.2 Check instrument performance. If an instrument performance problem is identified, correct the problem and reanalyze the sample. If the recovery is high due to interfering peaks, it may be possible to get a more accurate recovery by analyzing the sample on a different column type.

9.2.2.3 If no problem is found, reanalyze the sample. **NOTE:** If the recoveries are high and the sample is non-detect, then reanalysis may not be necessary. For any DoD QSM projects the resulting data must be qualified accordingly. If there is insufficient sample for reanalysis, footnote this on the report.

9.2.2.4 If upon reanalysis, the recovery is still not within control limits, the problem is considered matrix interference. Surrogates from both sets of analysis must be reported on the final report.

9.2.2.5 Historical data has shown that samples with pH > 11 will cause Dibromofluoromethane to degrade and fail low. If the remaining surrogates are within control limits, then samples with pH > 11 should be footnoted, but they do not need to be reanalyzed for Dibromofluoromethane failures.

9.3 Method Blank

9.3.1 The method blank is de-ionized water or de-ionized water with 5 grams of clean sand (depending upon sample matrix) to which the surrogate standard has been added. An appropriate aliquot of methanol must also be added. The method blank is then purged along with the other samples to determine any contamination from the system or ambient sources. The method blank must be free of any analytes of interest or interferences at ½ the required LLOQ to be acceptable. Common laboratory contaminants such as methylene chloride must be below the LLOQ if present. If the method blank is not acceptable, corrective action must be taken to determine the source of the contamination. Samples associated with a contaminated method blank shall be evaluated as to the best corrective action for each particular sample. This may include reanalyzing the samples or qualifying the results with a “B” or “V” qualifier.

9.3.2 If the MB is contaminated but the samples are non-detect, then the source of contamination must be investigated and documented. The sample results can be reported. **For any DoD QSM projects the resulting data must be qualified accordingly.**

9.3.3 If the MB is contaminated but the samples results are > 10 times the contamination level, the source of the contamination must be investigated and documented. The samples results may be reported with the appropriate “B” or “V” qualifier. This must be approved by the department supervisor.

9.3.4 If the MB is contaminated but the samples results are < 10 times the contamination level, the source of the contamination must be investigated and documented. The samples must be reanalyzed for confirmation. If there is insufficient sample to reanalyze, or if the sample is reanalyzed beyond hold time, the appropriate footnote and qualifiers must be added to the results. This must be approved by the department supervisor.

9.4 Blank Spike

9.4.1 The blank spike is de-ionized water or de-ionized water with 5 grams of clean sand (depending upon sample matrix) to which the surrogate standard and spike standard have been added. An appropriate aliquot of methanol must also be added. The blank spike is then processed along with the other samples to monitor the efficiency of the purge-and-trap procedure. The percent recovery for each analyte is calculated as follows:

% Recovery = (Blank Spike Amount / Amount Spiked) X 100

The percent recovery for each analyte of interest should fall within the established control limits for the results to be acceptable. The large number of analytes in this method presents a substantial probability that a few of the analytes will fall outside of the established control limits. This may not indicate that the system is out of control; therefore, corrective action may not be necessary.

Upper and lower marginal exceedance (ME) limits can be established to determine when corrective action is necessary. A marginal exceedance in the Blank Spike is defined as a recovery being outside of 3 standard deviations but within 4 standard deviations of the mean.

The number of allowable marginal exceedances is based on the number of analytes in the Blank Spike. Marginal Exceedances must be random. If the same analyte exceeds the BS control limits repeatedly, it is an indication of a systematic problem and corrective action must be taken.

Marginal exceedances are not permitted for analytes that are deemed to be “Compounds of Interest” for a specific project. “Compounds of Concern” are different from “Target Compounds”. “Target Compounds” are all analytes that are being reported for a site where “Compounds of Concern” are those analytes expected to be present at the site.

The number of allowable marginal exceedances is as follows:

1) > 90 analytes in BS, 5 analytes allowed in ME range;

2) 71-90 analytes in BS, 4 analytes allowed in ME range;

3) 51-70 analytes in BS, 3 analytes allowed in ME range;

4) 31-50 analytes in BS, 2 analytes allowed in ME range;

5) 11-30 analytes in BS, 1 analyte allowed in ME range;

6) < 11 analytes in BS, no analytes allowed in ME range.

NOTE: SC DHEC does not recognize the concept of Marginal Exceedances. Additionally, a secondary check against 70-130% limits must be performed for all analytes reported to SC DHEC.

9.4.2 If the blank spike recoveries are not within the established control limits, the following are required.

9.4.2.1 Check to be sure that there are no errors in calculations, dilutions, integrations, spike solutions or internal standard solutions. If errors are found, recalculate the data accordingly.

9.4.2.2 Check instrument performance. If an instrument performance problem is identified, correct the problem and reanalyze the sample.

9.4.2.3 Check to see if the recoveries that are outside of control limits are analytes of concern. If the analytes are not being reported, additional corrective action is not necessary, and the sample results can be reported without qualification.

9.4.2.4 If the recovery of an analyte in the BS is high and the associated sample is non-detect, the data may be reportable. **For any DoD QSM projects the resulting data must be qualified accordingly.**

9.4.2.5 If no problem is found, the department supervisor shall review the data and determine what further corrective action is best for each particular sample. That may include reanalyzing the samples or qualifying the results as estimated.

9.4.2.6 If there is insufficient sample to reanalyze, or if the sample is reanalyzed beyond hold time, the appropriate footnote and qualifiers must be added to the results. This must be approved by the department supervisor.

9.4.2.7 Because of their problematic nature, 2-chloroethyl-vinyl-ether and acrolein are generally not evaluated in the blank spike unless they are of specific concern for a given project.

9.5 Matrix Spike and Matrix Spike Duplicate

9.5.1 Matrix spike and spike duplicates are replicate sample aliquots to which the surrogate standard and spike standard have been added. The matrix spike and spike duplicate are then processed along with the other samples to monitor the precision and accuracy of the purge-and-trap procedure. The percent recovery for each analyte is calculated as follows:

% Recovery = [(Spike Amount – Sample Amount) / Amount Spiked] X 100

The percent recovery for each analyte of interest must fall within the established control limits for the results to be acceptable.

9.5.2 If the matrix spike recoveries are not within the established control limits, the following are required.

9.5.2.1 Check to be sure that there are no errors in calculations, dilutions, integrations, spike solutions or internal standard solutions. If errors are found, recalculate the data accordingly.

9.5.2.2 Check instrument performance. If an instrument performance problem is identified, correct the problem and reanalyze the sample. If the recovery is high due to interfering peaks, it may be possible to get a more accurate recovery by analyzing the sample on a different column type.

9.5.2.3 If no problem is found, compare the recoveries to those of the blank spike. If the blank spike recoveries indicate that the problem is sample related, document this on the run narrative. Matrix spike recovery failures are not grounds for reanalysis but are an indication of the sample matrix effects.

9.5.3 Precision

Matrix spike and spike duplicate recoveries for each analyte are used to calculate the relative percent difference (RPD) for each compound.

$$\text{RPD} = (|\text{ MS Result} - \text{MSD Result }| / \text{ Average Result}) \times 100$$

The RPD for each analyte should fall within the established control limits. If more than 33% of the RPDs fall outside of the established control limits, the department supervisor shall review the data and determine if any corrective action is necessary. RPD failures are generally not grounds for batch reanalysis.

10.0 CALCULATIONS

The concentration of each target compound in the original sample is calculated as follows:

Water (ug/l) = $(\text{CONC}_{\text{inst}}) \times \text{DF}$

Soil (ug/kg) = $[(\text{CONC}_{\text{inst}}) \times (5 / W_I)] / \%\text{solids}$ (*low level soils)*

Soil (ug/kg) = $[(\text{CONC}_{\text{inst}}) \times (V_F / V_A) \times (5 / W_I) \times \text{DF}] / \%\text{solids}$ (*high level soils)*

$\text{CONC}_{\text{inst}}$ = Instrument concentration calculated from the initial calibration using mean RF or curve fit.
DF = Dilution Factor
V_F = Volume of methanol extract (ul)
V_A = Volume of methanol aliquot (ul)
W_I = Weight of sample (g)
%solids = Dry weight determination in decimal form

For high level soils, V_F is calculated as follows:

$V_F = \{\text{ml of solvent} + [(\%\text{moisture} \times W_I) / 100]\} \times 1000 \text{ ul/ml}$

11.0 SAFETY AND POLLUTION PREVENTION

11.1 Safety

The analyst must follow normal safety procedures as outlined in the SGS Health and Safety Program, which includes the use of safety glasses, gloves, and lab coats.

The toxicity of each reagent and target analyte has not been precisely defined; however, each reagent and sample must be treated as a potential health hazard. Material Safety Data Sheets (MSDS) or Safety Data Sheets (SDS) are available for all reagents and many of the target analytes. Exposure must be reduced to the lowest possible level. Personal protective equipment must be used by all analysts.

11.2 Pollution Prevention

Waste solvents from the sample analysis, methanol extraction, and standards preparation are collected in waste storage bottles and are eventually transferred to the non-chlorinated waste drum.

Old stock standards are disposed of in the waste vial drum.

Dilution waste and purged aqueous samples and standards are rinsed down the drain with large amounts of water.

Samples are archived and stored for 30 days after analysis. After the storage time has elapsed, the remaining aqueous and soil samples are transferred to the appropriate drums for disposal.

12.0 REFERENCES

SW846 Method 8000D Revision 4, July 2014

SW846 Method 8260D Revision 4, June 2018

EPA CLP SOW for Organics Superfund Methods, SOM02.3, September 2015

DOD Quality Systems Manual (QSM) for Environmental Laboratories, Revision 5.4, Oct. 2021

TABLE 1

Routine Target Analytes

Dichlorodifluoromethane	**2-Butanone**	n-Propylbenzene
Chloromethane	1,1-Dichloropropene	Bromobenzene
Vinyl Chloride	Propionitrile	1,1,2,2-Tetrachloroethane
Bromomethane	Methacrylonitrile	1,3,5-Trimethylbenzene
Chloroethane	Benzene	2-Chlorotoluene
Trichlorofluoromethane	TAME	**trans-1,4-Dichloro-2-Butene**
Ethyl Ether	1,2-Dichloroethane	1,2,3-Trichloropropane
1,2-Dichlorotrifluoroethane	Trichloroethene	**Cyclohexanone**
1,1-Dichloroethene	Methylcyclohexane	4-Chlorotoluene
Freon 113	Dibromomethane	tert-Butylbenzene
Carbon Disulfide	1,2-Dichloropropane	1,2,4-Trimethylbenzene
Iodomethane	Bromodichloromethane	**Pentachloroethane**
Acrolein	Methyl methacrylate	sec-Butylbenzene
Allyl chloride	**2-Chloroethyl vinyl ether**	4-Isopropyltoluene
Methylene Chloride	cis-1,3-Dichloropropene	1,3-Dichlorobenzene
Acetone	Toluene	1,4-Dichlorobenzene
Methyl acetate	2-Nitropropane	n-Butylbenzene
trans-1,2-Dichloroethene	4-Methyl-2-pentanone	**Benzyl Chloride**
Hexane	trans-1,3-Dichloropropene	1,2-Dichlorobenzene
Methyl Tert Butyl Ether	Tetrachloroethene	**1,2-Dibromo-3-Chloropropane**
Acetonitrile	Ethyl methacrylate	Hexachlorobutadiene
Di-isopropyl ether	1,1,2-Trichloroethane	1,2,4-Trichlorobenzene
Chloroprene	Dibromochloromethane	Naphthalene
1,1-Dichloroethane	1,3-Dichloropropane	1,2,3-Trichlorobenzene
Acrylonitrile	1,2-Dibromoethane	**Ethanol**
ETBE	**2-hexanone**	Tert Butyl Alcohol
Vinyl acetate	1-Chlorohexane	Isobutyl alcohol
cis-1,2-Dichloroethene	Ethylbenzene	Tert Amyl Alcohol
2,2-Dichloropropane	Chlorobenzene	**1,4-Dioxane**
Bromochloromethane	1,1,1,2-Tetrachloroethane	3,3-Dimethyl-1-butanol
Cyclohexane	m,p-Xylene	Tert Amy Alcohol
Chloroform	o-Xylene	**Tert Butyl Formate**
Ethyl acetate	Styrene	1,2,3-Trimethylbenzene
Tetrahydrofuran	Bromoform	
Carbon Tetrachloride	Isopropylbenzene	
1,1,1-Trichloroethane	cis-1,4-Dichloro-2-butene	

Bolded analytes are considered “Poor Performing”

TABLE 2

Recommended Minimum Response Factors

Analyte	8260D Min RF	SOM2.3 Min RF
Dichlorodifluoromethane	0.01	0.01
Chloromethane	0.01	0.01
Vinyl chloride	0.01	0.01
Bromomethane	0.01	0.01
Chloroethane	0.01	0.01
Trichlorofluoromethane	0.01	0.01
Bromochloromethane	0.1	0.1
1,1-Dichloroethene	0.06	0.02
1,1,2-Trichloro-1,2,2-trifluoroethane	0.05	0.01
Acetone	0.01	0.01
Carbon disulfide	0.1	0.01
Methyl Acetate	0.01	0.01
Methylene chloride	0.01	0.01
trans-1,2-Dichloroethene	0.1	0.07
cis-1,2-Dichloroethene	0.2	0.1
Methyl tert-Butyl Ether	0.1	0.01
1,1-Dichloroethane	0.3	0.1
2-Butanone	0.01	0.01
Chloroform	0.3	0.04
1,1,1-Trichloroethane	0.05	0.05
Cyclohexane	0.01	0.1
Carbon tetrachloride	0.1	0.02
Benzene	0.2	0.3
1,2-Dichloroethane	0.07	0.01
Trichloroethene	0.2	0.1
Methylcyclohexane	0.05	0.2

Analyte	8260D Min RF	SOM2.3 Min RF
1,2-Dichloropropane	0.2	0.1
Bromodichloromethane	0.3	0.09
cis-1,3-Dichloropropene	0.3	0.1
trans-1,3-Dichloropropene	0.3	0.01
4-Methyl-2-pentanone	0.03	0.01
Toluene	0.3	0.4
1,1,2-Trichloroethane	0.2	0.04
Tetrachloroethene	0.1	0.1
2-Hexanone	0.01	0.01
Dibromochloromethane	0.2	0.05
1,2-Dibromoethane	0.2	0.01
Chlorobenzene	0.4	0.4
Ethylbenzene	0.4	0.5
meta-/para-Xylene	0.2	0.2
ortho-Xylene	0.2	0.3
Styrene	0.2	0.2
Bromoform	0.1	0.01
Isopropylbenzene	0.4	0.7
1,1,2,2-Tetrachloroethane	0.2	0.05
1,3-Dichlorobenzene	0.5	0.5
1,4-Dichlorobenzene	0.6	0.7
1,2-Dichlorobenzene	0.6	0.4
1,2-Dibromo-3-chloropropane	0.01	0.01
1,2,3-Trichlorobenzene	0.4	0.3
1,2,4-Trichlorobenzene	0.4	0.3

TABLE 3

Characteristic Ions

Analyte	Quant. Ion	Q1	Q2	Q3
Fluorobenzene	96	70		
Dichlorodifluoromethane	85	87		
Chloromethane	50	52		
Vinyl Chloride	62	64		
Bromomethane	94	96	93	
Chloroethane	64	66	49	
Trichlorofluoromethane	101	103		
Ethyl Ether	59	45	74	
1,2-Dichlorotrifluoroethane	67	117	85	69
1,1-Dichloroethene	61	96	98	63
Freon 113	101	151	103	85
Carbon Disulfide	76	44		
Iodomethane	142	127	141	
Allyl chloride	41	39	38	76
Methylene Chloride	49	84	86	51
Acetone	58	43		
Methyl acetate	74	43	42	
trans-1,2-Dichloroethene	61	96	98	63
Hexane	56	57	43	41
Methyl Tert Butyl Ether	73	57	43	41
Acetonitrile	40	41	39	
Di-isopropyl ether	45	43	87	
Chloroprene	53	88	51	50
1,1-Dichloroethane	63	65		
Acrylonitrile	53	52	51	
ETBE	59	87	57	
Vinyl acetate	43	42		
cis-1,2-Dichloroethene	96	61	98	63
2,2-Dichloropropane	77	97		
Bromochloromethane	128	49	130	51
Cyclohexane	56	84	41	55
Chloroform	83	85	47	
Ethyl acetate	43	45		
Tetrahydrofuran	42	41	72	
Dibromofluoromethane	113	111	192	
Carbon Tetrachloride	117	119	121	82
1,1,1-Trichloroethane	97	99	61	
2-Butanone	43	72		

TABLE 3 (cont)

Characteristic Ions

Analyte	Quant. Ion	Q1	Q2	Q3
1,1-Dichloropropene	75	39	110	77
Propionitrile	54	52	55	
Methacrylonitrile	41	39	40	52
Benzene	78	51		
TAME	73	43	55	
1,2-Dichloroethane-d_4	65	67	102	
1,2-Dichloroethane	62	49	64	
Trichloroethene	95	130	97	132
Methylcyclohexane	83	55	98	42
Dibromomethane	93	95	174	172
1,2-Dichloropropane	63	62	41	76
Bromodichloromethane	83	85	47	
Methyl methacrylate	41	69	39	100
2-Chloroethyl vinyl ether	63	43	44	65
cis-1,3-Dichloropropene	75	77	39	
Chlorobenzene-d_5	117	82		
Toluene-d_8	98	100		
Toluene	91	92		
2-Nitropropane	41	43	39	
4-Methyl-2-pentanone	43	58	57	41
trans-1,3-Dichloropropene	75	77	39	49
Tetrachloroethene	166	164	129	131
Ethyl methacrylate	69	41	39	99
1,1,2-Trichloroethane	83	97	61	99
Dibromochloromethane	129	127	131	
1,3-Dichloropropane	76	78	41	39
1,2-Dibromoethane	107	109		
2-hexanone	43	58	57	
1-Chlorohexane	91	55	41	43
Ethylbenzene	91	106		
Chlorobenzene	112	77	114	51
1,1,1,2-Tetrachloroethane	131	133	119	117
m,p-Xylene	91	106	105	
o-Xylene	91	106	105	
Styrene	104	78	103	51
Bromoform	173	175	171	91
Isopropylbenzene	105	120		
1,4-Dichlorobenzene-d_4	152	151		

TABLE 3 (cont)

Characteristic Ions

Analyte	Quant. Ion	Q1	Q2	Q3
4-Bromofluorobenzene	95	174	176	
cis-1,4-Dichloro-2-butene	53	75	88	39
n-Propylbenzene	91	120		
Bromobenzene	156	158		
1,1,2,2-Tetrachloroethane	83	85		
1,3,5-Trimethylbenzene	105	120		
2-Chlorotoluene	91	126	89	
trans-1,4-Dichloro-2-Butene	53	89	75	
1,2,3-Trichloropropane	110	61	112	49
Cyclohexanone	55	98	42	69
4-Chlorotoluene	91	126		
tert-Butylbenzene	91	41	134	
1,2,4-Trimethylbenzene	105	120	119	
1,2,3-Trimethylbenzene	105	120		
Pentachloroethane	167	117	119	165
sec-Butylbenzene	105	134		
4-Isopropyltoluene	119	134		
1,3-Dichlorobenzene	146	111	148	75
1,4-Dichlorobenzene	146	111	148	75
n-Butylbenzene	92	91	134	
Benzyl Chloride	126	91	65	
1,2-Dichlorobenzene	146	111	148	75
1,2-Dibromo-3-Chloropropane	75	155	157	39
Hexachlorobutadiene	225	190	118	260
1,2,4-Trichlorobenzene	180	182	145	109
Naphthalene	128	127		
1,2,3-Trichlorobenzene	180	182	145	109
Tert Butyl Alcohol-d10	65	46		
acrolein	56	55		
Tert Butyl Alcohol	59	41	43	
tert Amyl alcohol	59	55	73	
Isobutyl alcohol	42	43	41	39
1,4-Dioxane	88	58	43	
tert-Butyl Formate	59	57	41	56
Ethanol	45	46		
3,3-Dimethyl-1-butanol	57	69	41	56

ANALYSIS OF VOLATILE ORGANICS BY GC/MS

SOP Acknowledgement Form

I have read and understand this SOP. I will not knowingly deviate from this approved SOP without approval of the Department Supervisor, QA Officer, or Technical Director. If I notice any discrepancies between this SOP and the routine procedure, I will notify the Department Supervisor so that either the SOP or procedure can be changed. Furthermore, I understand that this SOP is property of SGS North America Inc. – Orlando and may not be printed nor duplicated in any manner.

Internal SOPs referenced within this SOP: GC001, OP020, OP021 and QA029

Print Name	**Signature**	**Date**

Print the SOP Acknowledgement Form, sign, and submit to the SGS Orlando QA department.

STANDARD OPERATING PROCEDURE FOR THE INTRODUCTION OF VOLATILE ORGANICS ANALYTES USING PURGE-AND-TRAP

Prepared by: Norm Farmer Date: 05/26/20

Approved by: Melissa Mangual Date: 05/28/20

Annual Review

Reviewed by: Svetlana Izosimova Date: 08/01/2022

Reviewed by: ________ Date: ________

Reviewed by: ________ Date: ________

Document Control

Issued to: QA Department Date: 05/29/20

Issued to: GC VOA Department Date: * ________

Issued to: MS VOA Department Date: ________

Issued to: ________ Date: ________

Issued to: ________ Date: ________

Issued to: ________ Date: ________

Effective 7 days after "*" date

CONTROLLED COPY
DO NOT DUPLICATE

TITLE: STANDARD OPERATING PROCEDURE FOR THE INTRODUCTION OF VOLATILE ORGANICS ANALYTES USING PURGE-AND-TRAP

REFERENCES: SW846 5030B and 5030C

REVISED SECTIONS: 2.0, 3.1.5, 3.2.3, 6.8, 6.9, 6.12, 7.5, 7.5.2 and 7.9

1.0 SUMMARY, SCOPE AND APPLICATION

1.1 Summary

Aqueous samples: An inert gas (Helium or Nitrogen) is bubbled through a portion of the aqueous sample at ambient or elevated temperature; the volatile components are transferred from the aqueous phase to the vapor phase. The vapor is swept through a sorbent column where the volatile components are adsorbed. After purging is completed, the sorbent column is rapidly heated and back flushed with helium to desorb the components onto a gas chromatographic column.

High-level extracts from Method 5035A: An aliquot of the extract is combined with organic free reagent water in the purging chamber. It is then analyzed following the procedure for aqueous samples.

1.2 Scope and Application

This method describes a purge-and-trap procedure for the analysis of volatile organic compounds (VOCs) in aqueous samples, water miscible liquids, and high-level extracts (prepared in Method 5035A).

2.0 DISCUSSION AND COMMENTS

This procedure is adapted from SW-846 method 5030B and 5030C. Cross contamination can occur whenever high concentration samples are analyzed. Any sample that contains analytes an order of magnitude higher than the highest level standard can be described as a possible source for cross contamination.

The purge efficiency of 1,4-Dioxane and select fuel oxygenates may be improved by using a heated purge (40°C). These fuel oxygenates generally include: methyl tert butyl ether (MTBE), ethyl tert butyl ether (ETBE), tert amyl methyl ether (TAME), di-isopropyl ether (DIPE), tert amyl ethyl ether (TAEE), tert amyl alcohol (TAA), tert butyl alcohol (TBA) and ethanol (ETOH). Tert butyl formate (TBF) may degrade at elevated purge temperatures (> 60°C).

System contamination is also possible. A high-level sample followed by a low-level sample may show “carryover” of compounds with higher boiling points or water solubility. This type of contamination usually only persists for the analysis immediately following the high-level sample.

Extremely high-level samples may cause more persistent system contamination. These samples will cause “carryover” in one or more subsequent analysis.

The analyst must use any available historical data or client supplied information to avoid contaminating the system. Any doubt or suspicion is cause for reanalysis.

3.0 PRESERVATION AND HOLDING TIMES

3.1 Preservation

3.1.1 Samples should be preserved to a pH < 2. The pH should be checked and recorded immediately after the sample analysis. If the sample is not preserved to a pH < 2, it must be noted on the report.

3.1.2 If 2-Chloroethyl vinyl ether is a compound of concern, the sample should not be preserved. If Acrolein and Acrylonitrile are compounds of concern, the sample should be adjusted to a pH 4 – 5 in the field.

3.1.3 The samples must be refrigerated at ≤ 6°C from the time of collection until analysis.

3.1.4 Samples should be checked for the presence of residual chlorine. If residual chlorine present, it must be noted on the report.

3.1.5 If samples containing MTBE, TAME, ETBE or other fuel ethers have been preserved with hydrochloric acid and will be analyzed by purging at temperatures > 60°C, they must be adjusted to pH >10 with tri-sodium phosphate dodecahydrate (TSP) prior to initiation of the analysis.

3.2 Holding Times

3.2.1 All sample preserved to a pH < 2 must be analyzed within 14 days of collection.

3.2.2 All samples that are not preserved must be analyzed within 7 days of collection.

3.2.3 Samples that are expected to contain 2-Chloroethyl vinyl ether, Acrolein, or Acrylonitrile should be analyzed as soon as possible but must be analyzed within 72 hours of collection.

4.0 DEFINITIONS

4.1 Batch: A group of samples which are similar with respect to matrix and the testing procedures being employed and which are processed as a unit. A sample batch is limited to a maximum of 20 samples or samples loaded on an instrument within the same 12-hour shift, whichever comes first.

4.2 Blank Spike (BS): An analyte-free matrix spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. Blank Spike Recoveries are used to document laboratory performance for a given method. This may also be called a Laboratory Control Sample (LCS).

4.3 Blank Spike Duplicate (BSD): An analyte-free matrix replicate spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The Blank Spike Duplicate recoveries are used to document laboratory precision and accuracy for a given method. This may also be called a Laboratory Control Sample Duplicate (LCSD).

4.4 Holding Time: The maximum times that samples may be held prior to preparation and/or analysis and still be considered valid.

4.5 Matrix Spike (MS): A sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The matrix spike recoveries are used to document the bias of a method in a given sample matrix.

4.6 Matrix Spike Duplicate (MSD): A replicate sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The matrix spike duplicate recoveries are used to document the precision and bias of a method in a given sample matrix.

4.7 Method Blank (MB): An analyte-free matrix to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank is processed simultaneously with the samples through all the steps of the analytical procedure. The method blank is used to document contamination resulting from the analytical process.

4.8 Sample Duplicate (DUP): A replicate sample which is used to document the precision of a method in a given sample matrix.

4.9 Preservation: Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical integrity of the sample.

4.10 Surrogate: An organic compound which is similar to the target analyte(s) in chemical composition and behavior, but which is not normally found in environmental samples. Surrogates are used to measure the purge efficiency.

4.11 Trip Blank: A sample of analyte-free matrix taken from the laboratory to the sampling site and returned to the laboratory unopened. A trip blank is used to document contamination attributable to shipping and field handling procedures. This type of blank is useful in documenting contamination of volatile organic samples.

5.0 REAGENTS

5.1 Reagent water – distilled or deionized water free of interferences

5.2 Methanol – purge-and-trap grade or equivalent

5.3 Hydrochloric acid (HCl) – ACS reagent grade or equivalent

5.4 Tri-sodium phosphate dodecahydrate (TSP) – ACS reagent grade or equivalent

5.5 Surrogate Solution – prepared in methanol at a concentration specified by the analyst.

5.6 Standard Solution – prepared in methanol or water at a concentration specified by the analyst.

5.7 Internal Standard Solution – prepared in methanol at a concentration specified by the analyst.

5.8 Spike Solution – prepared in methanol at a concentration specified by the analyst.

5.9 Inert Gas – UHP Helium or UHP Nitrogen

6.0 GLASSWARE AND APPARATUS

6.1 Microsyringes – 10ul, 25ul, 50ul, 100ul, 250ul, 500ul, and 1000ul. These syringes are gastight with Teflon plunger tips used for spike and surrogate solutions. These may also be used for sample dilutions.

6.2 Syringes – 5ml, and 10ml syringes with Luer-Lok tip.

6.3 Volumetric flasks – 5ml, 10ml, 50ml, and 100ml class A flasks are used for standard and spike preparation and sample dilution.

6.4 Vials – 40ml vials with Teflon lined septa.

6.5 pH paper – narrow range (0.0-3.0) and wide range (1-12)

6.6 Potassium iodide – starch paper (residual chlorine check)

6.7 OI Analytical 4560 and 4660 sample concentrators.

6.8 OI Analytical 4552 (Archon) and 4551A autosamplers.

6.9 OI Analytical #10 trap or equivalent for 8260 analysis, #7 trap or equivalent for 8015C and State TPH analysis. Other traps may be used provided that they meet method criteria.

6.10 EST Encon Evolution Purge and Trap Concentrator

6.11 EST Centurion Water Autosampler

6.12 EST (VOCARB 3000) K trap or equivalent for 8260 analysis. Other traps may be used provided that they meet method criteria.

7.0 PROCEDURE FOR AQUEOUS SAMPLES

7.1 Prior to sample analysis, the GC system must be calibrated. The procedures for the determinative methods give details on preparation of standards for initial and daily calibrations. The GC-MS methods also require instrument tuning prior to proceeding with calibration.

7.2 Adjust the purge gas flow rate to 30-45ml/min on the purge-and-trap device. Once the flow is optimized, it is not necessary to set the flow daily, although periodic checking is recommended.

7.3 Traps shall be conditioned according to manufacturer's instructions upon installation. Condition the trap daily by stepping the sample concentrator to the "bake" mode or by running a series of conditioning injections. Since bake temperature will vary according to method and trap type, ensure the proper concentrator method is loaded when performing the daily conditioning.

7.4 All samples and standard solutions must be allowed to warm to ambient temperature before analysis.

7.5 OI Analytical 4552 (Archon) or 4551A and EST Centurion (Water Sampler) Procedure

7.5.1 Prepare aqueous standards by injecting aliquots of standard solutions into a 50ml volumetric flask. Invert the flask several times to mix, then transfer to a 40ml vial with Teflon-lined septa cap.

7.5.2 Load standards, samples, and blanks into the auto-sampler tray. Program the auto-sampler methods to perform 5ml or 10ml purges and dilutions when appropriate. Link auto-sampler methods together to build the run sequence. Without disturbing the vial seal, the autosampler will transfer a 5ml or 10ml volume from the vial and transfer it to the purge-and-trap device, along with a 1ul aliquot of internal standard/surrogate mix.

NOTE: Care must be taken when programming the Archon. If the sample size exceeds the capacity of the purge vessel, catastrophic damage to the GC system may result! Consult the user manual if unfamiliar with use of the Archon.

7.6 Purge the sample for the time specified in the determinative method SOP.

7.7 Preheat the trap and desorb the analytes onto the GC column. The GC program and data acquisition will start at this point. Desorb for the time specified in the determinative SOP.

7.8 Recondition the trap by going into the bake mode. Trap temperature and bake time are specified in the determinative method SOP. Bake times may be extended in order to minimize potential carry over.

7.9 The steps discussed in 7.6 to 7.8 are programed into the autosampler and are automatically controlled throughout an analysis sequence and are not necessarily manually performed by the analyst. Some systems can also incorporate additional steps (such as hot water rinses of the purge chamber) between samples which may reduce contamination.

7.10 Calculate response factors (RF) or calibration factors (CF) for each analyte of interest using the procedure described in Method 8000. Update the calibration levels in the MS Chemstation method and evaluate the response factors. Specific calibration requirements are described in the determinative methods and in Method 8000. The method must be saved to the hard drive after all levels are updated.

7.11 Any compound of interest that exceeds the initial calibration range should be diluted and reanalyzed so that the highest peak of interest falls in the upper half of the linear range of the curve.

7.12 After analyzing the sample, remove the sample cap. Using narrow range pH paper (0.0 – 3.0) check the sample pH. If the pH is found to be > 3.0, use wide range pH test paper (1 – 12) to check the sample pH. Check for presence of residual chlorine with potassium iodide / starch test paper. Quickly recap the vial. Record sample pH and presence / absence of residual chlorine.

8.0 ANALYSIS OF WATER-MISCIBLE LIQUIDS

Water-miscible liquids are analyzed as water samples after first diluting them at least 50-fold with reagent water.

9.0 EXTRACTS FROM METHOD 5035A

9.1 The methanol soil extracts prepared according to Method 5035A are diluted into reagent water at least 50-fold. This may be done by adding an aliquot of the methanol extract directly to a new low level soil vial containing 5ml reagent water (when analyzing in soil mode) or by preparing the dilution in a 50ml volumetric flask and transferring to a 40ml VOA vial (when analyzing in water mode).

The volume of methanol extract added to 5ml should not exceed 100ul. The volume of methanol added to 5ml of water being purged should be kept constant. Therefore, add to the 5ml syringe whatever volume of clean methanol is necessary to maintain a volume of 100ul per 5ml of water. Higher dilutions are made by introducing smaller aliquots of methanol extract (not less than 1ul into 5ml), or by using a volumetric flask.

9.2 The methanol extract is introduced as either a soil or water depending on the system and method used. All standards and spikes must be treated in the same manner as the samples.

9.3 The purge temperature is either ambient or heated depending on the system and method used. All standards and spikes must be treated in the same manner as the samples.

10.0 QUALITY ASSURANCE AND QUALITY CONTROL

10.1 A sample batch is defined as samples of a similar matrix that are prepared for a particular parameter. The batch size is limited to 20 samples. A batch may be held open for up to 12 hours. **NOTE:** Some project plans may require different batch definitions.

10.2 A method blank (MB), blank spike (BS), matrix spike (MS), and matrix spike duplicate (MSD) must be analyzed with each new batch of samples. Some methods may also require a blank spike duplicate (BSD) or sample duplicate (DUP).

11.0 SAFETY AND WASTE DISPOSAL

11.1 Safety

11.1.1 Safety glasses, gloves and lab coats should be worn when handling samples, standards or solvents.

11.1.2 Material Safety Data Sheets (MSDS) or Safety Data Sheets (SDS) are available for all reagents and solvents used in the lab. Technicians should review the MSDS or SDS prior to using any new reagents or solvents.

11.1.3 For samples containing high levels of VOCs, a carbon filtration hood is available to minimize exposure to vapors.

11.2 Waste Disposal

11.2.1 Expired standards are disposed of in the waste vial drum.

11.2.2 Waste methanol is placed in the “non-chlorinated waste” container

11.2.3 Samples are archived and stored for 30 days after analysis. After the storage time has elapsed, the remaining aqueous samples are transferred to the appropriate drums for disposal.

12.0 REFERENCES

SW-846 Method 5030B, Rev. 2, 12/96

SW-846 Method 5030C, Rev. 3, 05/03

SW-846 Method 5035A, Rev. 1, 07/02

SW-846 Chapter Four, Rev 5, 07/14

STANDARD OPERATING PROCEDURE FOR SAMPLE PREPARATION FOR DISSOLVED GASES IN AQUEOUS SAMPLES

Prepared by: Norm Farmer Date: 05/27/20

Approved by: Juan Garcia Date: 05/29/20

Annual Review

Reviewed by: ____________________ Date: __________

Reviewed by: ____________________ Date: __________

Reviewed by: ____________________ Date: __________

Document Control

Issued to: QA Department Date: 06/01/20

Issued to: GC Volatiles Department Date: * __________

Issued to: ____________________ Date: __________

Issued to: ____________________ Date: __________

Issued to: ____________________ Date: __________

Issued to: ____________________ Date: __________

Effective 7 days after "*" date

CONTROLLED COPY
DO NOT DUPLICATE

TITLE: STANDARD OPERATING PROCEDURE FOR SAMPLE PREPARATION FOR DISSOLVED GASES IN AQUEOUS SAMPLES

REFERENCES: RSKSOP-147

REVISED SECTIONS: 2.0, 6.1 and 6.2

1.0 SUMMARY, SCOPE AND APPLICATION

1.1 Summary

A headspace is prepared in an aqueous sample vial using high purity helium. The headspace is allowed to equilibrate and then an aliquot of the headspace is analyzed to determine concentration of the dissolved gases in the original aqueous sample.

1.2 Scope and Application

This procedure is applicable to aqueous samples submitted for dissolved gases analysis by GC/FID method RSKSOP-147 and RSKSOP-175.

2.0 DISCUSSION AND COMMENTS

This procedure is adapted from RSKSOP-175. The FID is a non-selective detector and will respond to most organic compounds. It is important to minimize extraneous contaminants by scrupulously cleaning all glassware and by using only high purity reagents.

This SOP is not applicable to the preparation of headspace samples for the analysis of Carbon Dioxide (CO_2).

3.0 PRESERVATION AND HOLDING TIMES

3.1 Preservation

3.1.1 Samples should be preserved to a pH < 2. The pH should be checked and recorded immediately after the sample analysis.

3.1.2 If the sample is not preserved to a pH < 2, it must be noted on the report.

3.1.3 The samples must be refrigerated at ≤ 6°C from the time of collection until analysis.

3.2 Holding Times

3.2.1 All samples must be analyzed within fourteen days of collection. Samples are analyzed immediately after preparation using the procedure in SOP GC019.

3.2.2 Some agencies and project plans may require unpreserved samples to be analyzed within seven days of collection.

4.0 DEFINITIONS

4.1 Batch: A group of samples which are similar with respect to matrix and the testing procedures being employed and which are processed as a unit. A sample batch is limited to a maximum of 20 samples or samples loaded on an instrument within the same 12-hour shift, whichever comes first.

4.2 Blank Spike (BS): An analyte-free matrix spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. Blank Spike Recoveries are used to document laboratory performance for a given method. This may also be called a Laboratory Control Sample (LCS).

4.3 Blank Spike Duplicate (BSD): An analyte-free matrix replicate spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The Blank Spike Duplicate recoveries are used to document laboratory precision and accuracy for a given method. This may also be called a Laboratory Control Sample Duplicate (LCSD).

4.4 Holding Time: The maximum times that samples may be held prior to preparation and/or analysis and still be considered valid.

4.5 Helium Blank (HB): An aliquot of the helium used to prepare the samples. The helium blank is used to correct for any background levels of the target analytes that may be present in the helium.

4.6 Method Blank (MB): An analyte-free matrix, which is processed simultaneously with the samples through all the steps of the analytical procedure. The method blank is used to document contamination resulting from the analytical process.

4.7 Sample Duplicate (DUP): A replicate sample which is used to document the precision of a method in a given sample matrix.

4.8 Matrix Spike (MS): A sample aliquot spiked with a known amount of analyte(s), processed simultaneously with the samples through all the steps of the analytical procedure. The matrix spike recoveries are used to document the bias of a method in a given sample matrix.

4.9 Preservation: Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical integrity of the sample.

4.10 Trip Blank: A sample of analyte-free matrix taken from the laboratory to the sampling site and returned to the laboratory unopened. A trip blank is used to document contamination attributable to shipping and field handling procedures. This type of blank is useful in documenting contamination of volatile organic samples.

5.0 REAGENTS

5.1 Methanol – purge-and-trap grade or equivalent

5.2 Reagent water – distilled or deionized - free of interferences

5.3 Helium – UHP or equivalent

6.0 GLASSWARE AND APPARATUS

6.1 10ml and 50ml graduated cylinder (Class A)

6.2 10ml TFL syringe equipped with a 22-gauge needle

6.3 22-gauge needle (2-inch point style 5)

6.4 Digital thermometer

6.5 10ul, 25ul, 50ul, 100ul, 250ul, and 500ul gas-tight syringes equipped with Teflon gas sampling valves.

6.6 Wrist shaker

6.7 pH paper

6.8 Beaker or Flask

6.9 Hot Plate

7.0 PROCEDURE

7.1 Aqueous samples are collected in the field in 40-ml VOA vials and fixed by HCl preservation to a pH <2. Prior to analysis, remove the samples from the cooler and allow them to come to room temperature. Sample vials must be completely full with no visible headspace. Open the helium valve to start the flow of helium through the Teflon tubing.

NOTE: The helium should be allowed to flow through the Teflon tubing and needle for at least 30 minutes prior to preparation of the first sample

7.2 Place the sample upright in a test tube clamp attached to a ring stand. Insert a 22-gauge needle attached to a 10-ml syringe (with the plunger removed) through the septa of the sample vial. The needle tip should be near the bottom of the vial, but above any sediment layer.

7.3 Insert a 22-guage needle attached to the helium supply via Teflon tubing through the septa of the sample vial. The helium supply should pass through a single or double-stage regulator and a needle valve that regulates flow at approximately 5-ml per minute. The helium should bubble into the vial and displace sample into the 10-ml syringe. Care should be taken to ensure the helium enters the vial above the tip of the needle attached to the 10-ml syringe.

7.4 Withdraw the helium supply needle when the level of sample rises to the 5-ml mark on the syringe. Then withdraw the 10-ml syringe. Use a 10ml graduated cylinder to verify the volume of the syringe once a week. Record the volume of sample removed as the “headspace volume” in the analysis log.

7.5 Using the digital thermometer check and record the room temperature in the analysis log.

7.6 Place the sample vial into a clamp on the rotary shaker. Up to four samples may be shaken at a time. If less than four samples are shaken, the shaker must be balanced with vials of equal weight. Start the shaker and set the timer for five minutes.

7.7 After shaking, a portion of the headspace is taken by inserting a syringe needle through the septum and into the headspace. Withdraw 500ul (or less) of the gas into the syringe then close the sampling valve. Withdraw the syringe from the vial and then insert through the injection port septum. Open the sampling valve and quickly inject the sample into the GC and press “start” on the GC.

NOTE: The sequence must be set up and be running for the software to acquire data!

7.8 To prepare a Method Blank boil DI water in a beaker or flask for 10 minutes using a hot plate. Allow the DI water to cool for 10 minutes before removing it from the hot plate. Completely fill several clean 40ml VOA vials with this DI water. Prepare headspace as listed in steps 7.2 to 7.7.

7.9 To prepare a Blank Spike use a MB vial that has had a 500ul aliquot removed from the headspace. Inject into the headspace a 500ul aliquot of 10,000ppmv standard. Repeat steps 7.6 and 7.7. The on-column spike amount is equal to 1000ppmv.

7.10 To prepare a Blank Spike Duplicate use a second MB vial that has had a 500ul aliquot removed from the headspace. Inject into the headspace a 500ul aliquot of 10,000ppmv standard. Repeat steps 7.6 and 7.7. The on-column spike amount is equal to 1000ppmv.

7.11 To prepare a Matrix Spike choose a sample that was run undiluted (had a 500ul aliquot removed from the headspace). Inject into the headspace a 500ul aliquot of 10,000ppmv standard. Repeat steps 7.6 and 7.7. The on-column spike amount is equal to 1000ppmv.

7.12 After analyzing the sample, remove the sample cap. Using narrow range pH test paper (0.0 – 3.0) check the sample pH. If the pH is found to be > 3.0, use wide range pH test paper (1 – 12) to check the sample pH. Record sample pH in the analysis log.

7.13 If the VOA vials were not supplied by SGS Orlando, measure the volume of sample remaining in the vial. The vials that SGS Orlando currently uses have been verified to have an internal volume of 43ml, so the sample volume is 38ml when 5ml of headspace has been created. Record the sample amount in the analysis log.

7.14 Rinse all sampling syringes with methanol and then with reagent water in order to minimize cross-contamination.

7.15 If any target peaks exceed the calibration range, a new vial must be prepared, and an appropriately smaller volume of the headspace injected into the GC. This will work for sample dilutions up to 5x. For larger dilutions, see Section 7.16.

7.16 If the target peaks exceed the calibration range by more than 5-fold, a secondary dilution must be made. Dilute by creating an appropriately sized headspace in a vial with DI. Withdraw from the headspace an amount equal to the sample amount to be injected into the dilution volume. Inject the sample aliquot into the headspace, wait about ten seconds then withdraw the diluted sample to be injected onto the GC. **EXAMPLE**: sample needs a 20x dilution. Create a 5ml headspace in a blank (DI) vial, withdraw 250ul from the headspace, inject 250ul of headspace from a freshly prepared sample vial, wait 10 seconds, withdraw 500ul of the diluted (20x) sample and inject into the GC.

8.0 QUALITY ASSURANCE AND QUALITY CONTROL

8.1 A sample batch is defined as samples of a similar matrix that are prepared for a particular parameter. The batch size is limited to 20 samples. A batch may be held open for up to 12 hours

8.2 A method blank (MB), blank spike (BS), blank spike duplicate (BSD), matrix spike (MS), and sample duplicate (DUP) must be analyzed with each new batch of samples

9.0 SAFETY AND WASTE DISPOSAL

9.1 Safety

9.1.1 Safety glasses, gloves and lab coats should be worn when handling samples, standards or solvents.

9.1.2 Material Safety Data Sheets (MSDS) or Safety Data Sheets (SDS) are available for all reagents and solvents used in the lab. Technicians should review the MSDS or SDS prior to using any new reagents or solvents.

9.2 Waste Disposal

Samples are archived and stored for 30 days after analysis. After the storage time has elapsed, the remaining aqueous samples are transferred to the appropriate drums for disposal.

10.0 REFERENCES

RSKSOP-175, Rev. 2, 5/04

RSKSOP-147, Rev. 0, 1/93

This page intentionally left blank

Appendix D

Field Standard Operating Procedures

- MRS SOP 001 Anomaly Avoidance
- SOP001 Labels
- SOP002 Chain-of-Custody Form
- SOP003 Subsurface Utility Clearance
- SOP004 Sample Packing and Shipping
- SOP005 Field Decontamination
- SOP010 Water Level and Well Depth Measurements
- SOP011 Photoionization Detector
- SOP013 Collection of Monitoring Well Samples
- SOP016 Field Logbooks and Surface Water, Groundwater, and Soil-Sediment Field Checklists
- SOP019 Monitoring Well Installation
- SOP028 Well and Boring Abandonment
- SOP039 Sample Preservation and Container Requirements
- SOP042 Disposal of Investigative Derived Material
- SOP043 Multiprobe Water Quality Monitoring Instruments
- SOP048 Low-Flow Sampling
- SOP-A1 HACH Ferrous Iron
- SOP-A2 HACH Manganese

This page intentionally left blank

Munitions Response
Standard Operating Procedure No. 001
for Anomaly Avoidance

Prepared by

EA Engineering, Science, and Technology, Inc., PBC
225 Schilling Circle, Suite 400
Hunt Valley, Maryland 21031

Revision: 00
July 2022

PROJECT-SPECIFIC VARIANCE FORM

This form is to be completed to indicate if there are any client-, project-, or site-*specific* variances to this Munitions Response (MR) Standard Operating Procedure (SOP) (**also check Box A**), or if this MR SOP is being used with no changes (**only check Box B**).

☐ **A. Variances required; cite section(s) of the MR SOP to which there is a variance**

☐ **B. No variances**

MR SOP No. 001	
SOP Section	**Variance**

Project Manager (Name)

Project Manager (Signature) Date

CONTENTS

DOCUMENT REVISION HISTORY

ORIGINAL (MASTER) DOCUMENT REVISION HISTORY				
Revision Number	**Revision Date**	**Revision Summary**	**Revised By**	**Reviewed By**
0	July 2022	New SOP	Rick Hanoski	Rick Hanoski

1. SCOPE AND APPLICATION

1.1 PURPOSE

The purpose of this standard operating procedure (SOP) is to provide all EA employees and subcontractor personnel with the minimum procedures and safety and health requirements applicable to anomaly avoidance on project sites where munitions and explosives of concern (MEC) may be encountered. MEC anomaly avoidance procedures may be applicable during a variety of non-intrusive and intrusive field activities, including but not limited to: site inspection activities, site visits, geophysical surveys, topographic surveys, brush clearing operations, munitions constituent sampling, environmental soil sampling, groundwater sampling, construction support, or other activities that require avoidance from direct contact with MEC.

1.2 SCOPE

This SOP applies to all site personnel including subcontractor personnel where the potential or known MEC/unexploded ordnance (UXO) exists. This SOP is not meant to be all inclusive nor is it applicable in all situations. This SOP is not a standalone document; rather, it is to be used in conjunction with the applicable Uniform Federal Policy-Quality Assurance Project Plan; Project Work Plans, Site-Specific Safety and Health Plans; applicable federal, state, and local regulations; and contract specifications.

2. MATERIALS AND EQUIPMENT

The following materials and/or equipment required for this activity include but not limited to the following:

- Hand-held magnetometer(s) and/or all-metal detector(s). The type of equipment used depends on whether the suspected munitions item composition is ferrous or non-ferrous metal.

- Marking material listed in Table 1.

- Appropriate personal protective equipment and safety equipment as dictated in the approved Accident Prevention Plan or Site-Specific Safety and Health Plan.

Table 1. Flagging Color Codes – Anomaly Avoidance

Color	Description
Red Pin Flag[1]/Red Caution Tape	Danger, identified suspect MEC/UXO, special precaution required
Yellow Pin Flag[1]	Anomaly location
White Pin Flag[1]	Boundary or temporary marker
Green Pin Flag[1]	Cultural items or features of interest
Pink/Orange Ribbon	Path or roadway

1. All pin flags will have polyvinyl chloride shafts.

3. ROLES AND RESPONSIBILITIES

3.1 UXO TECHNICIAN II OR HIGHER

The UXO-qualified personnel will be a UXO Technician (Technician II or higher) and/or UXO Qualified Personnel (as defined by Department of Defense [DoD] Explosives Safety Board Technical Paper-18). The following responsibilities are for anomaly avoidance procedures during field activities on a site with known, suspected, or the potential presence of MEC:

- Provide the MEC familiarization and safety functions training for all site personnel during sampling activities.

- Conduct MEC safety briefings for all site personnel and visitors.

- Obtain utility clearance and/or excavation permits for underground utilities, if required, before beginning any subsurface analog detector survey activities. The UXO Technician is responsible for verifying that necessary excavation permits are on-site prior to commencing operations. EA, or the prime contractor, is responsible for contacting the appropriate agency(ies) or company(ies) to mark the location of all subsurface utilities in the operations area(s). Located utilities will be clearly marked by paint, pin flags, or other appropriate means to visually delineate their approximate subsurface routing. The color used for marking will not conflict with colors used in the MEC operations outlined in Table 1. If subsurface utilities are suspected to be present in a sampling/excavation area, the UXO Technician must attempt to verify their location.

3.2 AUTHORITY

The senior UXO-qualified person on-site (i.e., UXO Technician II or higher) has final on-site authority on MEC safety procedures and issues.

4. PROCEDURE

For anomaly avoidance on a site with known or suspected MEC, EA will employ a UXO Technician II or above to provide safety escort for non-UXO personnel. The UXO Technician must be on-site during site activities unless designated areas have previously been cleared for non-intrusive activities (e.g., access to monitoring wells). The UXO Technician will not handle, move, and/or perform MEC disposal operations. Potential MEC identified will be reported to the Site Manager, who will in turn notify the client representative in accordance with the approved project plans and safety plans. The appropriate procedure to be used should be discussed with project leaders prior to project execution.

4.1 ACCESS SURVEYS

The UXO Technician/s must conduct a surface access survey and a subsurface survey for anomalies before any type of activities commence, including foot and vehicular traffic.

- Sampling personnel must always be escorted by UXO-qualified personnel in areas potentially containing MEC until the UXO Technicians have completed necessary access surveys and cleared areas have been marked. Escorted personnel will follow behind the UXO Technician. If MEC item(s)s are identified, the UXO Technician will halt escorted personnel in place, select a course around the item(s), and instruct escorted personnel to follow.

- The UXO Technician will conduct an access survey of the footpath and/or vehicular lanes approaching and leaving the sampling/drilling areas with known or suspected MEC. Typically, the access route will be at least twice as wide as the widest vehicle that will use the route.

- The UXO Technician must also complete an access survey of an area around the proposed area of interest (e.g., investigation area) that is large enough to support planned operations. The size of the area to be surveyed will be site-specific and in accordance with project plans (e.g., Uniform Federal Policy-Quality Assurance Project Plan) and take into account the area needed to allow the maneuverability of required equipment (e.g., drill rig, excavation equipment, etc.), parking of support vehicles, and establishment of decontamination stations (if required). As a minimum, the survey area(s) will have a dimension in all directions equal to twice the length of the largest vehicle or piece of equipment to be brought on-site.

- Analog detector capable of detecting the smallest known or anticipated military munitions will be used to locate anomalies just below the surface that may be encountered through erosion from rain or continual vehicular traffic.

- If anomalies or surface MEC are encountered, they will be marked with flagging and the investigation area will be relocated to avoid contact. The UXO Technician will clearly mark the boundaries of the surveyed area using color coded survey flagging or polyvinyl chloride pin flags in accordance with Table 1. The UXO Technician will ensure the flagging and/or survey tape are well distinguishable from each other as well as from any utility markings that have been used at the site.

- If potential surface MEC are encountered, the UXO Technician will follow procedures set forth in project planning documents.

- No personnel will be allowed outside the surveyed areas.

4.2 SURFACE SOIL SAMPLING

Surface soil samples are normally collected at depths from 0 to 6 inches (in.) below ground surface (bgs). The following paragraphs describe anomaly avoidance procedures for surface soil sampling on sites with known or suspected MEC. Soil sampling at depths greater than 6 in. bgs with known or suspected MEC will follow the procedures discussed in this SOP.

- The UXO Technician must conduct an access survey of the routes to and from the proposed sample location as well as an area around the sample location, as described in this SOP.

- The UXO Technician must visually survey the surface of each proposed surface soil sample location for any indication of MEC. In addition, the UXO Technician must conduct a survey of the proposed sampling locations using analog detector instruments capable of detecting the smallest known or anticipated military munitions to a depth of at least 1 foot (ft).

- If anomalies are detected at a proposed sampling location or too many anomalies are detected in the general area of interest, the sampling personnel will select an alternate location for collection of surface soil samples. Any anomalies detected will be prominently marked with survey flagging or pin flags in accordance with Table 1 for avoidance during sampling activities.

4.3 SUBSURFACE BOREHOLE ADVANCEMENT FOR SAMPLING PROBE OR WELL INSTALLATION

Anomaly avoidance procedures for borehole advancement on a site with known or suspected MEC are described as follows:

- The UXO Technician must conduct an access survey of routes as described in in this SOP.

- Utilities will be cleared and dig permits will be obtained in accordance with procedures outlined in this SOP.

- The UXO Technician must complete a subsurface analog detector survey of the proposed borehole location(s). If an anomaly is detected, sampling personnel must select a new borehole location that is clear of any surface anomalies. Any anomalies detected will be prominently marked with survey flagging or pin flags for avoidance. If the subsurface sampling or well installation depth is greater than the analog detector instrument's detection capabilities, the UXO Technician must perform an incremental survey as outlined below:

  - ***Pilot Hole/Incremental Analog Detector Survey***—Once an access survey has been completed, the UXO Technician will install a pilot hole at each proposed borehole location. The pilot hole procedure will be utilized if the drill rig is not on-site using a hand auger. If the drill rig is on-site, the borehole will be advanced using the drill rig or hand auger and checked using the same procedure described below in this section. While the UXO Technician is completing the analog detector survey, remaining site personnel must withdraw out of the immediate area:

    - If an anomaly is detected, the pilot hole will be backfilled in accordance with site-specific procedures and the sampling personnel must select a new borehole location. Any anomalies detected will be prominently marked with survey flagging or pin flags for avoidance.

    - If no anomalies are detected, the pilot hole will be advanced incrementally to the to the maximum depth of the proposed borehole. During the excavation of the pilot hole, the drill rig's auger will be withdrawn, and the hole checked for anomalies every 12 in.

  In cases where the pilot hole does not reach the full depth of the proposed boring (i.e., the proposed depth of the borehole is greater than the maximum depth of the hand auger; or if the desired depth could not be reached due to soil conditions, the drill rig may be brought on-site and advanced in 24-in. increments beyond the clearance depth of the pilot hole. At the end of each 12-in. increment, the drill rig's auger will be withdrawn from the hole so that the UXO Technician may screen for anomalies with a downhole analog detector instrument. As necessary with loose soils, a polyvinyl chloride pipe 3 in. in diameter will be inserted to keep the hole open and to allow for the incremental analog detector screening.

  When working in areas that are known to have or potentially have the existence of MEC present, the UXO Technician may discontinue incremental screening once the borehole has extended to depths greater than 10 ft bgs, (or native soil) the depth of penetration of the MEC for the impact area has been exceeded, or the planned depth of drilling has been reached, whichever is less.

For all other areas, incremental screening will be determined based on an assessment of the site's characteristics and history.

- ***Monitoring of Drilling by Others***—Once the UXO Technician determines that a proposed drill location is free of anomalies, using the procedures described above, the drilling contractor shall be notified that the site is available for subsurface sampling or monitoring well installation.

  - The drilling contractor's actual borehole must be located within a 2-ft radius of the pilot hole installation by the UXO Technician. While this proximity to the pilot hole may affect the accuracy of "blow counts" for the sampling team, anomaly avoidance takes precedence.

  Any drilling beyond the clearance depth of the pilot hole will be conducted in 24-in. increments to allow the UXO Technician to screen for anomalies. In order to avoid magnetic interference from the augers, the drill rig must withdraw its augers from the hole for the analog detector survey. As necessary with loose soils, a polyvinyl chloride pipe 3 in. in diameter may be inserted to keep the hole open and to allow for incremental analog detector screening. Drilling equipment and/or metallic support materials may create an interference affecting the operation of the analog detector instruments during the incremental inspection process. In such an event, the item(s) creating the interference will be relocated outside the interference range of the analog detector instrument during each incremental inspection of the drill hole. If an anomaly is detected, the borehole will be backfilled in accordance with site-specific procedures and the sampling personnel will select a new borehole location.

  When working in impact areas, the UXO Technician may discontinue incremental screening once the drilling has extended to depths of 10 ft bgs, the depth of penetration of the MEC for the impact area has been exceeded, or the planned depth of drilling has been reached, whichever is less.

  - For all other areas, incremental screening will be determined based on an assessment of the site's characteristics and history.

4.4 TEST PIT, TRENCH, AND UTILITY EXCAVATIONS

Test pits, trench, and utility excavations are used to identify and characterize large subsurface areas of concern. The following paragraphs describe anomaly avoidance procedures for test pit and trench excavations on sites with known or suspected MEC.

- The UXO Technician must conduct an access survey of routes as described in Section 3.1.

- The UXO Technician must complete a subsurface analog detector survey of the proposed excavation location(s). If an anomaly is detected, sampling personnel must select a new excavation location. Any anomalies detected will be prominently marked with survey flagging or pin flags for avoidance. If the proposed excavation depth is greater than the analog detector instrument's detection capabilities, the UXO Technician will perform incremental procedures as outlined below.

  - ***Underground Utilities***—The procedures outlined in Section 3.1 will be followed.

  - ***Excavation Procedures***—Once an access survey has been completed, test pit personnel may begin excavation in 12-in. increments. While the UXO Technician is completing the analog detector survey, remaining site personnel will withdraw out of the immediate area.

    - At the end of each 12-in. increment, the UXO Technician will screen for anomalies. If an anomaly is detected, test pit personnel will modify the excavation location to avoid the anomaly. Any anomalies detected will be prominently marked with survey flagging and pin flags for avoidance.

  - ***Waste and/or Other Materials Encountered***—In the event that potentially hazardous waste, debris, or drums are encountered during test pit or trenching operations, excavation activities will cease. The Site Safety and Health Officer will assess the situation and may direct a change to the personal protective equipment for site personnel. The Site Safety and Health Officer will notify the appropriate personnel in accordance with project plans. After notification, waste will be handled in accordance with direction provided from the Site Supervisor or Project Manager.

4.5 PERIODIC MONITORING

Unless a path is clearly marked, the sampling personnel must be escorted by UXO-qualified personnel, as described in Section 4.1, any time they return to conduct groundwater monitoring/aquifer characterization activities.

4.6 MUNITIONS AND EXPLOSIVES OF CONCERN REPORTING PROCEDURES

During anomaly avoidance, the UXO Technician is not tasked to perform MEC disposal operations. If MEC are encountered that cannot be avoided or based on their fuzing or current condition, presents an imminent explosive hazard requiring immediate attention, the UXO Technician will notify the Site Supervisor who will make the necessary notifications as specified in the project and safety plans. The UXO Technician will not attempt to destroy any of the MEC encountered. The appropriate authority of the MEC discovery as described below, and the UXO Technician will safeguard the site pending arrival of the appropriate authority.

- If on an active DoD installation, notify the Site Supervisor, Government Designated Authority, DoD Project Manager, or installation point-of-contact (e.g., Range Control Officer, Facility Engineer, Post Headquarters) designated in the project plans who will facilitate Explosive Ordnance Disposal response.
- If not on a DoD installation (i.e., Formerly Used Defense Sites), immediately notify the local point-of-contact as specified in the project plans who will facilitate the appropriate response. In most cases, the local point-of-contact will notify local emergency response (e.g., local police, sheriff, or 911) to report the finding. If local emergency response is the responding entity, they will determine if they can manage the situation or if Explosive Ordnance Disposal should be contacted. The UXO Technician should remain on-site until local emergency response arrives to escort personnel to the item. The UXO Technician should also provide additional support, if requested (e.g., site security).

4.7 RECORDKEEPING

The senior UXO Technician conducting anomaly avoidance on-site will maintain a field logbook that will, at a minimum, contain a record of the following:

- Weather
- Analog detector instrument details and serial number
- Team personnel
- Areas worked or sample locations cleared
- Start and stop times
- Number of anomalies detected and location in the sample locations
- MEC/UXO items encountered, photo number, and Global Positioning System coordinates.

5. MAINTENANCE

Equipment (e.g., magnetometer) will be used within the manufacturer’s specifications. Maintenance activities for the specific equipment used for the project will be performed in accordance with the manufacturer's operations manual. General maintenance activities also include the daily visual inspection and testing of instruments.

6. SAFETY PRECAUTIONS

For the purpose of avoiding any unintentional contact with MEC, all field personnel being escorted must follow the UXO Technician and must not stray from designated areas cleared of anomalies.

6.1 BASIC AND GENERAL SAFETY PRECAUTIONS

These basic safety precautions are the minimum MEC safety requirements required of all personnel on-site. Other precautions and requirements are in other applicable MEC manuals and in the approved Accident Prevention Plan and/or Site-Specific Safety and Health Plan.

6.1.1 Basic and General Safety Precautions

The following should be taken into consideration when planning or conducting MEC avoidance support operations:

- Do not move or disturb unidentified items.
- Do not collect souvenirs.
- Do not smoke except in designated areas.
- Do not carry fire or spark producing devices into the site.
- All MEC operations will use the "Buddy" system.
- Non-essential personnel must be prohibited from visiting the site.

6.1.2 Basic Safety Precautions

The following safety precautions are applicable to all MEC:

- Suspend all operations immediately upon approach of an electrical storm.

- Observe the hazards of electromagnetic radiation precautions and grounding procedures when working with, or on, electrically initiated or susceptible MEC.

- Do not unnecessarily dismantle, strip, or handle any MEC.

- Avoid inhalation and skin contact with smoke, fumes, dust, and vapors of detonations and MEC residue.

- Do not attempt to extinguish burning explosives or any fire that might involve explosive materials.

- Do not manipulate external features of ordnance items.

7. REFERENCES CONSULTED

Department of Defense (DoD). 2019. Explosives Safety Regulation (DESR) 6055.09 Edition 1. January.

———. 2021. *Manual 4140.72. Material Potentially Presenting an Explosive Hazard (MPPEH)*. May.

U.S. Army Corps of Engineers (USACE). 2013a. *Engineer Manual 385-1-1*. Safety and Health Requirements Manual. 30 November.

———. 2013b. *Engineer Manual 385-1-97 Explosives Safety and Health Requirements Manual*. 17 May.

Standard Operating Procedure No. 001
for
Sample Labels

Prepared by

EA Engineering, Science, and Technology, Inc., PBC
225 Schilling Circle, Suite 400
Hunt Valley, Maryland 21031

Revision: 01
November 2018

This page intentionally left blank

PROJECT-SPECIFIC VARIANCE FORM

This form is to be completed to indicate if there are any client-, project-, or site-specific variances to this Standard Operating Procedure (SOP) (**also check Box A**), or if this SOP is being used with no changes (**only check Box B**).

☐ **A. Variances required; cite section(s) of the SOP to which there is a variance**

☐ **B. No variances**

SOP No. 001	
SOP Section	**Variance**

Project Manager (Name)

Project Manager (Signature) Date

This page intentionally left blank

CONTENTS

DOCUMENT REVISION HISTORY

ORIGINAL (MASTER) DOCUMENT REVISION HISTORY				
Revision Number	**Revision Date**	**Revision Summary**	**Revised By**	**Reviewed By**
1	November 2018	Systematic review and update	Dan Hinckley Sheena Styger Sanita Corum	Matthew Bowman

1. SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to delineate protocols for the use of sample labels. Every sample will have a sample label uniquely identifying the sampling point and analysis parameters. An example label is provided below. Other formats with similar levels of detail are acceptable. Some project software including Scribe (U.S. Environmental Protection Agency (EPA)-associated projects) and FUDSchem (U.S. Army Corps of Engineers-associated projects) can generate pre-prepared labels thus minimizing efforts in the field.

NOTE: It is important to review with the Project/Program Manager to determine if client or project-specific modifications to this SOP are required. For example, if using EPA laboratories, case numbers may be assigned in lieu of having site or project names on the label.

PROJECT NAME ______________ PROJECT NUM. ___________
SAMPLE LOCATION/SITE ID _____________________________
DATE: ____/____/____ TIME: _____:_____
ANALYTES: METALS VOC EXPLOSIVES ORGANICS OTHER
FILTERED: [NO] [YES]
PRESERVATIVE: [NONE] [HNO_3] [OTHER ______]
SAMPLER: _____________________

2. MATERIALS

The following materials may be required:

- Sample label
- Indelible marker.

3. PROCEDURE

The following sections describe how to use the sample labeling system.

3.1 LABEL INFORMATION

As each sample is collected/selected, fill out a sample label. Enter the following information on each label:

- Project name (do not include if there is a project or client-specific requirement to exclude)

- Project Number (or Case Number, as applicable)

- Location/site identification—enter the media type (i.e., well number, surface water, soil, etc.) sampling number, and other pertinent information concerning where the sample was taken

- Date of sample collection

- Time of sample collection

- Analyses to be performed (NOTE: Due to number of analytes, details of analysis should be arranged with laboratory *prior to start of work)*

- Whether filtered or unfiltered (water samples only)

- Preservatives (water samples only)

- Number of containers for the sample (e.g., 1 of 2, 2 of 2).

3.2 ROUTINE CHECK

Double-check the label information to make sure it is correct. Detach the label, remove the backing, and apply the label to the sample container. Cover the label with clear tape, ensuring that the tape completely encircles the container.

3.3 RECORD INFORMATION

Record the sample number and designated sampling point in the field logbook, along with the following sample information:

- Time of sample collection (each logbook page should be dated)

- Location of the sample

- Organic vapor meter or photoionization meter readings for the sample (when appropriate)

- Any unusual or pertinent observations (oily sheen on groundwater sample, incidental odors, soil color, grain size, plasticity, etc.)

- Number of containers required for each sample

- Whether the sample is a quality assurance sample (split, duplicate, matrix spike/matrix spike duplicate, or blank).

3.3.1 Logbook Entry

A typical logbook entry might look like this:

- 7:35 a.m. Sample No. MW-3. Photoionization Detector = 35 parts per million.
- Petroleum odor present. Sample designated MW-3-001.

NOTE: Duplicate samples may be given a unique sample designation rather than the actual sample number with an added prefix or suffix. This will prevent any indication to the laboratory that this is a duplicate sample thus making it “blind” to the laboratory. This fictitious sample number must be listed in the logbook along with the actual location of the sample.

4. MAINTENANCE

Not applicable.

5. PRECAUTIONS

If “blind” field duplicate samples have been called for, then no indication of which samples are duplicates is to be provided to the laboratory.

6. REFERENCES

Not applicable.

This page intentionally left blank

Standard Operating Procedure No. 002
for
Chain-of-Custody Form

Prepared by

EA Engineering, Science, and Technology, Inc., PBC
225 Schilling Circle, Suite 400
Hunt Valley, Maryland 21031

Revision: 01
November 2018

PROJECT-SPECIFIC VARIANCE FORM

This form is to be completed to indicate if there are any client-, project-, or site-specific variances to this Standard Operating Procedure (SOP) (**also check Box A**), or if this SOP is being used with no changes (**only check Box B**).

☐ **A. Variances required; cite section(s) of the SOP to which there is a variance**

☐ **B. No variances**

SOP No. 002	
SOP Section	**Variance**

Project Manager (Name)

Project Manager (Signature) Date

CONTENTS

Page

DOCUMENT REVISION HISTORY

ORIGINAL (MASTER) DOCUMENT REVISION HISTORY				
Revision Number	**Revision Date**	**Revision Summary**	**Revised By**	**Reviewed By**
01	November 2018	Systematic review and update	Dan Hinckley, Sheena Styger, Sanita Corum	Matthew Bowman

1. SCOPE AND APPLICATION

A chain-of-custody record (attached) is used as physical evidence of sample custody and as a permanent record for each sample collected. A chain-of-custody record documents the exchange and transportation of samples from the field to the laboratory. The purpose of this Standard Operating Procedure (SOP) is to delineate protocols for use of the chain-of-custody form. Three example forms are provided as Figures SOP002-1 (EA's standard electronic chain-of-custody form), SOP002-2 (EA's Toxicology Laboratory chain-of-custody form), and SOP002-3 (U.S. Environmental Protection Agency [EPA] Scribe chain-of-custody form). Other formats with similar levels of detail are acceptable.

Most EPA projects utilize sampling and chain-of-custody instructions as documented in EPA's Samplers Guide (2014), which includes the use of Scribe, an in-house software program used to establish computer records of all environmental data and includes generation of chain-of-custodies. Using Scribe requires training, and the software and guidance can be found at the following link: https://response.epa.gov/site/site_profile.aspx?site_id=ScribeGIS. Training on Scribe is necessary and can be obtained through the Scribe weblink.

All new U.S. Army Corps of Engineers projects require the use of Formerly Used Defense Sites chemistry database (FUDSchem), which can be found at the following link: http://fudschem.com/public/framework/bannerhtml.aspx?dsn=systm&idhtml=10642&themesuffix=default&banner=banner_fudschem.jpg. This software will generate chain-of-custody forms specific to the sampling session. As with Scribe, FUDSchem training is necessary.

It is essential that chain-of-custody forms be completed properly, and that sample relinquishment be signed and dated appropriately. Laboratories use chain-of-custodies as their statement of work and, if it is not correct, the samples will not be analyzed appropriately. Sample custody documentation assures that the particular samples have been in secure locations, and that none of them have been tampered with, thus assuring appropriate results.

2. MATERIALS

The following materials may be required: chain-of-custody form and indelible ink pen.

3. PROCEDURE

- Give the site name and project name/number.
- Enter the sample identification code.
- Indicate the sampling dates for all samples.
- List the sampling times (military format) for all samples.

- Enter the total number of containers per cooler.
- List the analyses/container volume.
- Obtain the signature of sample team leader.
- State the carrier service and airbill number, analytical laboratory, and custody seal numbers (if applicable).
- Sign, date, and time the “relinquished by” section. Be sure the carrier signs and enters dates and time of acceptance of the samples.
- Upon completion of the form, retain a copy or portable document format, and affix the laboratory copy to the inside of the sample cooler in a zip-seal bag to protect from moisture, to be sent to the designated laboratory.

4. MAINTENANCE

Not applicable.

5. PRECAUTIONS

None.

6. REFERENCES

U.S. Environmental Protection Agency (EPA). 2014. Sampler’s Guide, Contract Laboratory Program Guidance for Field Samplers. EPA/540/R014/013, Directive 92400.2-147. October.

Figures

This page intentionally left blank

Figure SOP002-1 EA Chain-of-Custody Form

Company Name:

Project Manager or Contact:

Phone:

Project No.

Project Name:

Dept.: Task:

Sample Storage Location:

P.O. No.:

Page of

Report No.:

Parameters/Method Numbers for Analysis

Chain-of-Custody Record

EA Laboratories
231 Schilling Circle
Hunt Valley, MD 21031
Telephone: (410) 584-7000

Report Deliverables:
1 2 3 4 D E

EDD: Yes/No

DUE TO CLIENT: __________

Date	Time	Water	Soil	Sample Identification 19 Characters	**No. of Containers**														**EA Labs Accession Number**	Remarks
				XXXXXXXXXXXXXXXXXXX																**LPM**:
				XXXXXXXXXXXXXXXXXXX																
				XXXXXXXXXXXXXXXXXXX																
				XXXXXXXXXXXXXXXXXXX																
				XXXXXXXXXXXXXXXXXXX																
				XXXXXXXXXXXXXXXXXXX																
				XXXXXXXXXXXXXXXXXXX																
				XXXXXXXXXXXXXXXXXXX																
				XXXXXXXXXXXXXXXXXXX																
				XXXXXXXXXXXXXXXXXXX																
				XXXXXXXXXXXXXXXXXXX																
				XXXXXXXXXXXXXXXXXXX																
				XXXXXXXXXXXXXXXXXXX																
				XXXXXXXXXXXXXXXXXXX																
				XXXXXXXXXXXXXXXXXXX																
				XXXXXXXXXXXXXXXXXXX																
				XXXXXXXXXXXXXXXXXXX																
				XXXXXXXXXXXXXXXXXXX																
				XXXXXXXXXXXXXXXXXXX																
				XXXXXXXXXXXXXXXXXXX																
				XXXXXXXXXXXXXXXXXXX																
				XXXXXXXXXXXXXXXXXXX																
				XXXXXXXXXXXXXXXXXXX																
				XXXXXXXXXXXXXXXXXXX																
				XXXXXXXXXXXXXXXXXXX																

Company Name:

Project Manager or Contact:

Phone:

Parameters/Method Numbers for Analysis

Chain-of-Custody Record

EA Laboratories
231 Schilling Circle
Hunt Valley, MD 21031
Telephone: (410) 584-7000

Project No.

Dept.: Task:

Project Name:

Sample Storage Location:

P.O. No.:

Page of

Report No.:

Report Deliverables:
1 2 3 4 D E

EDD: Yes/No

DUE TO CLIENT: _________

Date	Time	Water	Soil	Sample Identification 19 Characters	**No. of Containers**														**EA Labs Accession Number**	Remarks
				XXXXXXXXXXXXXXXXXXX																
				XXXXXXXXXXXXXXXXXXX																
				XXXXXXXXXXXXXXXXXXX																
				XXXXXXXXXXXXXXXXXXX																
				XXXXXXXXXXXXXXXXXXX																
				XXXXXXXXXXXXXXXXXXX																
				XXXXXXXXXXXXXXXXXXX																
				XXXXXXXXXXXXXXXXXXX																
				XXXXXXXXXXXXXXXXXXX																

Samples by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time
Relinquished by: (Signature)	Date/Time	Received by Laboratory: (Signature)	Date/Time	Airbill Number:	Sample Shipped by: (Circle) Fed Ex. Puro. UPS Hand Carried Other:

Cooler Temp. _______C pH: ___ Yes ___ No Comments: Custody Seals Intact ___ Yes ___ No

NOTE: Please indicate method number for analyses requested. This will help clarify any questions with laboratory techniques.

Figure SOP002-2 EA Toxicology Laboratory Chain-of-Custody Form

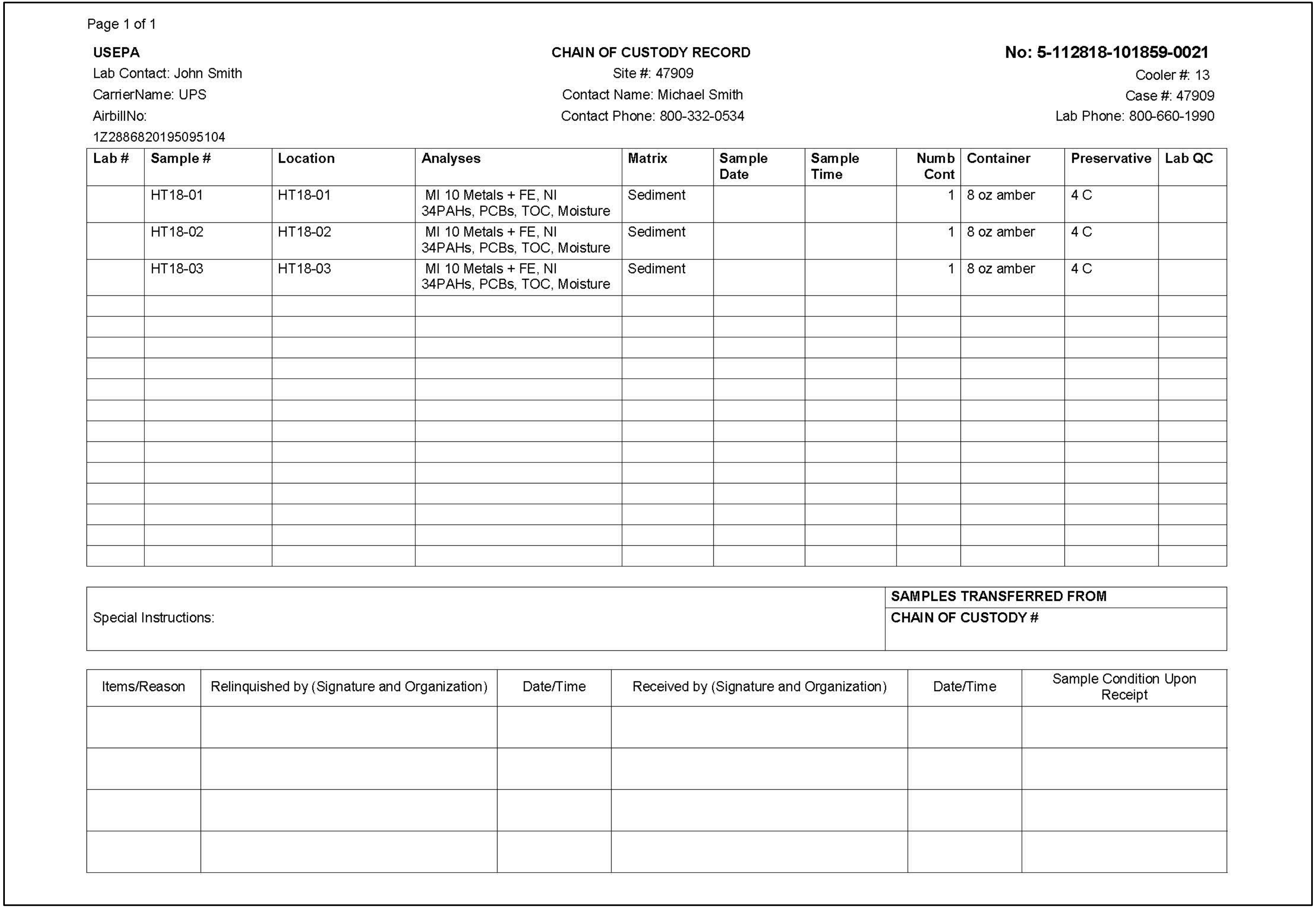
Client:	Project Manager: Phone:
	Project Contact: Phone:
Project Name: Project#:	
Page 1 of 1	

Sample Collected		Matrix		SAMPLE IDENTIFICATION	No. of Containers																							
Date	Time	Sediment	Water																									

Sampled by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time
Relinquished by: (Signature)	Date/Time	Received by Laboratory: (Signature)	Date/Time

This page intentionally left blank

Figure SOP002-3 EPA Scribe Chain-of-Custody Form



Page 1 of 1

USEPA
Lab Contact: John Smith
CarrierName: UPS
AirbillNo:
1Z2886820195095104

CHAIN OF CUSTODY RECORD
Site #: 47909
Contact Name: Michael Smith
Contact Phone: 800-332-0534

No: 5-112818-101859-0021
Cooler #: 13
Case #: 47909
Lab Phone: 800-660-1990

Lab #	**Sample #**	**Location**	**Analyses**	**Matrix**	**Sample Date**	**Sample Time**	**Numb Cont**	**Container**	**Preservative**	**Lab QC**
	HT18-01	HT18-01	MI 10 Metals + FE, NI 34PAHs, PCBs, TOC, Moisture	Sediment			1	8 oz amber	4 C	
	HT18-02	HT18-02	MI 10 Metals + FE, NI 34PAHs, PCBs, TOC, Moisture	Sediment			1	8 oz amber	4 C	
	HT18-03	HT18-03	MI 10 Metals + FE, NI 34PAHs, PCBs, TOC, Moisture	Sediment			1	8 oz amber	4 C	

Special Instructions:	**SAMPLES TRANSFERRED FROM** **CHAIN OF CUSTODY #**

Items/Reason	Relinquished by (Signature and Organization)	Date/Time	Received by (Signature and Organization)	Date/Time	Sample Condition Upon Receipt

This page intentionally left blank

Standard Operating Procedure No. 003
for
Subsurface Utility Clearance

Prepared by

EA Engineering, Science, and Technology, Inc., PBC
225 Schilling Circle, Suite 400
Hunt Valley, Maryland 21031

Revision: 01
July 2018

This page intentionally left blank

PROJECT-SPECIFIC VARIANCE FORM

This form is to be completed to indicate if there are any client-, project-, or site-specific variances to this Standard Operating Procedure (SOP) (**also check Box A**), or if this SOP is being used with no changes (**only check Box B**).

☐ **A. Variances required; cite section(s) of the SOP to which there is a variance**

☐ **B. No variances**

SOP No. 003	
SOP Section	**Variance**

Project Manager (Name)

Project Manager (Signature) Date

This page intentionally left blank

CONTENTS

DOCUMENT REVISION HISTORY

ORIGINAL (MASTER) DOCUMENT REVISION HISTORY				
Revision Number	**Revision Date**	**Revision Summary**	**Revised By**	**Reviewed By**
01	June 2018	Systematic review and update	Matt Bowman	Pete Garger

1. SCOPE AND APPLICATION

1.1 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to prevent injury to workers and damage to subsurface structures (including tanks, pipe lines, water lines, gas lines, electrical service, etc.) during ground disturbance activities (including drilling, augering, sampling, use of direct-push technologies, excavation, trenching, concrete coring or removal, fence post installation, grading, or other similar subsurface operations).

1.2 LIMITATIONS

The procedures set forth in this document are general guidance, but may not be entirely applicable to particular sites based on the site-specific considerations. The Project Manager is responsible for making a site-specific evaluation of each site to determine how subsurface utility clearance procedures should be utilized or modified. If safety or other site-specific considerations require a modified or different procedure, the Project Manager should review the modified procedure with the Business Unit Director, Profit Center Manager, or Senior Technical Reviewer. Evaluation support of modified procedures may be provided by the Corporate Health and Safety Director or the Lead Construction Quality Engineer.

Special considerations may be required for utility location activities at complex or challenging project sites (underwater utilities, hazardous waste sites, etc.). Additional subsurface utility clearance procedures should be added as appropriate for difficult sites. When health and safety risks to workers or potential utility damage cannot be effectively managed through utility location, clearance, and protection measures, the Project Manager must consider the modification of ground disturbance activities (e.g., establishing a safe offset from high risk utilities). In these cases, detailed coordination with the client and/or regulatory staff is likely required.

1.3 SCOPE

This SOP provides minimum guidance for subsurface utility clearance activities, which must be followed prior to and during ground disturbance activities at EA project sites. Even after completing the subsurface utility clearance activities required in this SOP, all ground disturbance activities should proceed with due caution.

Deviations from this SOP may be provided on an exception basis for specific situations, such as underground storage tank systems removals, verified aboveground/overhead services/lines, undeveloped land/idle facilities, shallow groundwater conditions, soil stability, or well construction quality assurance/quality control concerns, etc.

EA or its subcontractors are responsible for, and shall ensure that, all ground disturbance activities are completed safely, without incident, and in accordance with applicable federal, state, and local regulations.

This SOP shall not override any site-specific or consultant/contractor procedures that are more stringent or provide a greater degree of safety or protection of health or the environment.

2. PROCEDURES

The EA Project Manager or his/her designee must complete the Subsurface Utility Clearance Checklist (Attachment A) in conjunction with the following procedures. The checklist must be completed before initiating any ground disturbance activities. The completed checklist must be submitted to the appropriate team individuals, subcontractors, and/or the client and included in the project files.

2.1 SAFETY

A Health and Safety Plan must be available onsite and followed by all contractors and subcontractors.

Work areas should be defined and secured with safety cones, safety tape, construction fence, other barriers, or signs as appropriate.

Site work permits must be obtained as required by site procedures. Based on site conditions or classification, the use of intrinsically-safe equipment may be required.

To ensure the safety of all onsite personnel and subsurface structure integrity, consideration should be given to de-energizing and locking out selected site utilities or temporarily shutting down a portion of or the entire facility.

2.2 SUBSURFACE UTILITY LOCATION ACTIVITIES

To gather all relevant information about potential subsurface structures prior to ground disturbance activities, the project team should pursue multiple lines of evidence on the type, location, depth, size, material of construction, and status (active/abandoned) of all utilities within and near the area planned for ground disturbance activities. A minimum of three lines of evidence should be obtained and documented; however, additional lines of evidences should be secured when possible. Lines of evidence may include the following:

- Historical Site Information
- Public Utility Mark-Out (One Call – 811)
- Private Utility Mark-Out
- Site Inspection
- Client/Facility Interviews and Coordination.

2.2.1 Historical Site Information

The most recent as-built drawings and/or site plans (including underground storage tank, product, and vent lines) should be obtained, as available.

NOTE: As-built drawings may not accurately depict the locations and depths of improvements and subsurface structures and should, therefore, not be **solely** relied upon.

EA should obtain any other site information such as easements, right-of-ways, historical plot plans, fire insurance plans, tank (dip) charts, previous site investigations, soil surveys, boring logs, and aerial photographs, etc. as relevant to the planned ground disturbance activities. Where applicable, EA should also contact contract personnel who may have historical site knowledge.

2.2.2 Public and Private Utility Mark-Outs

EA must ensure that a thorough mark-out at the site is completed to locate electrical, gas, telephone, water, sewer, low voltage electric lines, product delivery pipelines, fiber optic, and all other subsurface utilities/services.

- Where available, public utility companies must be contacted to identify subsurface utilities. (This can be accomplished through the One-Call system in most instances.) Attachment B provides a brochure for the 811 Utility Locate Call Center.

- In addition, where available and warranted by site conditions, a private utility/pipeline mark-out company should be contracted to perform an electronic subsurface survey to identify the presence of suspected hazardous or critical subsurface utilities and structures. In some cases, this is necessary to confirm public utility mark-outs in the vicinity of planned ground disturbance activities.

EA will review all available site plan subsurface information with the private mark-out company to assist in locating utilities and other subsurface structures.

NOTE: Mark-outs may not accurately depict the exact locations of improvements and subsurface structures and should, therefore, not be **solely** relied upon.

Where possible, EA personnel are encouraged to be onsite at the time of subsurface mark-outs. This is to ensure accuracy and understanding of subsurface utility structures identified and provides an opportunity to exchange information with mark-out company personnel regarding planned work activities.

Subsurface utility structures should be marked throughout the entire work area(s) with adequate materials (e.g., site conditions may require paint and tape/flags). Ground disturbance activities must be started within 30 days of mark-out, unless local ordinances specify a shorter time period.

If activities are not started within required time period or markings have faded, mark-outs must be redone.

EA personnel will record time and date of mark-out request and list all companies contacted by the service and confirmation number. This information should be available for review onsite and checked off after visual confirmation of markings.

2.2.3 Site Inspection

To compare the site plan to actual conditions based on information gathered in other lines of evidence, a site inspection should be performed to identify potential signs of subsurface utilities. These signs may include:

- Signage identifying subsurface utilities
- Asphalt patching or paving scars
- Pull boxes, junction boxes, valve box covers, or manhole covers
- Sewer drains and clean-out traps
- Meters and light poles
- Piping or conduit on the walls or roofs of buildings
- Linear ground depressions
- Markings from previous utility mark-out efforts
- Other utilities including fire hydrants, on/below grade electrical transformers, splice cages, sprinkler systems, steam lines (including insulated tanks that may indicate steam lines), and cathodic protection on lines/tanks.

EA will document all findings and update the site plan with this information. In some regions, it may be more effective and efficient to conduct the site inspection at the same time the contractor performing the ground disturbance activity is mobilized to the site. The site inspection may include others as determined by the consultant/contractor and the Project Manager.

2.2.4 Client/Facility Interviews and Coordination

Knowledgeable client and facility staff familiar with site utilities should be interviewed to obtain information and documentation on potential subsurface utility locations, depth, etc. Results of these interviews should be documented and included with the Subsurface Utility Clearance Checklist. On third party sites, close coordination with the site owner's representatives for mark-outs, review of as-builts, and other information reviews should be conducted prior to any ground disturbance work. Project Managers are encouraged to provide updated as-built information to the client.

EA will review the selected ground disturbance locations with the client. EA will not proceed with the subsurface activities until the plan has been discussed with the client. During execution of the project, if subsurface activities are required outside of the area previously approved by the client, EA will submit these changes to the client for approval prior to execution.

2.2.5 Ground Disturbance Activity Sequence

When practical, EA will plan ground disturbance activities starting at the point farthest from the location of suspected underground improvements. This is done to determine the natural subsurface conditions and to allow EA site personnel to recognize fill conditions.

Experience has shown that the following warning signs may indicate the presence of a subsurface structure:

- Warning tape (typically indicative of underground services).
- Pea gravel/sand/non-indigenous material (typically indicative of tanks or lines).
- Red concrete (typically indicative of electrical duct banks).
- The abrupt absence of soil recovery in a hand auger. This could indicate pea gravel or sand that has spilled out of the auger. This may not be indicative in areas where native soil conditions typically result in poor hand auger recoveries.
- Any unexpected departure from the native soil or backfill conditions as established by prior onsite digging.

If any of these conditions is encountered by EA site personnel, digging should stop and the client should be contacted.

3. UTILITY PROTECTION MEASURES DURING GROUND DISTURBANCE ACTIVITIES

After mobilization, but prior to the primary ground disturbance activities, the physical location of subsurface utilities should be cleared and verified whenever possible and practical. The clearance method used to clear and verify the subsurface utilities should be compatible with the inherent associated risk given the type of facility/property, subsurface utility material of construction, utility depth, soil stratigraphy, and the location of the ground disturbance activity, such that required delineation is obtained. It should be noted that in areas where there is paving, sufficient paving should be removed to allow clear visibility of the subsurface conditions during clearance activities. The following is a list of potential clearance methods that may be used on a job site:

- Vacuum digging
- Probing
- Hand digging
- Hand augering
- Post-hole digging.

EA personnel will evaluate the potential for electrical shock or fire/explosion for each subsurface disturbance project and will evaluate as necessary the use of non-conductive or non-sparking tools (i.e., fiberglass hand shovels, and thick electrically insulating rubber grips on hand augers or probes). The potential need for the use of non-conductive materials, electrical safety insulated gloves, and footwear will also be evaluated on a case-by-case basis.

For drilling, direct-push technology, fence post installation, or other borehole installation, the area to be delineated will exceed the diameter of the largest tool to be advanced and sufficiently allow for visual inspection of any obstructions encountered.

3.1 SUBSURFACE CLEARANCE PROCEDURES FOR TRENCHING/ EXCAVATION ACTIVITIES

For trenching and excavation activities, appropriate subsurface clearance methods should be conducted along the length and width of the excavation at a frequency sufficient to ensure adequate precautions have been applied to the entire work area. The frequency and density of investigations will be based on site knowledge, potential hazards, and risks of the work area to surrounding locations.

Whenever subsurface structures are exposed, EA will cease work and mark the area (e.g., flags, stakes, cross bracing) to ensure the integrity of these exposed structures is maintained during subsequent trenching/excavation/backfilling.

During ground disturbance activities, EA and its subcontractors should consider the use of spotters to monitor the excavation for signs of subsurface utilities (pipes, conduits, cables, bedding material, warning tape, tracing wire, soil material changes, etc.) to provide early warning in the event unknown subsurface utilities are encountered. The decision to use spotters should be based on the risk of encountering unknown subsurface utilities, utility hazards associated potential unknown utilities that could be encountered (electrical, natural gas, etc.), and the physical and environmental hazards to have a spotter in proximity to the excavation. Spotters, if used, should be briefed on the potential physical and utility hazards that may be present at the site and the signs of subsurface utilities that they should be monitoring for during ground disturbance activities.

Uniform color codes for marking of underground facilities are provided in Attachment C.

Attachment A

Subsurface Utility Clearance Checklist

This page intentionally left blank

SUBSURFACE UTILITY CLEARANCE CHECKLIST

Site Identification: ______________________

Project Consultant/Contractor: ______________________

Section 1: Safety, Preparation Tasks, and Mark-Outs

Activity	Yes	No	N/A	Comments including Justification if Response Is No or Not Applicable
Health and Safety Plan is available and all contractors and subcontractors are familiar with it.				
All applicable local, state, and federal permits have been obtained.				
Site access/permission has been secured.				
Most recent as-built drawings and/or site plans (including underground storage tank, product, and vent lines) obtained.				
Reviewed site information to identify subsurface structures relevant to planned site activities (easements, rights-of-way, historical plot plans, fire insurance plans, tank dip charts, previous site investigations, soil surveys, boring logs, aerial photographs, etc.).				
Utility mark-outs have been performed by public utility company(s). Mark-outs clear/visible.				
Subsurface structure mark-outs performed by private mark-out company. Mark-outs clear/visible.				
Additional Activities: Were dig locations reviewed with site representative?				

Section 2: Initial Site Visit and Selecting Ground Disturbance Locations

Activity	Yes	No	N/A	Comments, including Justification if Response Is No or Not Applicable
Location of all aboveground indicators of subsurface utilities/services that may be leading to or from buildings within the planned work area has been identified.				
Location of utility mark-outs by all utility companies previously contacted has been identified within required time period.				
Location of all subsurface structure mark-outs by private mark-out company has been identified within required time period.				
Location of area lights/signs and associated subsurface lines identified.				
Location of all phones and associated subsurface lines identified.				
Location of all drains and associated interconnecting lines identified.				
Location of all electrical junction boxes and associated interconnecting lines identified				
Location of all natural gas meters or connections and all interconnecting lines identified				

Completed by: ______________________
Name

Signature: ______________________ ____________
Company Date

This page intentionally left blank

Attachment B

811 Utility Locate Brochure

This page intentionally left blank

ALWAYS
CALL
BEFORE YOU
DIG

One free, easy call gets your utility lines marked AND helps protect you from injury and expense.

Know what's below. Always call 811 before you dig. Visit call811.com for more information.

811
Know what's below.
Call before you dig.

INSERT
CALL CENTER
LOGO HERE

U.S. Department
of Transportation

Building Your Quality of Life

JOHN DEERE

TRAVELERS

Common Ground Alliance

Know what's below.
Call before you dig.

Q: WHAT IS 811?

A: 811 is a new federally-mandated N-11 number designated by the FCC to consolidate all local “Call Before You Dig” numbers and help save lives by minimizing damages to underground utilities. One easy phone call to 811 quickly and easily begins the process of getting underground utility lines marked. Local One Call Center personnel will then notify affected utility companies, who will continue to mark underground lines for free.

Q: WHY SHOULD I CALL 811 BEFORE EVERY DIG?

A: Calling 811 will help save lives and protect infrastructure. Knowing where underground utility lines are buried before each digging project begins helps protect you from injury, expense and penalties. The depth of utility lines varies and there may be multiple utility lines in the same area. Even simple digging projects can damage utility lines and can disrupt vital services to an entire neighborhood, harm diggers, and potentially result in expensive fines and repair costs. Marked lines show diggers the approximate location of underground lines and help prevent undesired consequences.

Q: I’M JUST A HOMEOWNER, NOT A CONTRACTOR—IS 811 FOR ME?

A: Calling 811 is for professional excavators and do-it-yourself homeowners. A recent national survey revealed that roughly half of Americans are “active diggers” who have done (or are planning to do) some type of digging project at home. Whether you are a professional excavator or an avid do-it-yourselfer, you need to call 811 before every dig every time.

Q: WHO IS PROMOTING AWARENESS OF 811?

A: The national 811 campaign is a project of The Common Ground Alliance (CGA), working with its 1,400 individual members, member organizations, sponsors and 811 campaign national launch partners. CGA is a member-driven association dedicated to ensuring public safety, environmental protection, and the integrity of services by promoting effective damage prevention practices. In recent years, the association has established itself as the leading organization in an effort to reduce damages to all underground facilities in North America through shared responsibility among all stakeholders.

Attachment C

Uniform Color Codes for Marking of Underground Facilities

This page intentionally left blank

APWA UNIFORM COLOR CODE

WHITE - Proposed Excavation

PINK - Temporary Survey Markings

RED - Electric Power Lines, Cables, Conduit and Lighting Cables

YELLOW - Gas, Oil, Steam, Petroleum or Gaseous Materials

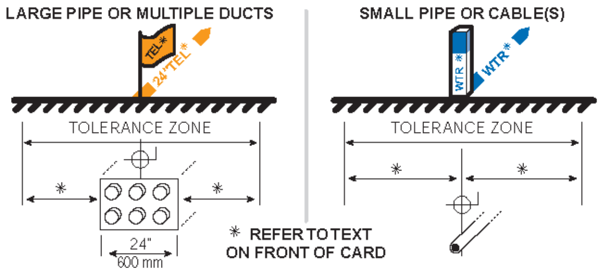
ORANGE - Communication, Alarm or Signal Lines, Cables or Conduit

BLUE - Potable Water

PURPLE - Reclaimed Water, Irrigation and Slurry Lines

GREEN - Sewers and Drain Lines

TYPICAL MARKING


LARGE PIPE OR MULTIPLE DUCTS

SMALL PIPE OR CABLE(S)

Customize with your center's phone and address information

GUIDELINES FOR UNIFORM TEMPORARY MARKING OF UNDERGROUND FACILITIES

This marking guide provides for universal use and understanding of the temporary marking of subsurface facilities to prevent accidents and damage or service interruption by contractors, excavators, utility companies, municipalities or any others working on or near underground facilities.

ONE-CALL SYSTEMS

The One-Call damage prevention system shall be contacted prior to excavation.

PROPOSED EXCAVATION

Use white marks to show the location, route or boundary of proposed excavation. Surface marks on roadways do not exceed 1.5" by 18" (40 mm by 450 mm). The facility color and facility owner identity may be added to white flags or stakes.

USE OF TEMPORARY MARKING

Use color-coded surface marks (i.e., paint or chalk) to indicate the location or route of active and out-of-service buried lines. To increase visibility, color coded vertical markers (i.e., stakes or flags) should supplement surface marks. Marks and markers indicate the name, initials or logo of the company that owns or operates the line, and width of the facility if it is greater than 2" (50 mm). Marks placed by other than line owner/operator or its agent indicate the identity of the designating firm. Multiple lines in joint trench are marked in tandem. If the surface over the buried line is to be removed, supplementary offset markings are used. Offset markings are on a uniform alignment and clearly indicate the actual facility is a specific distance away.

TOLERANCE ZONE

Any excavation within the tolerance zone is performed with non-powered hand tools or non-invasive method until the marked facility is exposed. The width of the tolerance zone may be specified in law or code. If not, a tolerance zone including the width of the facility plus 18" (450 mm) measured horizontally from each side of the facility is recommended.

ADOPT UNIFORM COLOR CODE

The American Public Works Association encourages public agencies, utilities, contractors, other associations, manufacturers and all others involved in excavation to adopt the APWA Uniform Color Code, using ANSI standard Z535.1 Safety Colors for temporary marking and facility identification.

Rev. 4/99

This page intentionally left blank

Standard Operating Procedure No. 004
for
Sample Packing and Shipping

Prepared by

EA Engineering, Science, and Technology, Inc., PBC
225 Schilling Circle, Suite 400
Hunt Valley, Maryland 21031

Revision: 01
September 2018

PROJECT-SPECIFIC VARIANCE FORM

This form is to be completed to indicate if there are any client-, project-, or site-specific variances to this Standard Operating Procedure (SOP) (**also check Box A**), or if this SOP is being used with no changes (**only check Box B**).

☐ **A. Variances required; cite section(s) of the SOP to which there is a variance**

☐ **B. No variances**

SOP No. 004	
SOP Section	**Variance**

Project Manager (Name)

Project Manager (Signature) Date

This page intentionally left blank

CONTENTS

DOCUMENT REVISION HISTORY

ORIGINAL (MASTER) DOCUMENT REVISION HISTORY				
Revision Number	**Revision Date**	**Revision Summary**	**Revised By**	**Reviewed By**
01	September 2018	Systematic update and review	Cristina Radu Amanda Kohn	Matthew Bowman

1. SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to delineate protocols for the packing and shipping of environmental samples to the laboratory for analysis. Additional requirements are applicable when shipping samples under the U.S. Environmental Protection Agency's Superfund Contract Laboratory Program.

NOTE: Samples collected from process wastewater streams, drums, bulk storage tanks, soil, sediment, or water samples from areas suspected of being highly contaminated could require shipment as dangerous goods; procedures for shipping of such samples are not covered in this SOP.

2. MATERIALS

The following materials may be required:

- Clear tape
- Custody seals
- Ice
- Packing material
- Plastic garbage bags
- Sample documentation
- Waterproof coolers (hard plastic)
- Zip-seal plastic bags.

3. PROCEDURE

Refer to SOP Numbers (Nos.) 001, 002, 016, and 039 as applicable.

Samples will be placed in clean, bubble-wrap lined sample coolers with double-bagged ice immediately after collection to ensure proper preservation. Most sample analyses require that the sample material is maintained at 2-6 degrees Celsius (°C). It is also important to ensure that sample containers are maintained at all times at the temperature required by the analytical method used to analyze the sample media; as such, samples should be retained in a chilled cooler during the inventory, quality control, and packaging process.

Check cap tightness and wipe down outside of each sample container. Verify that information on sample labels is correct and matches chain-of-custody forms. Ensure that both waterproof labels and indelible ink are used to label sample containers. Clear tape should be placed completely over the label. Wrap breakable sample containers in bubble wrap. Enclose each sample in a clear zip-seal plastic bag.

Prepare cooler for shipping. Empty any water that has accumulated in coolers from melting ice. Securely seal all valves and/or drain holes in the shipping container, both inside and out, with duct tape to prevent leakage in the event of sample container breakage or melting ice.
Place several layers of bubble wrap on top of absorbent material and line the cooler sidewalls with bubble wrap. Line cooler with open garbage bag.

Prepare sample containers for shipping as follows:

- ***Glass Containers***—Wrap each glass sample container in bubble wrap or closed cell foam sheets. It is acceptable to package up to three 40-milliliter vials in one bubble wrap bag that is usually provided by the analytical laboratory. Enclose sample containers in a clear zip-seal plastic bag.

- ***Polyethylene Containers***—Place sample containers in clear zip-seal bags.

- ***Zip-Seal Bags***—Double-bag the samples to ensure that moisture will not reach the label.

Place all the sample containers upright inside garbage bag. Do not stack glass containers or lay them on their sides. Add additional bubble wrap between and around sample containers as needed to ensure containers do not shift during transport. If a second garbage bag was used, tie the (inner) garbage bag to isolate samples.

Double bag and seal loose, fresh ice to prevent melting ice from soaking the packing material. Fill gallon-size or larger zip-seal bags with fresh ice about two-thirds full and squeeze excess air out of the bags before sealing. Turn bag upside down and place in a second zip-seal bag, also removing excess air. Prepare sufficient bags to cover sample containers and ensure that the proper temperature (2-6° C) is maintained during transport.

Place ice on top of sample containers. Ensure that packing material does not insulate samples from ice. Do not use loose ice in sample coolers. Do not use bagged ice as packing material between or around sample bottles. Tie the garbage bag ensuring that the cooler lid will close securely.

Place a temperature blank into the cooler. The temperature blank consists of a plastic bottle containing either potable or deionized water. Temperature blanks are typically provided by the analytical laboratory. If temperature blanks are not provided, field staff must add a clean container filled with deionized water; ensure the cap is tight and container is labeled before placing in cooler.

If aqueous volatile organic analyte samples are being submitted, ensure a trip blank sample set is placed in each cooler containing volatile organic analyte samples. Trip blanks are used to check for contamination of volatile organic compound samples during handling, storage, and shipment from field to laboratory. The trip blanks consist of volatile organic analyte vials filled with deionized water and are typically provided by the analytical laboratory. Ensure that the trip blank samples and analyses are included on the chain-of-custody record.

Make copies of sample documentation (chain-of-custody forms or other field records) and retain in field files for record. Enclose the original field documentation forms in a waterproof plastic bag and tape the bag to the underside of the cooler lid. If more than one cooler is being used, each cooler will have its own documentation.

Seal coolers with signed and dated custody seals such that if the coolers were opened, the custody seals would be broken. Place clear tape over the custody seals to prevent damage to the seals.

Tape the cooler shut with packing tape over the hinges and custody seals. Tape should be wrapped around the cooler a minimum of five times. Ship all samples via overnight delivery on the same day they are collected if possible. Project-specific shipping requirements (e.g., Saturday delivery, communication with the receiving laboratory, etc.) should be discussed with the sample manager or project manager during project planning.

After samples are packaged within shipping containers, place shipping labels clearly on the outside of the container; clearly mark the number of containers in the shipment on the shipping label. Mark each cooler as “1 of 2,” “2 of 2,” etc.

4. MAINTENANCE

Not applicable.

5. PRECAUTIONS

The project manager and field team leader are responsible for determining if samples collected during a specific field investigation meet the definitions for dangerous goods. If a sample meets or is suspected to meet the definition of “dangerous goods” per the Dangerous Goods Regulation of the International Air Transport Association, then that sample must be handled according to the instructions given for that material. Dangerous goods must be prepared for shipping only by personnel trained and certified by International Air Transport Association in dangerous goods shipment.

6. REFERENCES

Not applicable.

This page intentionally left blank

Standard Operating Procedure No. 005
for
Field Decontamination

Prepared by

EA Engineering, Science, and Technology, Inc., PBC
225 Schilling Circle, Suite 400
Hunt Valley, Maryland 21031

Revision: 02
September 2018

This page intentionally left blank

PROJECT-SPECIFIC VARIANCE FORM

This form is to be completed to indicate if there are any client-, project-, or site-*specific* variances to this Standard Operating Procedure (SOP) (**also check Box A**), or if this SOP is being used with no changes (**only check Box B**).

☐ **A. Variances required; cite section(s) of the SOP to which there is a variance**

☐ **B. No variances**

SOP No. 005	
SOP Section	**Variance**

Project Manager (Name)

Project Manager (Signature) Date

This page intentionally left blank

CONTENTS

Page

DOCUMENT REVISION HISTORY

ORIGINAL (MASTER) DOCUMENT REVISION HISTORY				
Revision Number	**Revision Date**	**Revision Summary**	**Revised By**	**Reviewed By**
1	September 2018	Systematic update and review	Cristina Radu, Amanda Kohn	Matthew Bowman

1. SCOPE AND APPLICATION

All personnel or equipment involved in intrusive sampling, or that enter a hazardous waste site, must be thoroughly decontaminated prior to leaving the site to minimize the spread of contamination and prevent adverse health effects. This Standard Operating Procedure (SOP) describes the normal decontamination of sampling equipment and site personnel. Specific projects and programs may have additional decontamination requirements. Refer to the planning document(s) for additional site-specific requirements.

As a good practice, sampling at a site should be conducted moving from least to most impacted locations to minimize the potential for cross-contamination. It is advisable to use disposable tools and personal protective equipment to the extent possible such that decontamination is not necessary. If disposable equipment cannot be used, all attempts will be made to minimize the need for decontamination by using dedicated equipment when practical.

1.1 MATERIALS

The following materials may be required:

0.01 normal (N) hydrochloric acid	Non-phosphate laboratory detergent (Liquinox)
0.10 N nitric acid	Plastic garbage bags
Aluminum foil or clean plastic sheeting	Plastic sheeting, buckets, etc. to collect washwater and rinsates
Approved water (deionized, potable, etc.)	Pressure sprayer, spray bottles, brushes, laboratory wipes, disposable cloth (shop towel or similar)
High performance liquid chromatography (HPLC)-grade water[a]	Reagent grade alcohol[b]

Notes:

(a) For the purpose of this SOP, HPLC-grade water is considered equivalent to “deionized ultra-filtered water,” “reagent-grade distilled water,” and “deionized organic-free water.” The end product is water that is pure with no spurious ions or organics to contaminate the sample. The method of generation is left to the individual contractor.

(b) For the purpose of this SOP, the term “reagent grade alcohol” refers to either pesticide grade isopropanol or reagent grade methanol.

1.2 PROCEDURE

All reusable (non-dedicated) equipment that contacts or could potentially contact environmental samples shall be decontaminated prior to use at a site, between sampling locations, and at the completion of sampling events before leaving the site. Decontamination procedures are conducted in the Contaminant Reduction Zone, which may or may not be contiguous to the Exclusion Zone. The Contaminant Reduction Zone should be located on a level, preferably paved surface, either in an area upwind of the investigation/sampling area or in an area believed to be free of surface contamination. Care must be employed when moving contaminated tools and equipment to the Contaminant Reduction Zone to prevent the spread of contamination.

Specially designated and properly built decontamination pads may be built at a centralized location to accommodate larger pieces of equipment. The pads are built such that any water produced during the decontamination process can be contained and pumped into investigative-derived waste holding containers (i.e., frac tank, 55-gallon drum, etc.) for waste profiling and disposal.

For other field equipment, the Contaminant Reduction Zone may be a mobile decontamination station set up in the vicinity of the Exclusion Zone or sampling location. Plastic sheeting will be used to create a clean surface for the sampling and decontamination equipment to be placed upon.

1.2.1 Sample Bottles

At the completion of each sampling activity, the exterior surfaces of the sample bottles must be decontaminated as follows:

- Ensure the bottle lids are on tight.
- Wipe the outside of the bottle with a paper towel to remove gross contamination.

1.2.2 Personnel Decontamination

Review the Health and Safety Plan for the appropriate decontamination of site personnel and reusable personal protective equipment, such as protective suits used at highly contaminated sites, respirators, safety boots, safety glasses, etc. Decontamination will be conducted in a designated Contaminant Reduction Zone as per the Health and Safety Plan and the general decontamination procedures outlined further in this SOP.

1.2.3 Non-Dedicated Equipment

Reasonable attempts will be made to minimize the need for decontamination by using dedicated equipment when practical.

All reusable (non-dedicated) equipment that contacts or could potentially contact environmental samples shall be decontaminated prior to use at a site, between sampling locations, and at the completion of sampling events before leaving the site. Decontamination shall be conducted at a central decontamination station (i.e., decontamination pad) or at the sampling location.

Decontamination stations should be located on a level, preferably paved surface, either in an area upwind of the investigation area or in an area believed to be free of surface contamination. Plastic sheeting will be used to create a clean surface for the sampling and decontamination equipment to be placed upon.

Used decontamination solutions will be disposed of properly according to the site-specific Health and Safety Plan or applicable planning documents.

1.2.3.1 Field Monitoring and Testing Equipment

Water quality meters and temperature, pH, conductivity, redox, and dissolved oxygen probes will be cleaned per the manufacturer's instructions. If no such specifications exist, remove gross contamination and triple rinse probe with HPLC-grade water. If downhole probes are used, wipe the wetted portion of the cable with a clean laboratory wipe or disposable cloth (shop towel or similar) that has been soaked with non-phosphate laboratory detergent solution to remove gross contamination and rinse with approved water.

Electronic water level indicators, weighted tapes, measuring tapes transducers, level loggers, etc. will be decontaminated after each use as follows:

- Wipe the wetted or contaminated portion of the tape or cable and the probe with a clean laboratory wipe or disposable cloth (shop towel or similar) that has been soaked with non-phosphate laboratory detergent solution to remove gross contamination. Rinse cloth in the solution and continue wiping until tape or cable is clean.

- Wipe with a second wipe or cloth or rinse with HPLC-grade water to remove soap residue.

- Dry tape with a third cloth (or laboratory wipe) and rewind into case or on spool, or re-coil tape.

Other field monitoring or measuring equipment such as beakers and graduated cylinders used to measure flow rates; flow-through cells used for monitoring water quality parameters; piezometers used to determine water levels; packers, mechanical slug device, and downhole equipment used during aquifer (hydraulic) testing; etc. will be decontaminated by washing with a non-phosphate laboratory detergent solution, followed by approved water and HPLC-grade water rinse.

1.2.3.2 Bladder Pumps

Non-dedicated bladder pumps with disposable bladders will be decontaminated as follows:

- Disconnect tubing from pump.

- Completely disassemble the pump, being careful to note the initial position of and retain any springs and loose ball checks.

- Discard the pump bladder.

- Clean all parts in the same manner as provided in Section 1.2.3.1.

- Install a new Teflon® bladder and reassemble pump.

- Store pump in a clean, dedicated polyvinyl chloride, polytetrafluorethylene (PTFE), or low density polyethylene (for perfluorooctanesulfonic acid/per- and polyfluoroalkyl substances sampling) storage container.

1.2.3.3 Grundfos Redi-Flow® or Similar Submersible Pumps

Non-dedicated Grundfos Redi-Flow® and similar pumps will be disassembled and decontaminated per the manufacturer's instructions on an as-needed basis (i.e., where high concentrations and an elevated risk of cross-contamination exist). Due to the challenges associated with pump decontamination, if possible, consider designating one pump for sampling in highly contaminated areas and a second pump for sampling non-impacted areas or areas with lower contaminant concentrations. In most cases, the pumps will be decontaminated following the procedures below.

The pump and support cable/electrical wires that come in contact with water will be decontaminated via pumping as detailed below. To avoid electrical shock, always disconnect power from the pump when handling the pump body during decontamination procedures.

- Disconnect sample tubing from pump.

- Decontaminate the wetted portion of the cable/electrical wires by washing with non-phosphate laboratory detergent solution, followed by approved water and HPLC-grade water rinse. Coil cable/electrical wires on spools or clean plastic sheeting.

- Scrub the exterior of the pump to remove gross (visible) contamination, using appropriate brush(es), approved water, and non-phosphate detergent (steam cleaning may be substituted for detergent scrub).

- Transfer pump to rinse bucket filled with approved water. Rinse by pumping no less than nine volumes or a minimum of 5 minutes of approved water.

- Rinse pump exterior with reagent grade alcohol.

- Rinse pump exterior with HPLC-grade water.

- Rinse pump exterior with 0.10 N nitric acid solution

- Rinse pump exterior with HPLC-grade water.

- Allow pump to air dry.

- Wrap pump in aluminum foil or clean plastic sheeting, or store in a clean, dedicated polyvinyl chloride or PTFE storage container.

- Prior to reusing pump, rinse exterior again with HPLC-grade water.

1.2.3.4 Other Liquid Sampling Equipment

Other sampling equipment used to collect surface water, groundwater, non-aqueous phase liquid (NAPL), or other liquid samples includes but is not limited to PTFE double-check valve bailers, dip samplers (whether bucket, long-handled, or short-handled), discrete interval stainless-steel samplers, ball check valves and foot valves, and labware (i.e., beakers, graduated cylinders, vials, and other containers that are used to hold samples for field measurements/screening and water chemistry). This equipment will be decontaminated after each use as follows:

- Discard all ropes, tubing, etc. used in sampling in a properly marked sealable container, or as directed by the Health and Safety Plan. NOTE: No tubing is to be used in conjunction with a bailer in collecting samples.
- Wash sampling equipment with non-phosphate laboratory detergent and approved water solution using appropriate brush(es), laboratory wipes, or disposable cloth (shop towel or similar) to remove gross (visible) contamination.
- Rinse with approved water.
- Rinse with reagent grade alcohol.
- Rinse with HPLC-grade water.
- Rinse with 0.10 N nitric acid solution using a spray bottle. This rinse may be eliminated if inorganic compounds such as metals are not being sampled/are not a contaminant of concern.
- Rinse with HPLC-grade water.
- Allow equipment to air dry. If sampling equipment has just been used for purging and is being decontaminated prior to sampling, do not air dry. Double rinse with HPLC-grade water and proceed to collect samples.
- Wrap equipment in aluminum foil or clean plastic sheeting, or store in a clean, dedicated polyvinyl chloride or PTFE storage container.
- Rinse equipment with HPLC-grade water immediately prior to re-use.

1.2.3.5 Solid Materials Samplers

Solid materials samplers include soil and sediment sampling probes, augers, trowels, shovels, sludge samplers, and other sampling equipment (e.g., core tubes, grab samples, core catchers, core liners, scoops, spoons, etc.), which will be decontaminated as follows:

- Scrub the sampler to remove gross (visible) contamination, using appropriate brush(es), approved water, and non-phosphate laboratory detergent (steam cleaning may be substituted for detergent scrub).

- Rinse off detergent with approved water.

- Rinse sampler with reagent grade alcohol.

- Rinse sampler with HPLC-grade water.

- For non-metallic samplers only, rinse sampler with 0.10 N nitric acid solution.

- For non-metallic samplers only, rinse sampler with HPLC-grade water.

- Allow sampler to air dry.

- Wrap sampler in aluminum foil or clean plastic sheeting, or store in a new zip-seal bag (size permitting) or clean, dedicated polyvinyl chloride or PTFE storage container.

- Rinse sampler with HPLC-grade water immediately prior to re-use.

For larger sediment sampling equipment, if sediment can be collected from the interior of a sampling device and away from potentially contaminated surfaces of the sampler, a site water rinse may be sufficient between stations. A site water rinse may also be sufficient for vessel surfaces between sample locations. However, all tools and equipment coming into contact with the sample should be decontaminated in accordance with the procedures above. Washwater from decontamination activities should be collected and disposed of properly.

1.2.3.6 Other Sampling and Measurement Probes

Soil (or sediment) gas sampling probes will be decontaminated as solids sampling devices.

1.2.3.7 Drilling Rigs, Sediment Sampling Vessels, and Other Heavy Equipment

All drilling rigs, sediment sampling vessels, and associated equipment such as augers, drill casing, rods, samplers, tools, recirculation tank, and water tank (inside and out) will be decontaminated prior to site entry after over-the-road mobilization and immediately upon departure from a site after drilling a hole. Supplementary cleaning will be performed prior to site entry when there is a likelihood that contamination has accumulated on tires and as spatter or dust on the way from one site to the next.

- Place contaminated equipment in an enclosure (i.e., existing wash pad, decontamination pad, etc.) designed to contain all decontamination residues (water, sludge, etc.).

- Steam clean equipment until all dirt, mud, grease, asphaltic, bituminous, or other encrusting coating materials (with the exception of manufacturer-applied paint) have been removed.

- Water used will be taken from an approved source.

- Containerize decontamination fluids in 55-gallon drums; sample; characterize; and, based on sample results, dispose of all decontamination residues properly.

Other heavy equipment includes use of backhoes, excavators, skid steers, etc. If heavy equipment is utilized during field activities (i.e., a backhoe for test pitting), the bucket should not come in contact with soil to be sampled. If the bucket contacts the soil to be sampled, then it should be decontaminated between sample locations, following the same procedures as listed above for a drill rig.

1.2.3.8 Ice Chests and Reusable Shipping Containers

Scrub exterior/interior with approved brush and Liquinox detergent. Rinse off detergent with approved water. Let air dry and properly store until re-use.

NOTE: If container/ice chest is severely contaminated, clean as thoroughly as possible, render unusable, and properly dispose of.

2. PRECAUTIONS

Segregate all waste streams as specified in the sampling documents and store investigation-derived waste properly. Dispose of all washwater, rinse water, rinsates, and other sampling wastes (tubing, plastic sheeting, etc.) in properly marked, sealable containers, or as directed by the Health and Safety Plan or applicable planning documents.

Once a piece of equipment has been decontaminated, be careful to keep it in such condition until needed.

3. REFERENCES

Site-specific Health and Safety Plan and/or applicable planning documents.

This page intentionally left blank

Standard Operating Procedure No. 010
for
Water Level and Well Depth Measurements

Prepared by

EA Engineering, Science, and Technology, Inc., PBC
225 Schilling Circle, Suite 400
Hunt Valley, Maryland 21031

Revision: 02
March 2021

This page intentionally left blank

PROJECT-SPECIFIC VARIANCE FORM

This form is to be completed to indicate if there are any client-, project-, or site-specific variances to this Standard Operating Procedure (SOP) (**also check Box A**), or if this SOP is being used with no changes (**only check Box B**).

☐ **A. Variances required; cite section(s) of the SOP to which there is a variance**

☐ **B. No variances**

SOP No. 010	
SOP Section	**Variance**

Project Manager (Name)

Project Manager (Signature) Date

CONTENTS

Page

DOCUMENT REVISION HISTORY

ORIGINAL (MASTER) DOCUMENT REVISION HISTORY				
Revision Number	**Revision Date**	**Revision Summary**	**Revised By**	**Reviewed By**
01	September 2018	Systematic update and review	Cristina Radu Amanda Kohn	Matthew Bowman
02	March 2021	Added “Relative Elevation Survey” section	AnnMarie Ricchino	Matthew Bowman

1. SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to present the protocols for measuring depth to groundwater, presence and thickness of non-aqueous phase liquid (NAPL), and well depth in groundwater wells. This procedure is applicable to the sampling of monitoring wells and must be performed prior to any activities that may disturb the water level (i.e., purging or aquifer testing).

2. MATERIALS

The following materials may be required:

- Electronic sounding device with calibrated cable or tape measured at 0.01-foot increments (i.e., water level meter or oil/water interface probe) OR transducer and datalogger
- Plastic sheeting
- Photoionization detector or intrinsically safe flame ionization detector
- Materials required for decontamination per SOP Number (No.) 005
- A leveling rod and an auto level equipped with a telescope tube and tripod if conducting a relative elevation survey
- Well construction diagrams, well records, and/or survey information
- Field forms (i.e., well gauging forms, well assessment forms, purge logs) and/or field logbook.

3. PROCEDURE

3.1 PRELIMINARY STEPS

Compile well construction data/forms, survey information, and historical data, if available, prior to field mobilization. The type and length of electronic sounding device to be used will be based on the monitoring well diameter, well installation depth, and the presence/absence of NAPL. Oil/water interface probes will be used in all wells for the first round of sampling, regardless of site history.

When planning on measuring depth to water at a site where product may be present in wells, the wells should be segregated between potentially contaminated and not contaminated categories.

The sequence of well gauging should be established to minimize the potential of cross contamination by generally gauging clean wells first.

Ensure that the electronic sounding device is working prior to mobilization by submerging the probe in a container of potable or deionized water. Keep the indicator probe in its protective case when not in use. Locate the well and verify its position on the site map. Record on the applicable field form(s) or in the field logbook whether positive identification was obtained, including the well number/identification and any identifying marks, codes, or tags contained on the well casing or protective casing.

3.2 RELATIVE ELEVATION SURVEY

A relative elevation survey of groundwater monitoring wells is essential to produce accurate groundwater elevation measurements. This task requires a minimum of two people and necessitates the use of an auto level equipped with a telescope tube and tripod (referred to as the instrument) as well as a leveling rod. The telescope tube is designed to impose a set of cross hairs on the image viewed through the telescope, which will intersect with a numbered graduated line on the leveling rod when held in its line of site.

All measurements should be taken relative to an accurately surveyed and clearly visible elevation reference point on the monitoring well. For consistency, the reference point shall be located on the north side of the inner well casing and be clearly visible with a notch or some other permanent method. The proper steps to conduct the relative elevation survey are as follows:

- The survey process is started from a benchmark (BM) of known elevation or that has been assigned an arbitrary elevation. This can be a monitoring well or other known location.

- The instrument should be set up within 300 feet of the BM to reduce the potential of reading errors.

- A check should be done to ensure the bubble is in the center of the small bullseye level located on the instrument, indicating a horizontal line of sight. (Large adjustments can be made using the legs of the tripods whereas smaller adjustments can be made using the leveling screws.)

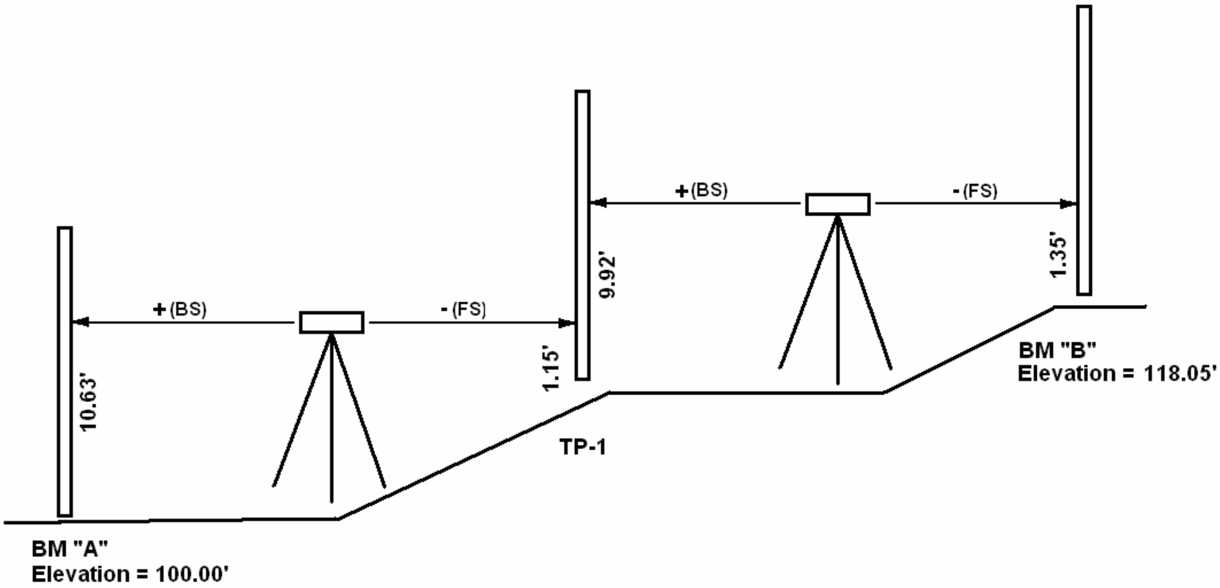
- The rod person will hold the rod vertically on the BM with the face of the rod containing the numbered graduations facing the instrument. The instrument person will look through the telescope and take note of the graduated line reading where the crosshairs intersect. This reading is the backsight (BS).

- The BS reading should be added to the known BM elevation to calculate the height of instrument (HI).

- Once the HI is known, multiple points can be determined from that setup if a rod reading is visible on the point. If the instrument person is unable to observe a rod reading on the point, establishment of a turning point (TP) is necessary.

- To establish a TP, keep the instrument in its current setup location and move the leveling rod to the chosen TP location. Take a rod reading and note it as a foresight (FS). Subtract the FS reading from the HI to determine the elevation of that TP. The instrument can then be moved ahead, and the entire process repeated with the TP as the new BM (Figure 1 provides an example diagram and accompanying notes below). Be sure to mark TP locations on a map of the site. If multiple TPs are established during surveying, number them accordingly (e.g., TP1, TP2, etc.).

- If a line of levels is run involving two or more setups, run a line of levels back to the original BM or to another BM to check for accuracy of work.



Surveying notes				
STA.	**BS (+)**	**HI**	**FS (-)**	**Elev.**
BM A	10.63	110.63		100.0
TP-1			1.15	109.48
TP-1	9.92	119.40		
BM B			1.35	118.05

Figure 1. Differential leveling instrument setup and elevation calculations including one turning point (Archuleta and Gilbert 2000).

Leveling Term	Definition
Benchmark (BM)	Monument or point with known elevation
Backsight (BS)	Rod reading taken on a point of known elevation (always add to determine elevation)
Foresight (FS)	Rod reading taken on a point to determine the elevation at that point (always subtract from HI to determine elevation)
Height of Instrument (HI)	The elevation of the level line sight projected by the instrument
Turning Point (TP)	Intermediate reference point used when it is necessary to move the instrument ahead while running a line of levels

3.3 WELL HEADSPACE SCREENING

Refer to the Health and Safety Plan or applicable planning documents to determine if well headspace screening is required. At a site where historical information is available, well headspace screening may be omitted.

Headspace screening will be conducted using an organic vapor meter (photoionization detector or flame ionization detector). All headspace screening should be performed at arm’s length and from the upwind side of the well, if possible. Refer to SOP Nos. 011, 023, or 024 as appropriate.

Screen the ambient air in the breathing area around the wellhead and record the reading on the applicable field form(s) and/or in the field logbook. Once the breathing area is deemed safe, unlock/open the well protective casing to get access to the wellhead. Re-screen the ambient air again to determine if organic vapors may have accumulated.

Screen the air in the wellhead (headspace) for gross organic vapors. This will indicate the presence of gross volatile contaminants as well as potential sampler exposure. Most well casings are covered with a cap, some are outfitted with pump assemblies, while some may not have a cap at all. If a cap is present, sample the air in the wellhead for gross organic vapors by lifting the well cap only high enough for the organic vapor meter probe to be entered into the well casing. If a pump assembly is present on top of the casing, locate the gauging port, remove the cap, and insert the probe to make the measurement. If a cap is not present, insert the probe in the well casing. Record the reading on the applicable field form(s) and/or in the field logbook.

If volatiles are detected, allow the well to vent for 60-90 seconds and re-screen and record the headspace readings. If the second reading is lower than the first, use the second reading to determine whether respiratory protection will be required during subsequent activities.

3.4 WELL ASSESSMENT

Once the breathing zone at the wellhead is deemed safe or applicable respiratory protection is donned if needed, conduct the well assessment. Record the well assessment information on applicable field forms (well assessment form) or in the field logbook.

Assess and record the condition of the well casing, well pad and bollards, well cover, and any equipment (pump assembly). Record any observations and remarks regarding the completion characteristics and well condition (i.e., evidence of cracked casing or surface seals, security of the well [locked cap], or evidence of tampering). Note if there are discrepancies between current well condition/completion and well construction diagrams/records or well survey data (i.e., damage or modifications to the well including but not limited to frost heaving, broken or otherwise damaged casing, conversion to/from flush mount or stick-up, installation or removal of polyvinyl chloride collar or other material on inner casing, installation or removal of a pump assembly, etc.).

Next, locate the measurement reference point from where water, NAPL, and well depth measurements will be performed. This reference point should be scribed, notched, or otherwise noted and the elevation included in the documentation of the well survey data. It is critical that the actual survey point is known and used consistently throughout monitoring events.

If no reference marks are present or if changes have been made to the well casing since the survey, measure depths based on the highest point of the well casing. If there is no high point, measure depths to the northern side of either the well polyvinyl chloride casing or the pump assembly cover. Permanently mark the measurement location for future survey and/or measurement purposes. Determine the new reference point elevation by measuring the distance from a known surveyed point (surveyed elevation of the protective casing or ground surface). Record this difference on the applicable field form(s) or in the field logbook for use in groundwater elevation calculations.

3.5 LIQUID LEVEL AND WELL DEPTH MEASUREMENTS

Typically, a complete round of static liquid levels and monitoring well depths is conducted as one of the first steps during groundwater monitoring. However, if monitoring wells are to be sampled for per- and polyfluoroalkyl substances, gauging should be completed after groundwater sampling to mitigate the possibility of cross-contamination.

Equipment should be decontaminated prior to first use in the field and after each use. Refer to SOP No. 005 for decontamination procedures. Keep all equipment and supplies protected from gross contamination; use clean plastic sheeting and keep the electronic sounding device probe in its protective case when not in use.

Measure NAPL and water levels and well depths as detailed in the subsections below. When measuring depths, grasp the cable with the thumb and forefingers at the top of the casing and record the depth based on the measurement reference point detailed in Section 3.3.

Gauging information including dates/times, water depths, NAPL depths and thicknesses, and well depths will be recorded on applicable field forms (i.e., well gauging form, well assessment form, purge form, etc.) and/or in the field logbook.

3.5.1 Non-Aqueous Phase Liquid Level Measurements

Always perform NAPL checks for the following conditions:

- The first time a well is sampled
- In wells installed in or near areas with suspected or confirmed NAPL contamination
- If headspace test reveals presence of volatiles.

Use an oil/water interface probe to determine the presence and thickness of NAPL. An oil/water interface probe will have a different alarm tone (continuous or intermittent) for NAPL versus water. The air/liquid interface depth measurements will be more accurate if the probe is lowered into liquid. The NAPL/water depths will be more accurate if the probe is moved from water into NAPL. Always lower and raise the interface probe slowly to prevent undue mixing of media. Complete all measurements as follows:

- Upon removing the well cap as a part of headspace screening described in Section 3.2, ensure that enough time (a couple of minutes) has passed for the air pressure in the well to have equalized with atmospheric pressure.

- Turn the interface probe on and test the alarm and liquid indication light.

- Remove the indicator probe from the protective case. Slowly lower the probe and cable into the well, allowing the cable reel to unwind. Continue lowering until the alarm sounds and the liquid indication light comes on.

- If light non-aqueous phase liquid (LNAPL) is detected on top of the water column, record the depth of the initial level/first alarm (top of the product layer). Continue to slowly lower the probe until it passes into the water phase. Slowly retract the probe until the NAPL alarm sounds and record the product/water interface depth (base of the product layer). Calculate and record the LNAPL thickness.

- Continue to slowly lower the interface probe through the water column to check for the presence of dense non-aqueous phase liquid (DNAPL). If DNAPL is encountered, measure and record the product interface depths (top and base of the DNAPL layer[s]) and calculate and record the DNAPL thickness(es).

- Continue lowering the probe until the base of the well is encountered. Measure the depth of the well as detailed in Section 3.5.3.

- Slowly raise the interface probe, recording the depth to each interface as the probe is withdrawn. While raising the probe, wipe the wetted portion of the tape with a clean laboratory wipe or disposable cloth (shop towel or similar) that has been soaked with non-phosphate laboratory detergent solution to remove gross contamination. If there is a discrepancy in depths, clean the probe sensors and re-measure the depths.

- Decontaminate the measuring tape and probe between well locations as detailed in SOP No. 005 to minimize the potential of cross contamination.

3.5.2 Water Level Measurements

If a well has been sampled previously and no NAPLs were present, or if none of the preceding NAPL check conditions are met, the NAPL check may be omitted and an electronic water level detector can be used to measure water levels.

- Upon removing the well cap, ensure that enough time (a couple of minutes) has passed for the air pressure in the well to have equalized with atmospheric pressure.

- Turn the water level meter and test the alarm and liquid indication light. Adjust the sensitivity scale as needed.

- Remove the water level indicator probe from the case, and slowly lower the probe and cable into the well, allowing the cable reel to unwind. Continue lowering until the alarm sounds and the liquid indication light comes on. Very slowly, raise and lower the probe until the point is reached where the alarm just sounds. Record the depth to water.

- Slowly raise the probe and wipe the wetted portion of the tape (if any) with a clean laboratory wipe or disposable cloth (shop towel or similar) that has been soaked with non-phosphate laboratory detergent solution to remove gross contamination.

- Decontaminate the measuring tape and probe between well locations as detailed in SOP No. 005 to minimize the potential of cross contamination.

3.5.3 Well Depth Measurements

The depth of a well is a stable value established during well construction; changes in well depth are usually indicative of a potential problem with the well. Fluctuations in well depth may be caused by either settlement of fine-grained material (i.e., silt) at the bottom of the well or damage to the well casing or screen.

Do not attempt to measure the depth of a well when a dedicated pump is installed in the casing. The weighted tape or the electric water level indicator will likely get snagged onto the tubing and damage the pump assembly. The depth of the well should also not be measured in wells in which passive diffusion samplers have been deployed; tag the bottom of the well after the samplers have been removed and before their re-deployment for the next sampling round.

A weighted tape is the preferred tool for measuring well depths. For shallow wells, an electronic water level indicator probe may be employed. In deeper wells, a weight may be attached to the probe to aid in measuring the well depth. Well depths will be measured as follows:

- Lower the probe until it is resting on the bottom of the well. Slowly pull upward on the tape until a tug can be felt while lifting the probe off the well bottom.

- Record the depth of the well. If the tape distance markings on the electronic sounding device are not marked to the end of the probe (i.e., markings are referenced to an electrode in the middle of the probe), add the length of the probe beneath the electrode to the measured depth to obtain the true depth of the well.

- Compare the recorded depth to the installation depth in the well construction diagram/record and note any discrepancies. If discrepancies exist, re-measure the well depth. Note the presence of sediment at the base of the well (i.e., hard bottom versus soft bottom).

- Withdraw the probe and tape. While raising the probe, wipe the wetted portion of the tape with a clean laboratory wipe or disposable cloth (shop towel or similar) that has been soaked with non-phosphate laboratory detergent solution to remove gross contamination.

- Decontaminate the measuring tape and probe between well locations as detailed in SOP No. 005 to minimize the potential of cross contamination.

3.6 TRANSDUCERS AND DATALOGGERS

Transducers and dataloggers may be used for depth to water measurements in wells where water level fluctuations over time are to be measured, such as tidal fluctuation studies (SOP No. 045) and aquifer (hydraulic) tests (SOP No. 033). Note that transducers are inappropriate for measuring well depth.

No calibration is necessary before use. Depending upon the device used, correction factors may be required for some measurements. Check instrument batteries prior to each use. Exercise care not to break the seals at the top of the electric water level indicator probe.

3.6.1 Transducers Deployment

Attach the transducer umbilical leads to the datalogger. Turn datalogger on. Program the transducer following instructions provided in the instrument user manual. Refer to the planning document(s) for site-specific parameters and recording frequency.

Measure and record the depth to water and well depth using an electronic sounding device as detailed in Sections 3.5.2 and 3.5.3. Slowly lower the transducer into the well until it is below the lowest possible piezometric level (typically 2-3 feet below the water table). Attach the cable grip to the well protective casing and/or tape the cable to the casing to prevent the transducer from falling further.

Record the following information and computations in the field logbook during transducer deployment:

- Date and time of deployment
- Weather
- Casing elevation
- NAPL surface elevation = casing elevation – depth to NAPL
- NAPL thickness = depth to bottom of NAPL – depth to top of NAPL
- Water level elevation = casing elevation – depth to water
- Well bottom elevation = casing elevation – depth to bottom (or read directly from tape)
- Method of measurement.

With the transducer deployed and the umbilical secured to the protective casing, ensure that the transducer unit is programmed to start logging at a desired date and time, or manually start logging. Record the logging start time. View real-time readings using the data logger and download a series of data using the data logger to verify proper operation. If the transducer is logging as desired, allow the transducer to continue logging. If the data are not logging as required in the planning documents, stop data collection, re-program the transducer, and restart logging.

3.6.2 Transducer Data Recording and Manipulation

Periodically check and download data per the manufacturer's instructions at the frequency detailed in the planning document(s) using a datalogger or computer and instrument software to download the transducer. If data are downloaded onto a datalogger, upload the data to a computer upon returning to the office.

Use the transducer manufacturer's software and transducer deployment information to make the following updates to the transducer data as needed:

- Correct the raw water pressure data files from the submersible transducer(s) for barometric effects

- Convert the transducer-reported values to equivalent feet of water over the sensor

- Normalize the transducer water levels as depths to groundwater in feet below the water level measuring point.

3.6.3 Transducer Retrieval

Upon completion of data collection, withdraw the transducer and cable from the well. Decontaminate the transducer and cable as detailed in SOP No. 005.

4. SPECIAL CONSIDERATIONS

Measurement of depth to water in new wells should only be performed after the water elevation in the well has stabilized. This may take as long as 72 hours; however, if the formation in which the well was installed is tight, the well may take even longer to achieve steady state. Ensure that steady-state conditions have been reached before making measurements as determined by the project geologist.

Electronic sounding devices may sometimes give erroneous readings due to water droplets along the side of polyvinyl chloride casing or on sample/pump tubing within a well. To check for erroneous readings, raise the probe above the point where the first sound was noted; a continued buzzer alarm indicates that the water table has not been reached. Shake the tape to remove water adhered to the tape and continue lowering to the water table.

5. CALIBRATION

No calibration is required. If more than one instrument is used at a site during the same gauging event, consider comparing the markings of the tapes on all instruments by stretching them on clean plastic sheeting to the anticipated length to be used. If the delta is known between the tapes, corrections of the measurements can be done at the time data are processed.

6. PRECAUTIONS

Depending upon the device used, correction factors may be required for some measurements. Check instrument batteries prior to each use. Exercise care not to break the seals at the top of the electric water level indicator probe.

7. REFERENCES

Archuleta, E. and A. Gilbert. 2000. *Basic Surveying*. Link: codot.gov/programs/tetp/construction-inspector-qualification/self-study-manuals/BasicSurveying.pdf.

Standard Operating Procedure No. 011
for
Photoionization Detector

Prepared by

EA Engineering, Science, and Technology, Inc., PBC
225 Schilling Circle, Suite 400
Hunt Valley, Maryland 21031

Revision: 01
May 2020

This page intentionally left blank

PROJECT-SPECIFIC VARIANCE FORM

This form is to be completed to indicate if there are any client-, project-, or site-specific variances to this Standard Operating Procedure (SOP) (**also check Box A**), or if this SOP is being used with no changes (**only check Box B**).

☐ **A. Variances required; cite section(s) of the SOP to which there is a variance**

☐ **B. No variances**

SOP No. 011	
SOP Section	**Variance**

Project Manager (Name)

Project Manager (Signature) Date

CONTENTS

DOCUMENT REVISION HISTORY

ORIGINAL (MASTER) DOCUMENT REVISION HISTORY				
Revision Number	**Revision Date**	**Revision Summary**	**Revised By**	**Reviewed By**
01	May 2020	Systematic Review and Update	Caron Mierczak Amy Sponaugle	Matthew Bowman

1. SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to delineate protocols for field operations with a photoionization detector (PID). The PID uses an ultraviolet emitting lamp designed to detect, measure, and display the total concentration of airborne ionizable gases and vapors. This information is used as a field screening device for sampling and/or to determine health and safety control measures (i.e., protection and action levels) during project execution.

Any client-, project-, or site-specific variances to this SOP (if any) are documented on the Project-Specific Variance Form, located immediately after the SOP title page. Prior to using this SOP, field personnel should refer to the Project-Specific Variance Form to verify whether any variances are required.

The use of brand names in this SOP is not intended as an endorsement or mandate that a given brand be used. Alternate equivalent brands of detectors, sensors, meters, etc. are acceptable. If alternate equipment is to be used, the manufacturer will provide applicable and comparable procedures for the maintenance and calibration of the instrument. Alternative procedures should be documented using the Project-Specific Variance Form. This SOP includes two standardized EA forms for environmental monitoring (Attachment A – Environmental Monitoring Record) and instrument calibration (Attachment B – Field Calibration Form).

2. MATERIALS

The following materials may be required:

Charging alternating current (AC)/direct current (DC) adapter and/or extra battery packs	Tedlar bag (optional)
Calibration gases – a span gas (typically 100 parts per million [ppm] isobutylene) and a zero gas (if required)	Tygon tubing
Regulator	Calibration adaptor (if needed)
PID (e.g., MiniRae 3000)	Microtip (if needed)
Field logbook or project-specific forms	Proper site-specific personal protective equipment (PPE)

3. STARTUP/CALIBRATION PROCEDURE

NOTE: The general startup/calibration procedures in this section are applicable for any brand of PID; however, since the MiniRae 3000 PID is a fairly common instrument, specific usage instructions for that instrument are also included in ***bold/italics***.

A. Turn the instrument on. ***For the MiniRae PID: Press and hold down the "MODE" button. When the display turns on, release the "MODE" button. The system logo should appear first, then "Start Up" and "Self-Test." Once the startup procedure is complete, the***

instrument shows a numerical reading screen with icons. This indicates that the instrument is fully functional and ready to use.

B. Perform Calibrations: A standard 2-point calibration has two steps: (1) measurement of a zero gas to determine the zero point of the sensor calibration curve, and (2) measurement of a span gas to determine the second point of the calibration curve. A canister of span gas with a regulator (flow-limiting or flow-matching) should be provided with the PID. Optionally, a Tedlar bag with the desired calibration gas can also be used. The calibration gas is typically 100 ppm isobutylene because it is near the midpoint ionization point of most volatile organic compounds (VOCs) and is not flammable or toxic at the low concentrations used for calibration. For the zero gas, usually clean outdoor air will be suitable. However, if any doubt exists as to the cleanliness of the background air, a filtering device (e.g., charcoal filter) or a commercial source of zero gas should be used.

If project-specific planning documents require a specific span gas, span gas concentration (span concentration should match the anticipated measurement concentration), and/or zero gas or filter, or if a multi-point span calibration is needed, these requirements should be documented in the Project-Specific Variance Form. Additionally, if the PID is calibrated with 100 ppm isobutylene, but field measurements need to be reported/quantified for a specific VOC (i.e., benzene), a correction factor needs to be applied to the measurements; this correction factor and the protocol for application should be specified in the Project-Specific Variance Form.

The general approach for a 2-point calibration using a span gas canister and clean outdoor air for the zero gas is as follows:

- Collect a measurement of the clean outdoor air. Confirm that the instrument reading is appropriate for zero-point calibration. Record this measurement (location and the result) in a field logbook or Project-Specific Form.

- Don PPE appropriate for the hazard potential of the span gas.

- Connect the regulator to the span gas bottle and connect tubing from the regulator to the instrument intake (use a calibration adaptor, if needed). Ensure that the regulator flow rate matches or exceeds the flow rate of the instrument pump.

- Turn on the span gas and collect a measurement. Confirm that the instrument reading is appropriate for calibration based on the known concentration of the span gas. Record this measurement result in a field logbook or project-specific form.

Span gas calibration readings should be close to the span gas concentration (within plus or minus 5 percent). If not, document the reading and discuss immediately with EA warehouse staff or manufacturer, as appropriate. Notify the Project Manager if the disparity cannot be resolved with the EA warehouse staff or manufacturer.

The instrument should be calibrated at least once a day (prior to starting work). Follow manufacturer recommendations for any additional calibration or bump tests required. Identify those additional calibration or bump testing requirements in the Project-Specific Variance Form. As identified previously in this SOP, a field calibration form has been provided in Attachment B.

For the MiniRae PID, press and hold the "MODE" and "N/-" buttons at the same time until you see the Password screen. In Basic User Level, you do not need a password, just press the "MODE" button. The Calibration Screen is now visible with Zero Calibration highlighted. Press the "Y/+" button to select Zero Calibration. You will see a message stating "Please apply zero gas….." Press the "Y/+" button to start zero calibration. A 30-second countdown begins and the screen displays "Zeroing.…" When zero calibration is complete, you will get the message "Zeroing is done! Reading = 0 ppm."

The instrument will then show the Calibration menu on its display with Span Calib highlighted. Press the "Y/+" button to enter Span calibration. The PID display screen will display the name of your span gas (isobutylene) and the span value in parts per million (100 ppm). Turn on your span gas canister fitted with a 500 cubic centimeters per minute regulator or a flow-matching regulator, and connect the regulator to the instrument using the proper sized tubing. Alternatively, the span gas can first be filled into a Tedlar bag or delivered through a demand-flow regulator. Press the "Y/+" button to initiate calibration. Span calibration starts and displays the message "Calibrating.…" There is a 30-second countdown for calibration and, upon completion, the message appears saying "Span is done! Reading = 100 ppm."

Remove the span gas from the inlet probe and remove the regulator from the span gas When you are done performing calibrations, press the "MODE" button. You will see the following message "Updating settings.…" Once the display reverts to normal, the instrument is calibrated and ready for use.]

C. Turn off the instrument. ***For the MiniRae PID: in order to turn the instrument off, press and hold the "MODE" button for 3 seconds. A 5-second countdown to shutoff begins. Once the countdown stops, release the "MODE" button. NOTE: If you remove your finger from the "MODE" button before the countdown has finished, it will cancel the shutoff operation and the instrument will continue normal operation.***

4. PROCEDURES

The PID can be used as a field screening device (e.g., for sampling) or for health and safety monitoring of field personnel. Don proper site-specific PPE before beginning work activities.

For screening purposes, the PID is typically used to determine VOC levels in soils or at the well head of groundwater monitoring wells. A microtip can be attached to the PID to filter soil particles from clogging the internal pump. In order to get an accurate measurement when screening soils, one of the following procedures should be used:

- Create a hole in the soil, turn on the PID and insert the tip into the hole, and collect a measurement.

- Fill a Ziploc® bag with soil, turn on the PID, and place the tip into the air space of the bag (ensure that the bag opening is sealed around the PID tip), and collect a measurement

- Fill a jar with soil, cover the jar opening with aluminum foil, turn on the PID and push the tip through the aluminum foil, and collect a measurement in the air space.

Readings should be recorded in a field logbook or project-specific field forms. **If there is a project-specific measurement protocol for soil, identify that protocol on the Project-Specific Variance Form. Otherwise, use one of the methods above.**

For monitoring well screening, the PID tip should be inserted into the well head immediately upon removal of the J-plug (the J-plug should be used to act as a seal over the PID as best as possible), and a measurement should be collected. Readings should be recorded in the field notebook or on Project-Specific Field Forms.

For health and safety monitoring, the PID is typically operated in continuous run mode to monitor the worker breathing zone, the general work area, and/or the work perimeter to assess VOC concentrations. PID measurements should be compared to project-specific action levels to determine whether those action levels have been exceeded and to assess whether PPE is appropriate. Measurements should be collected at determined intervals (e.g., every 10 minutes), at the start of new work activities, and/or when field conditions change. Low-level/high-level alarms for exceedances of project-specific action levels can be set, if required, using instructions in the instrument's user manual.

5. BATTERY CHARGING

Typically, when an instruments' battery charge falls below a preset voltage, the instrument will warn the user. If there is no warning mechanism, the user should periodically check the battery level to ensure continued usage. ***For the MiniRae PID: the instrument warns you by beeping once and flashing every minute, and the "empty battery" icon blinks on and off once per second. You should turn off the instrument within 10 minutes and recharge the battery.***

To charge a battery:

- Ensure that the instrument is turned off.

- Plug the AC/DC adapter's barrel connector into the instrument and then plug the AC/DC adapter into a wall outlet.

- The instrument will likely have a visual indicator during charging ***(for the MiniRae PID, the instrument will blink green to indicate charging).***

- Allow the battery to charge in accordance with manufacturer's instructions (typically, this is at least 8 hours).

- After charging, remove the charger, first from the outlet then from the instrument.

6. PRECAUTIONS

If an instrument does not carry an Intrinsic Safety Rating, it must not be used in a hazardous location where flammable concentrations of gases or vapors are present.

All calibration and field maintenance activities for the instrument, including battery charging, must be performed in a safe area away from hazardous conditions. Instrument servicing will only be conducted by the manufacturer or other authorized representative.

Do not open or mutilate battery cells. Do not defeat proper polarity orientation between the battery pack and battery charger. Substitution of components may affect safety rating.

Gas cylinders should be stored away from heat and other energy sources. Handle the cylinders carefully and do not allow them to drop from height. Ensure that the cylinders are securely stored (e.g., straps, etc.) when not in use. Prior to conducting calibration with span gas, don PPE appropriate for the potential hazard of the gas.

7. REFERENCES

None.

This page intentionally left blank

Attachment A

Environmental Monitoring Record

This page intentionally left blank

ENVIRONMENTAL MONITORING RECORD

SITE:
PROJECT NO.
INSTRUMENT:

SITE:
PROJECT NO.
INSTRUMENT:
CALIBRATION: Gas: Conc.: Span?

Time	Monitoring Location	Reading	Corrective Action Taken[(a)]

(a) Corrective actions taken must be documented whenever readings at or above action levels are reached.

Comments:

Recorded By:

Site Health and Safety Supervisor Date

This page intentionally left blank

Attachment B

Field Calibration Form

This page intentionally left blank

FIELD CALIBRATION FORM

SITE NAME:	
INSTRUMENT:	
INSTRUMENT ID NO.:	
OPERATOR:	
WEATHER:	
SPAN GAS TYPE:	
DATE:	
CALIBRATION NOTES:	
COMMENTS:	
SIGNATURE/DATE:	

This page intentionally left blank

Standard Operating Procedure No. 013
for
Collection of Monitoring Well Samples

Prepared by

EA Engineering, Science, and Technology, Inc., PBC
225 Schilling Circle, Suite 400
Hunt Valley, Maryland 21031

Revision: 01
January 2019

This page intentionally left blank

PROJECT-SPECIFIC VARIANCE FORM

This form is to be completed to indicate if there are any client-, project-, or site-specific variances to this Standard Operating Procedure (SOP) (**also check Box A**), or if this SOP is being used with no changes (**only check Box B**).

☐ **A. Variances required; cite section(s) of the SOP to which there is a variance**

☐ **B. No variances**

SOP No. 013	
SOP Section	**Variance**

Project Manager (Name)

Project Manager (Signature) Date

CONTENTS

DOCUMENT REVISION HISTORY

ORIGINAL (MASTER) DOCUMENT REVISION HISTORY				
Revision Number	**Revision Date**	**Revision Summary**	**Revised By**	**Reviewed By**
01	January 2019	Systematic update and review	Jason Stroup Scott Dobson	Matthew Bowman

1. SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to delineate protocols for the collection of groundwater samples from monitoring wells.

2. MATERIALS

The following materials may be required:

0.45-µM filters	Polyvinyl chloride bailer (for purging only)
Bladder pump (dedicated to one well only)	Sample bottles and labels
Conductivity meter	Stainless steel bailer (for purging and sampling)
Dissolved oxygen meter	Submersible pump and hose (for purging only)
Generator	Thermometer (optional)[1]
Logbook or book of field parameter forms	Transparent bailer with a double check valve
Peristaltic pump with tubing for filtering samples	Turbidity meter
pH meter with oxidation-reduction potential probe	Poly or Teflon® and/or Teflon® lined tubing **(PTFE or Teflon® should not be used when sampling for PFCs/PFAS)**
Photoionization detector organic vapor analyzer.	Variable speed, low flow submersible pump (e.g., Grundfos MP1 groundwater sampling pump) (for purging and sampling)
Variable speed peristaltic pump	Peristaltic head tubing
Plastic sheeting	Water level indicator
Polypropylene rope	Interface probe
NOTES: µM = Micrometer(s) L = Liter mL = Millimeter PFAS = Per- and polyfluoroalkyl substances PFC = Perfluorinated compound PTFE = Polytetrafluoroethelyne VOC = Volatile organic compound PTFE bailer with PTFE-coated stainless steel cable, double check valve top, and controlled flow bottom discharge attachment[2] for VOC sampling (40-mL vials), and top discharge attachment for collecting larger samples (1-L bottles) (for purging and sampling)	

3. PROCEDURE

3.1 GENERAL

Groundwater sampling will follow these general steps:

---

[1] Temperature compensation and measurement capabilities are generally available as integral functions of pH meters and conductivity meters. If this is the case, a separate thermometer is not required.

[2] Although use of a controlled flow bottom discharge valve is historically preferred, use of such a device can cause aeration of the sample.

- Arrive onsite
- Set up apparatus (generators, pumps, etc.)
- Glove
- Organic vapor check, water level, and well depth measurements
- Sample non-aqueous phase liquids (NAPLs) (as required)
- Begin purge procedure
  - — If using bailer to purge and sample, see Section 3.6
  - — If using pump to purge and bailer to sample, see Section 3.7
  - — If using bladder or low-flow pump to purge and sample, see Section 3.8
- Decontaminate/re-glove
- Take samples
  - — If with bailer, see Section 3.6
  - — If with bladder or low flow pumps, see Section 3.8
- Decontaminate/dispose of wastes, move equipment to next site.

NOTE: Sampling monitoring wells that contain PFAS have specific requirements that must be followed. Review SOP No. 073 prior to planning or conducting any sampling for PFAS.

3.2 GENERAL RULES FOR GROUNDWATER FIELD PARAMETER LOGBOOK

Use only one site or installation per logbook, and only one sampling location per page or form (if using pre-printed forms). The same logbook may be used for more than one sampling event. The first five pages will be reserved for index, general notes, etc. Sign and date each entry. The last five pages will be reserved for recording calibration data for the pH, temperature, turbidity, oxidation-reduction potential, dissolved oxygen, and conductivity meters. Use the page number or a separately recorded “Cal Reference Number” to refer to each calibration.

As appropriate, insert the cardboard flap under the form being filled out so that writing does not go through to the pages below. As appropriate, fill in the forms from front to back of the logbook, tearing out the white copy for each sample when the sample has been collected. This copy goes in the cooler with the sample, directly to the laboratory. The original copy must be torn out before you write on the back of the duplicate form. As appropriate, duplicate copies, index pages, and calibration sheets remain intact.

Reference SOP No. 016 for additional procedures and requirements for the use and maintenance of field logbooks for sampling.

3.3 GROUNDWATER SAMPLING GENERAL RULES

Groundwater samples will be collected from the least contaminated wells first, progressing to the most contaminated[3]. Upon arrival at the well site, immediately set up and organize the purging, sampling, and filtration equipment. If needed, due to muddy or contaminated ground, remoteness from sampling vehicle, and/or for placement of hose(s) and/or power cord if a pump is used, place clean plastic sheeting at, or around the well, to serve as a clean staging area for purging and sampling equipment, as conditions warrant. Care must be exercised not to step on plastic sheeting. If the well is remote from the sampling vehicle, set up the filtration equipment and place rope, wrapped bailer, and pre-labeled sample containers on the plastic sheet from the well. When a pump is to be used, situate the portable generator on level ground approximately 15 feet (ft) away from and downwind from the well. All generator maintenance (oil and fueling) is to be performed offsite. If the hose(s) and/or power cord of the pump are not on a reel, place the pump with its hose and power cord on the plastic sheeting downhill from the well.

Check well headspace for organic vapor, which may pose a health and safety hazard and indicate the presence of NAPL. Measure depth(s) to and thickness(es) of NAPL(s) as appropriate. Measure the depth to water and depth of well. From the water depth, well diameter, sand pack length, etc., calculate the equivalent volume (1 EV) of water in the well.

$$1\text{ EV} = \text{volume in casing} + \text{volume in saturated sand pack}$$

Therefore, if the water table lies below the top of the sandpack, use the following equation:

$$1\text{ EV} = (\pi R_w^2 h_w) + (0.30\pi(R_s^2 - R_w^2)h_w) * (0.0043)$$

If the water table lies above the top of the sandpack use this equation:

$$1\text{ EV} = [(\pi R_w^2 h_w) + (0.30\pi(R_s^2 - R_w^2)h_s)] * (0.0043)$$

where

R_s = Radius of sandpack in inches
R_w = Radius of well casing in inches
h_s = Height of sandpack in inches
h_w = Water depth in inches
0.0043 gallons (gal)/inch $(\text{in.})^3$
Assumed filter pack porosity = 30 percent.

---

[3] First round samples are to be collected from upgradient wells first, moving to downgradient wells under the assumption that upgradient wells will be less contaminated than downgradient wells. Results of first round analysis may mandate a change in sampling sequence.

Samples will always be collected in order of decreasing volatility (i.e., the samples to be analyzed for the volatile constituents should be collected first). Deliver the VOC sample to the vial by allowing the water to trickle down the inside wall of the vial at a rate no greater than approximately 100 mL/minute. Other samples may be delivered at a faster rate. Sampling rates will at no time exceed 1 L/minute. Procedures for each class of samples are contained in the site-specific Quality Assurance Project Plan.

When collecting samples for volatile analysis, care should be taken to prevent analyte loss by volatilization. The following procedures should be adhered to when collecting these samples:

- Avoid excessive aeration and agitation of sample.
- Fill vial so that a reverse meniscus is present by adjusting the flow rate from the sampling device.
- Place septum on vial so that the PTFE side is in contact with the sample. After the cap is on the bottle, check for air bubbles in the sample. If air bubbles are present, properly dispose of that sample and recollect the sample in the same vial or a new vial if prepreserved.
- Make sure vial is labeled and immediately transfer the vial to the cooler with ice.

Filtered and unfiltered samples will be taken for inorganics (metals) analyses, as appropriate. The samples will be filtered through an in-line 0.45-µM filter (preferred method), or by gravity through a 0.45-µM membrane placed in a filter funnel. Use forceps to place the membrane into the funnel and pour sample through funnel until appropriate volumes have been filtered.

If necessary, due to slow filtering, a peristaltic pump may be used to filter the sample through an in-line filter. Connect the pump to the generator, and attach tygon tubing to the bottom discharge valve on the bailer. Start pump and collect sample from the end of the in-line filter directly into the proper container, preserved, and placed in the cooler. Filtered samples will be preserved in the field with acid to a pH of less than 2. Make sure sample bottle is labeled and the cap is on tightly. Then place in cooler with ice immediately.

— OR —

If a low flow pump is used collect the samples, filtered samples will be taken by installing a 0.45-µM filter in-line and pumping the water through the filter. Collect sample from the end of the in-line filter directly into the proper container, preserved, and placed in the cooler. If a flow-through cell is used to measure water quality parameters, collect samples before flow-through cell. Filtered samples will be preserved in the field with acid to a pH of less than 2. Make sure sample bottle is labeled and the cap is on tightly. Then place in cooler with ice immediately.

Unfiltered samples will be collected by slowly pouring the sample water into the appropriate sample container, being careful not to agitate or cause bubbles to form. Do not overfill bottles. Make sure sample bottle is labeled and the cap is on tightly, then place the sample in cooler with ice immediately.

All samples will be delivered to the laboratory as soon as possible. If possible, samples will be shipped on the same day as they are collected. If samples must be retained due to weekend sampling (Friday through Sunday), the laboratory will be notified as to the time sensitive nature of the samples.

3.4 SAMPLING OF NON-AQUEOUS PHASE LIQUIDS

If NAPLs are detected in the well, a sample from all layers must be collected prior to any purging activities. NAPLs may be indicated by the presence of volatiles in the well headspace, and confirmed by the oil/water interface probe.

Collecting light non-aqueous phase liquid (LNAPL) will be accomplished using a transparent bailer with a double check valve. This bailer will be slowly lowered until the bottom of the bailer is 1-2 in. below the LNAPL-water interface, then slowly withdrawn. Verify that the interface was sampled by visual inspection of the bailer contents through the side of the bailer. Measure the thickness of the LNAPL in the bailer and note in the Field Logbook. Sample for laboratory analysis. An additional field verification may be performed by decanting the remainder of the contents of the bailer into a glass jar, adding a hydrophobic dye such as Sudan IV, or Redoil, shaking the sample and looking for coloration of NAPL. Alternate field tests are: examine the sample under ultraviolet light (many fluoresce), or allow the sample to stand overnight, and examine for interface and/or volatiles in the headspace the following day. Refer to the following sections on purging and sample collection for setup and general operation.

Collecting dense non-aqueous phase liquids (DNAPLs) will be accomplished using a transparent bailer with a double check valve. The bailer must be lowered very slowly to the bottom of the well and raised slowly out of the well in a controlled fashion. Sample for analysis as above. The same field check described above may be employed for DNAPL. Refer to the following sections on purging and sample collection for set up and general operation.

If NAPLs are present in the well, **and** a low-flow pump is to be used for purging and sampling, the well will be allowed to re-equilibrate prior to purging and sampling. This will be accomplished by allowing the well to stand undisturbed for at least 8 hours prior to purging and sample collection.

3.5 WELL PURGING GENERAL RULES

Water within the casing of a well will stagnate, de-gas, lose volatiles, possibly precipitate metals due to changes in redox potential, and may react with the screen and/or casing material. It is, therefore, necessary to purge a sufficient volume of this stagnant water from the well and/or casing to ensure that a representative sample of formation water can be obtained. Traditionally, the volume of water to be purged was arbitrarily set at 3-5 equivalent volumes. Recent advances in sampling technologies have caused a re-thinking of such arbitrary purge volumes. It is, for this reason, that monitoring of select chemical and physical properties of the sample medium will be used instead of strict volumes to determine when a representative sample may be taken from a well.

Acceptable purge/sampling devices include: bailers, high-discharge submersible pumps (purge only), and variable speed, low-flow pumps that include both submersible pumps (purge and sample) and dedicated bladder pumps (purge and sampling). It is recommended to purge and sample at similar rates with one type device per well. An acceptable exception to this general rule is to use a high-discharge submersible pump to purge a deep, fast-recharging well, and a bailer to sample the same well.

Peristaltic, gas-lift, and centrifugal pumps can cause volatilization, produce high pressure differentials, and result in variability in the analysis of some analytes of interest. For this reason, these pumps should be used with caution and flow rate slowed to minimize volatilization.

To prevent groundwater from cascading down the sides of the screen into an open hole, thereby aerating the sample, purge rates will closely match recharge rates. If the static water level is within the casing, the initial purge rates may be set high enough to lower the water level to the top of the screen, then reduced to maintain that level and identify the well’s recharge rate.

Purging will be accomplished with either a submersible pump, a low-flow (submersible or bladder) pump, or bailer. The choice of bailer or pump will be based on depth to water table, volume to be purged, and permeability of the aquifer. If the well recharges rapidly and/or has greater than 20 gal (estimated EV) to be purged, water may be removed with a submersible pump or a low-flow pump. If the well recharges slowly and/or has less than 20 gal to be purged, water will be removed with a bailer or a low-flow pump.

Purging will be accomplished with as minimal disturbance to the surrounding formation as possible.

Purge water will be containerized onsite until analysis of samples is completed. Based on sample results, accumulated purge water will be properly disposed of.

If the water level is within the screened interval and the well recharge rate is less than 0.1 L/minute, purge the well using a low-flow pump as follows:

1. Draw the water down to within 1 ft of the top of the pump.
2. Allow the well to recover.
3. Check and record field parameters.

4. Repeat Steps 1 through 3 then collect samples for metals analysis only[4].

5. Note the event in the Field Logbook, and report the problem to the Project Manager. If this extremely low recharge problem consistently occurs in a given well, the well may be considered for re-development and/or replacement.

6. If adjacent wells have elevated VOC levels, additional soil gas surveys will be considered in the vicinity of the low recharge well to help determine the need for replacement.

3.6 PURGING AND SAMPLING WITH BAILERS

Bailers may be used for both purging and sampling wells if: (1) the well recharge rate is less than 4 L/minute, (2) depth to the water table is less than 50 ft, and (4) less than 20 gal are to be purged (5 EV < 20 gal)[5].

When purging with a bailer, either a polyvinyl chloride, PTFE, or stainless steel bailer may be used. The bailer will be attached to either a spool of PTFE-coated stainless steel cable or polypropylene rope. If using cable, attach it to the bailer using stainless steel cable clamps. Thoroughly decontaminate the cable after each use, prior to rewinding cable onto spool. Cable clamps and raw cable ends may serve to trap contamination. Exercise particular caution in decontaminating these areas. If using rope, attach the rope to the bailer using a bowline knot, dispense the needed length (a few feet more than the well depth), and cut the remainder away; then, at the end opposite the bailer, make a slip knot and place it around the well casing or protective posts to prevent losing the bailer and rope down the well. The polypropylene rope will be not reused; it will be properly disposed of. Either type of bailer will be repeatedly lowered gently into the well until it fills with water, is removed, and the water discharged into an appropriate container until purging is complete. Care must be taken not to unduly agitate the water, as this tends to aerate the sample, increase turbidity, makes stabilization of required parameters difficult to achieve, and generally prolongs purging.

After purging 2 EV, obtain a sample of groundwater and measure the following stabilization parameters: temperature, conductivity, pH, turbidity, redox potential (Eh), and dissolved oxygen level at each successive half-well volume. When three of these stabilization parameters are in agreement within approximately 10 percent in three consecutive half-well volume samples, sufficient water has been purged from the well. The results of these tests should be recorded in the sampling logbook. Should these parameters not reach agreement, no more than five well volumes will be purged.

---

4. Analyte losses due to volatilization in a drained well are too high for valid VOC sampling (McAlary and Barker 1987).
5. These numbers are based on the following assumptions: (1) In purging, it is preferable to remove water at approximately the recharge rate; (2) 4 L/minute is estimated as the approximate maximum rate at which water can be removed with a bailer from depths of 20-50 ft; and (3) 20 gal is estimated to be at the limit of the sampler’s endurance, at which point fatigue and sloppiness of technique begin.

Immediately upon completion of purging, collect samples for laboratory analysis using a PTFE bailer on a PTFE-coated stainless steel cable. The bailer will be equipped with double check valve top and controlled flow bottom discharge attachments for VOC sampling (40-mL vials), and top discharge attachment for collecting larger samples (1-L bottles).

Slowly, so as not to agitate the water, lower the bailer into the well, using a spool of PTFE-coated cable. Allow bailer to fill, withdraw smoothly. Refill bailer as needed.

If the controlled flow bottom discharge attachment is used for VOC sampling, attach it to the bottom of the bailer. Using the stopcock valve on the bailer to control the flow, and fill sample vials as described above in Section 3.3.

Remove check valve top and pour unfiltered sample into inorganics sample bottles.

Collect filtered samples as described in Section 3.3. Decontaminate bailer and cable.

3.7 PURGING WITH PUMP, SAMPLING WITH BAILER

If the recharge rate of the well is greater than 30 L/minute, or the water level is deeper than 50 ft, or more than 20 gal of purge water will be generated (5 EV > 20 gal), then purging and sampling may be accomplished using a submersible pump/bailer combination.

When purging with a pump, gradually lower the intake until it is submerged within the screened interval. Lower an electronic water level probe to the top of the screen (as determined from completion records) to the monitor water level, start pump, and slowly lower the pump as the water level continues to fall. Care should be exercised to lower the water column to the top of the screened interval (water level probe will stop beeping) but not below the top of the screen if possible. This will ensure that the stagnant layer has been removed, but should minimize the detrimental effects of over pumping the well. Secure hose(s) and/or power cord to casing and place discharge hose into the proper container, downhill and as far away from the well as possible. Determine and record the discharge rate.

Discharge rate = volume of container/time to fill container

The discharge rate will be established at approximately equal to or just greater than the well's recharge rate (determined from well development). If well development records are incomplete, recharge rate can be determined by monitoring the rise/fall of the water level within the casing as one purges the well. If the water level is static at a given pumping rate, but fluctuates up or down as pumping rate is decreased or increased, the pumping rate at which the water level is static is the recharge rate.

After purging 2 EV, obtain a sample of groundwater and measure the following stabilization parameters: temperature, conductivity, pH, turbidity, redox potential (Eh), and dissolved oxygen level at each successive half-well volume. When three of these stabilization parameters are in agreement within approximately 10 percent in three consecutive half-well volume samples, sufficient water has been purged from the well. The results of these tests should be recorded in the sampling logbook. Should these parameters not reach agreement, no more than five well volumes will be purged.

Immediately upon completion of purging, collect samples for laboratory analysis using a PTFE bailer on a PTFE-coated stainless steel cable. The bailer will be equipped with a double check valve top and controlled flow bottom discharge attachments for VOC sampling (40-mL vials), and top discharge attachment for collecting larger samples (1-L bottles). Filtration of metals samples will be accomplished using either an in-line filter attached to the bottom of the bailer, or a funnel and appropriate filter (Section 3.3).

Slowly, so as not to agitate the water, lower the bailer into the well, using a spool of PTFE-coated cable. Allow bailer to fill, withdraw smoothly, and fill sample containers as described in Section 3.6. Decontaminate bailer and cable in and decontaminate pump.

3.8 PURGING AND SAMPLING WITH LOW-FLOW PUMP

To obtain representative samples, subsurface disturbances should be kept to a minimum, thereby preventing sample alteration due to sampling actions. The reasoning behind the use of low-flow pumps to purge and sample monitoring wells is that these pumps minimize physical disturbance (turbulence) at the sampling point and chemical changes (aeration) in the medium. For these reasons, the low-flow pump is the preferred method for both purging and sampling in most cases. For the purposes of this SOP, “low-flow pumps” are defined as either dedicated bladder pumps or variable speed submersible pumps. Practical operational flow rates for these sampling devices range from 0.1 to 30 L/minute.

Low-flow pumps may be used for purging and sampling any well having recharge greater than 0.1 L/minute, which is the practical lower limit of pump performance. Below that pumping rate, pump inefficiencies and/or overheating may alter the physical and chemical properties of the sample. If the pump is continuously operated at sampling rates higher than the well recharge rate, the water level will be lowered in the well, possibly allowing aeration of the sample that is unacceptable sampling procedure. Low-flow pumps are suitable for sampling wells with recharge rates lower than 0.1 L/minute if precautions are taken to avoid aeration of the sample.

Low flow submersible pumps will be used as follows:

- Lower the pump into the well, slowly so as not to agitate the water, until the pump is at the mid-point of the screened interval or the mid-point of the water column if the static water table lies below the top of the screen.[6]

---

6. This assumes a 10-ft screened interval. If the screened interval is greater than 10 ft, multiple samples should be taken as follows:
    - If the screen is 10-12 ft, sample the canter of the water column, as outlined above.
    - If the screen is longer than 12 ft, and the water column is 10 ft or less, sample the center of the water column.

- Attach the pump's umbilical cord (which will consist of power cord and sampling tubing) to the protective casing, or lock the cord spool so that the pump cannot move vertically in the well during sampling.

- Lower the water level probe into the well behind the pump until it just touches water. This will allow the sampler to monitor the water level while purging and sampling, and prevent the inadvertent drying of the well.

- Begin purging at the pump's lowest setting, then gradually increase rate[7] until the pumping rate matches the aquifer recharge rate. **If the water level is above the top of the screen**, the pumping rate may be allowed to slightly exceed recharge rate, lowering the water level to no less than 1 ft above the screen, then reduced until it matches recharge rate and purging continued. **If the water level is below the top of the screen**, always keep the purge rate lower than well's recharge rate.

- Monitor stabilization parameters listed in Section 3.6 beginning immediately, using an in-line monitoring system. Record parameters regularly, at a rate of one set of parameters per each 1-3 liters of water removed from the well. When these parameters stabilize to within 10 percent over three consecutive readings, reduce[8] flow rate to 0.1 L/minute (if needed) and begin collecting VOC samples directly from the discharge line.

- If the well recharges at a rate less than 0.1 L/minute, purge until the water level is even with the top of the screen, allow the well to recover, and sample immediately.

- Remove and decontaminate water level probe and pump.

4. MAINTENANCE

Refer to manufacturer's requirements for maintenance of pumps and generators.

5. PRECAUTIONS

Refer to the site-specific Health and Safety Plan for appropriate personal protective equipment.

- If the screen is longer than 12 ft, and the water column fills the screen, or extends above the screen, sample at 1/3 and 2/3 the height of the water column, or about every 6 ft.

[7] Some sources indicate that the pumping rate should not exceed 1 L/minute, with 0.5 L/minute being preferable. The optimal purge rate is highly aquifer dependent, and may range from less than 0.5 L/minute to greater than 10 L/minute. The purge rate for a given well will, therefore, be a field decision, based on well development, purge, and sampling records rather than SOP mandate.

[8] Sampling should occur at the same rate as purging as long as aeration of sample does not occur.

6. REFERENCES

McAlary, T.A. and J.F. Barker. 1987. Volatilization Losses of Organics During Groundwater Sampling From Low Permeability Materials, in Groundwater Monitoring Review. Fall.

This page intentionally left blank

Standard Operating Procedure No. 016
for
Field Logbooks and Surface Water, Groundwater, and Soil/Sediment Field Checklists

Prepared by

EA Engineering, Science, and Technology, Inc., PBC
225 Schilling Circle, Suite 400
Hunt Valley, Maryland 21031

Revision: 01
July 2019

This page intentionally left blank

PROJECT-SPECIFIC VARIANCE FORM

This form is to be completed to indicate if there are any client-, project-, or site-specific variances to this Standard Operating Procedure (SOP) (**also check Box A**), or if this SOP is being used with no changes (**only check Box B**).

☐ **A. Variances required; cite section(s) of the SOP to which there is a variance**

☐ **B. No variances**

SOP No. 016	
SOP Section	**Variance**

Project Manager (Name)

Project Manager (Signature) Date

CONTENTS

DOCUMENT REVISION HISTORY

ORIGINAL (MASTER) DOCUMENT REVISION HISTORY				
Revision Number	**Revision Date**	**Revision Summary**	**Revised By**	**Reviewed By**
01	June 2019	Combine SOP 059 with 016. Reviewed and updated content as appropriate.	Dan Hinckley Jesse Drummond	Matthew Bowman

This page intentionally left blank

1. SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to delineate protocols for completion of field logbooks and completion of field forms used to record surface water, groundwater, soil/sediment sampling information, instrument calibration data, and data from hydrologic testing. Acceptable field logbooks are bound, unprinted books such as a surveyor's field logbook, or a Federal Supply Service Number (No.) 7530-00-222-3525 record book (or equivalent); or they may be company-proprietary, pre-printed forms bound into a field logbook. Example forms are provided herein. Alternate, equivalent forms are acceptable.

2. MATERIALS

The following material may be required: field logbook, indelible ink pen, and field checklists documented in Sections 3.1 through 3.7.

3. PROCEDURE

All information pertinent to a field survey or sampling effort will be recorded in a bound logbook. Each page/form will be consecutively numbered, dated, and signed. All entries will be made in indelible ink, and all corrections will consist of line-out deletions that are initialed and dated. The person making the correction will provide a brief explanation for the change. Entries are factual only. No personal opinions should be entered.

There should be no blank lines on a page. A single blank line or a partial blank line (i.e., at the end of a paragraph) should be lined to the end of the page. If only part of a page is used, the remainder of the page should have an "X" drawn across it. The bottom of each page must be signed and dated by the field personnel entering the information.

At a minimum, entries in the field logbook will include but not be limited to the following:

- Date.
- Project number and project name.
- Name and address of field contact.
- Identification of sample crew members.
- Documentation should include model numbers of equipment used (e.g., data loggers, drilling rigs) and calibration (if applicable). Each day's entry should begin with time onsite, who is onsite (including observers other than the sampling crew), brief description of what work will be performed that day and how, and the weather.

- If samples are being taken in or near tidal waters, the time of high and low tide for the site should be determined from local gauges or tables and recorded.

- References such as maps of the sampling site.

- Times of key daily milestones should be entered (e.g., time borings began, times personnel arrived and left site, times subcontractors arrived and left site, etc.). Time should be recorded in the left-hand margin on the page in military time.

- Sample-specific information:

  — Unique, sequential field sample number

  — Purpose of sampling

  — Location, description, and log of photographs of each sampling point

  — Details of the sample site (e.g., elevation of the casing, casing diameter and depth, integrity of the casing, etc.)

  — Documentation of procedures for preparation of reagents or supplies that become an integral part of the sample (e.g., filters and absorbing reagents)

  — Type of media of sample (e.g., groundwater, surface water, soil, sediment, and product)

  — Suspected waste composition

  — Number and volume of sample taken

  — Sampling methodology, including distinction between grab and composite sample

  — Sample preservation

  — Date and time of collection

  — Collector's sample identification number(s)

  — Sample shipment (e.g., name of the laboratory and cartage agent: Federal Express, United Parcel Service, etc.)

  — Field observations (e.g., oily sheen on groundwater sample, incidental odors, soil color, grain size, plasticity, moisture content, layering, Unified Soil Classification System classification, etc.)

- Any field measurements made (e.g., pH, conductivity, explosivity, water depth, organic vapor analyzer readings, etc.)

- Signature and date by the personnel responsible for observations

- Decontamination procedures.

Sampling situations vary widely. No general rules can specify the extent of information that must be entered in a field logbook. However, records should contain sufficient information so that someone can reconstruct the sampling activity without relying on the sampler's memory. Further, the project work plan or field sampling plan should be reviewed to identify additional specific information or requirements that should be included in the field logbook.

The Project Manager will keep a master list of all field logbooks assigned to the Sampling Team Leaders. One field logbook kept by the Project Manager will be a master site log of daily activities and will contain the list of field logbooks assigned to Sampling Team Leaders.

Project name and number should be clearly marked on the outside cover using indelible ink. If more than one field logbook exists for the project, then the number of the field logbook should also be clearly marked on the outside cover.

Field checklists associated with the collection of soil, sediment, surface water, and groundwater are shown in Figures SOP016-1 through SOP016-9 and described in Sections 3.1 through 3.7. The details described above for completion of the field logbook should be completed even though these field checklists have been completed, and the field checklists noted in the field logbook. While the importance of the use of field logbooks is emphasized in this SOP, it is acknowledged that alternate documentation approaches may be necessary (e.g., higher reliance on documentation forms, use of electronic tablets) for a variety of client and project-specific reasons. It is essential the team establish clear expectations for the use of field logbooks during project planning and document any differences from this SOP in the project-specific variance form.

3.1 SOIL/SEDIMENT FIELD CHECKLISTS (REQUIRES FIGURES SOP016-1 AND SOP016-3)

3.1.1 Field Parameter Form (Items on Figures SOP016-1 and SOP016-2)

1. HIGH CONCENTRATION EXPECTED?: Answer "Yes" or "No."

2. HIGH HAZARD?: Answer "Yes" or "No."

3. SITE: Record the complete name of the site.

4. AREA: Record the area designation of the sample site.

5. INST CODE: Record the 2-letter installation code appropriate for the installation or site. Correct abbreviations can be found on Pages 3-6 of the Installation Restoration Data Management System (IRDMS) User's Guide for chemical data entry.

6. FILE NAME: Record "CSO" for a soil sample or "CSE" for a sediment sample.

7. SITE TYPE: Record the abbreviation appropriate for where the sample was taken. Correct abbreviations can be found on Pages 18-21 of the IRDMS User's Guide for chemical data entry. This entry must match the Site Type on the map file form.

8. SITE ID: Record a code up to 10 characters or numbers that is unique to the site.

9. FIELD SAMPLE NUMBER: Record a code specific for the sample.

10. DATE: Enter the date the sample was taken.

11. TIME: Enter the time (12-hour or 24-hour clock acceptable as long as internally consistent) the sample was taken.

12. AM PM: Circle "AM" or "PM" to designate morning or afternoon (12-hour clock).

13. SAMPLE PROG: Record "GQA" (Groundwater Quality Assessment) or other appropriate sample program.

14. DEPTH (TOP): Record the total depth sampled.

15. DEPTH INTERVAL: Record the intervals at which the plug will be sampled.

16. UNITS: Record the units of depth (feet, meters)

17. SAMPLE MEASUREMENTS: Check the appropriate sampling method.

18. CHK: Check off each container released to a laboratory.

19. ANALYSIS: Record the type of analysis to be performed on each sample container.

20. SAMPLE CONTAINER: Record the sample container type and size.

21. NO.: Record the number of containers.

22. REMARKS: Record any remarks about the sample

23. TOTAL NUMBER OF CONTAINERS FOR SAMPLE: Record the total number of containers.

24. SITE DESCRIPTION: Describe the location where the sample was collected.

25. SAMPLE FORM: Record the form of the sample (i.e., clay, loam, etc.) using The Unified Soil Classification System.

26. COLOR: Record the color of the sample as determined from standard Munsell Color Charts.

27. ODOR: Record the odor of the sample or “none.” See SOP No. 001 Section 5.

28. PID (HNu): Record the measured photoionization detector (PID) (HNu) values.

29. UNUSUAL FEATURES: Record anything unusual about the site or sample.

30. WEATHER/TEMPERATURE: Record the weather and temperature.

31. SAMPLER: Record your name.

3.1.2 Map File Form (Figure SOP016-3)

1. The map file logbook form will be located on the reverse of the field parameter logbook form, or on an adjoining page of the field logbook (if level book is used).

2. SITE ID: Record the Site ID from the field parameter form.

3. POINTER: Record the field sample number for the sample being pointed to.

4. DESCRIPTION/MEASUREMENTS: Describe the location where the sample was taken, along with distances to landmarks.

5. SKETCH/DIMENSIONS: Diagram the surroundings and record the distances to landmarks.

6. MAP REFERENCE: Record which U.S. Geological Survey Quad Map references the site.

7. COORDINATE DEFINITION: Write the compass directions the X- and Y-Coordinates of the map run.

8. COORDINATE SYSTEM: Write “UTM” (Universal Transverse Mercator).

9. SOURCE: Record the 1-digit code representing the Map Reference.

10. ACCURACY: Give units (e.g., write “1-M” for 1 meter).

11. X-COORDINATE: Record the X-Coordinate of the sample site location.

12. Y-COORDINATE: Record the Y-Coordinate of the sample site location.

13. UNITS: Record the unit's map sections are measured in.

14. ELEVATION REFERENCE: Record whether topography was determined from a map or a topographical survey.

15. ELEVATION SOURCE: Record the 1-digit code representing the elevation reference.

16. ACCURACY: Record the accuracy of the map or survey providing the topographical information.

17. ELEVATION: Record the elevation of the sampling site.

18. UNITS: Write the units in which the elevation is recorded.

19. SAMPLER: Write your name.

3.2 SURFACE WATER FIELD CHECKLISTS (REQUIRES FIGURES SOP016-2 AND SOP016-3)

3.2.1 Field Parameter Form (Items Unique to Figure SOP016-3)

1. CAL REF: Record the calibration reference for the pH meter.

2. pH: Record the pH of the sample.

3. TEMP: Record the temperature of the sample in degrees Celsius.

4. COND: Record the conductivity of the water.

5. For all other sections, see Section 3.2.1.

3.3 GROUNDWATER SAMPLING FIELD CHECKLISTS (REQUIRES FIGURES SOP016-2, SOP016-3, AND SOP016-4)

3.3.1 Field Parameter Form (Items on Figure SOP016-4)

1. WELL NO. OR ID: Record the abbreviation appropriate for where the sample was taken. Correct abbreviations can be found on Pages 18-21 of the IRDMS User's Guide for chemical data entry.

2. SAMPLE NO.: Record the reference number of the sample.

3. WELL/SITE DESCRIPTION: Describe the location where the sample was taken, along with distances to landmarks.

4. X-COORD and Y-COORD: Record the survey coordinates for the sampling site.

5. ELEV: Record the elevation where the sample was taken.

6. UNITS: Record the units the elevation was recorded in.

7. DATE: Record the date in the form MM/DD/YY.

8. TIME: Record the time, including a designation of AM or PM.

9. AIR TEMP.: Record the air temperature, including a designation of C or F (Celsius or Fahrenheit).

10. WELL DEPTH: Record the depth of the well in feet and inches.

11. CASING HT.: Record the height of the casing in feet and inches.

12. WATER DEPTH: Record the depth (underground) of the water in feet and inches.

13. WELL DIAMETER: Record the diameter of the well in inches.

14. WATER COLUMN HEIGHT: Record the height of the water column in feet and inches.

15. SANDPACK DIAM.: Record the diameter of the sandpack. Generally, this will be the same as the bore diameter.

16. EQUIVALENT VOLUME OF STANDING WATER: Use one of the following equations, to determine one equivalent volume (EV):

    1 EV = Volume in casing + volume in saturated sand pack. Or to restate:

    $$1\ \text{EV} = (BR_w^2h_w + 0.30B(R_s^2 - R_w^2)h_s) * (0.0043)$$

    where

    R_s = Radius of sandpack in inches
    R_w = Radius of well casing in inches
    h_s = Height of sandpack in inches
    h_w = Water depth in inches

    0.0043 = gal/in.^{3}
    and filter pack porosity is assumed as 30 percent

— OR —

Volume in casing = $(0.0043\ \text{gal/in.}^3)(B)(12\ \text{in./ft})(R_c^2)(W_h)$

where

R_c = Radius of casing in inches
W_h = Water column height in feet

Vol. in sandpack = $(0.0043\ \text{gal/in.}^3)(B)(12\ \text{in./ft})(R_b^2 - R_c^2)(W_h)(0.30)$

(if W_h is less than the length of the sandpack),

— PLUS —

Vol. in sandpack = $(0.0043\ \text{gal/in.}^3)(B)(12\ \text{in./ft})(R_b^2 - R_c^2)(S_h)(0.30)$

(if W_h is greater than the length of the sandpack).

where

R_b = Radius of the borehole
S_h = Length of the sandpack.

Show this calculation in the comments section.

17. VOLUME OF BAILER OR PUMP RATE: Record bailer volume or pump rate.

18. TOTAL NUMBER OF BAILERS OR PUMP TIME: Record the number of bailers required to remove 3 equivalent volumes (EV) of water from the well or the total purge time and volume as applicable.

19. WELL WENT DRY? Write "YES" OR "NO."

20. NUMBER OF BAILERS OR PUMP TIME: Record the number of bailers or pump time which made the well go dry.

21. VOLUME REMOVED: Record the volume of water (gal) removed before the well went dry.

22. RECOVERY TIME: Record the time required for the well to refill.

23. PURGE AGAIN?: Answer "YES" or "NO."

24. TOTAL VOL. REMOVED: Record the total volume of water (in gal) removed from the well.

25. CAL REF.: Record the calibration reference for the pH meter.

26. TIME: Record time started (INITIAL T[0]), 2 times DURING the sampling and the time sampling ended (FINAL).

27. pH: Record the pH at start of sampling (INITIAL), twice DURING the sampling and at the end of sampling (FINAL).

28. TEMP: Record the water temperature (Celsius) at the start of sampling, twice DURING the sampling, and at the end of sampling (FINAL).

29. COND: Record the conductivity of the water at the start of sampling, twice DURING the sampling, and at the end of sampling (FINAL).

30. D.O.: Record the dissolved oxygen level in the water at the start of sampling, twice DURING the sampling, and at the end of sampling (FINAL).

31. TURBIDITY: Record the readings from the turbidity meter (nephelometer) and units at the start of sampling, twice DURING the sampling, and at the end of sampling (FINAL).

32. ORD: Record the oxidation/reduction (RedOx) potential of the water sample at the start of sampling, twice DURING the sampling, and at the end of sampling (FINAL).

33. HEAD SPACE: Record any positive readings from organic vapor meter reading taken in well headspace prior to sampling.

34. NAPL: Record the presence and thickness of any non-aqueous phase liquids (light or dense)

35. COMMENTS: Record any pertinent information not already covered in the form.

36. SIGNATURE: Sign the form.

3.4 FIELD CALIBRATION FORMS (MAINTAINED AS A SEPARATE LOGBOOK, OR INCORPORATED INTO SAMPLING LOGBOOKS)

3.4.1 Items on Figure SOP016-5

1. Record time and date of calibration. Note whether 12- or 24-hour clock was used.

2. Record calibration standard reference number.

3. Record meter I.D. number

4. Record initial instrument reading, recalibration reading (if necessary), and final calibration reading on appropriate line.

5. Record value of reference standard (as required).

6. COMMENTS: Record any pertinent information not already covered on form.

7. SIGNATURE: Sign form.

3.5 GROUNDWATER HYDROLOGY TESTS CHECKLISTS (MUST INCLUDE FIGURES SOP016-6 AND SOP016-7 AND/OR SOP016-8 OR SOP016-9)

3.5.1 Field Permeability Test Data Sheet (Items on Figures SOP016-6)

1. CONTRACTOR: Organization performing the test.

2. SEQ. #: Enter page number of this set of forms (page # of #).

3. PROJECT NAME: Record the name assigned by the contractor's organization to the project.

4. PROJECT NO.: Record the contractor assigned project number or the contract number.

5. LOCATION: Specific location

6. CLIENT: Agency or company with the contract under which the work is being performed.

7. FIELD PARTY CHIEF: Printed name of the person responsible for this particular field test.

8. WELL #: Record the well number as it appears on the well completion tag, affixed to the protector casing or well completion records.

9. TEST TYPE: Short description of the type of test to be performed.

10. RISING/FALLING HEAD WITH SLUG: Check if the test involved the insertion/removal of and inert object.

11. RISING/FALLING HEAD WITHOUT SLUG: Check if the test involved the addition/removal of a quantity of water.

12. START DATE: Date on which the test was begun.

13. CLOCK TIME: Time each datum (depth to groundwater level) is collected. Note whether 12- or 24-hour clock was used.

14. ELAPSED TIME: Time since the last datum was collected.

15. DEPTH TO GWL (ft): Depth to the top of the groundwater table (Groundwater Level) as measured by manual methods.

16. REC. (ft): Water level as reported by transducer/datalogger (this is the depth of water above the transducer.

17. TIME: Time the discharge rate check was begun (addition or removal of water method). Note whether 12- or 24-hour clock was used.

18. FLOW METER (Addition or removal of water method): The amount of water added or removed as registered by the flowmeter, in gal of liters.

19. DISCHARGE RATE: Flowmeter reading divided by time interval (gal/min or liters/min).

20. SIGNATURE: The person completing this form must sign the form at the end of the test.

21. DATE: Date the form was signed.

3.5.2 Groundwater Levels – Single Well (Items on Figure SOP016-7)

1. CONTRACTOR: Organization performing the test.

2. SEQ. #: Enter page number of this set of forms (page # of #).

3. PROJECT NO.: Record the contractor assigned project number or the contract number.

4. WELL #: Record the well number as it appears on the well completion tag, affixed to the protector casing or well completion records.

5. PROJECT NAME: Record the name assigned by the contractor's organization to the project.

6. LOCATION: Specific location.

7. FIELD PARTY CHIEF: Printed name of the person responsible for this particular field test.

8. CLIENT: Agency with the contract under which the work is being performed.

Well Data

9. STICKUP: Enter the length of well casing extending above the average ground surface at the base of the protective casing.

10. MEASURED UP(+)/DOWN(-) FROM: Describe the starting point for the previous measurement.

11. MP ELEVATION: Enter the elevation of the measuring point here. NOTE: This datum may require reference to tables and/or maps and may be added after completing the day's fieldwork.

12. DATUM = MSL OR: Is the datum for the previous elevation Mean Sea Level? If not, what? Also tell whether it was derived from a map elevation (write "MAP") or survey data (write "SURVEY").

13. MEASURING POINT DESCRIPTION: Describe the point used as the origin for all down-hole (water table) measurements. NOTE: Remedial investigation wells are required to have a permanently marked reference (measuring) point (refer to SOP No. 019).

14. REMARKS: Record any pertinent observations about the site/well conditions not specifically required in the preceding.

15. DATE: Date of each water level reading

16. TIME: Time of each water level reading. Note whether 12- or 24-hour clock was used.

17. ELAPSED TIME: Time since test was begun.

18. DEPTH TO WATER: Measured depth to the groundwater table.

19. WATER ELEVATION: Elevation of the top of the groundwater table (use datum listed above).

20. MEAS. METH.: Method used to measure the water level in the well (see abbreviation key at the bottom of the data sheet).

21. TAPE NO.: The unique identification number of the traceable standard tape used to calibrate the measuring device.

22. WELL STATUS: Condition of the well at the time of measuring (see abbreviation key at the bottom of the data sheet).

23. REMARKS: Any additional pertinent comments not specifically required above.

24. INITIALS: Initials of person completing this data entry.

25. ABBREVIATION KEYS: Self-explanatory.

26. SIGNATURE: The person completing this form must sign the form at the end of the test.

27. DATE: Date the form was signed.

3.5.3 Groundwater Levels – Single Well (Items on Figure SOP016-8)

1. CONTRACTOR: Organization performing the test.

2. SEQ. #: Enter page number of this set of forms (page # of #).

3. PROJECT NO.: Record the contractor assigned project number or the contract number.

4. WELL #: Record the well number as it appears on the well completion tag, affixed to the protector casing or well completion records.

5. PROJECT NAME: Record the name assigned by the contractor’s organization to the project.

6. LOCATION: Specific location.

7. FIELD PARTY CHIEF: Printed name of the person responsible for this particular field test.

8. CLIENT: Agency with the contract under which the work is being performed.

Well Data

9. STICKUP: Enter the length of well casing extending above the average ground surface at the base of the protective casing.

10. MEASURED UP(+)/DOWN(-) FROM: Describe the starting point for the previous measurement.

11. MP ELEVATION: Enter the elevation of the measuring point here. NOTE: This datum may require reference to tables and/or maps and may be added after completing the day’s fieldwork.

12. DATUM = MSL OR: Is the datum for the previous elevation Mean Sea Level? If not, what? Also tell whether it was derived from a map elevation (write “MAP”) or survey data (write “SURVEY”).

13. MEASURING POINT DESCRIPTION: Describe the point used as the origin for all down-hole (water table) measurements. NOTE: All Rhode Island wells are required to have a permanently marked reference (measuring) point (refer to SOP No. 019).

14. REMARKS: Record any pertinent observations about the site/well conditions not specifically required in the preceding.

15. DATALOGGER: This section is record of pertinent datalogger information.

16. MANUFACTURER: Record the manufacturer/brand name as stated on the datalogger.

17. MODEL: Enter the model number of the datalogger.

18. S/N: Enter the serial number of this datalogger.

19. TAG PROGRAMMED IN LOGGER: What is the identifier used in the datalogger's program to indicate that this unit was used to record a given data set?

20. TRANSDUCER: This section is a listing of pertinent information about the transducer used.

21. MANUFACTURER: Record the manufacturer/brand name as stated on the transducer.

22. MODEL: Enter the model number of the transducer.

23. S/N: Enter the serial number of this transducer.

24. INPUT/UNITS: What are the units this transducer uses?

25. RANGE: Record the pressure or depth range over which this transducer is certified.

Calibration

26. PRESSURE RATING: This is taken from the manufacturer's specifications for a given transducer. (Usually in psi, or kpa).

27. "SUBMERGENCE = ___ (V) / (MV)": Record the voltage returned by the transducer at a given depth of submergence. Indicate whether the reading is in volts (v), or millivolts (mv).

28. VOLUME WATER ADDED/REMOVED: (Applicable if inert object insertion/removal method was not employed.) Record the volume of water added to or removed from the well.

29. DISCHARGE RATE: If z (above) is filled, enter the rate at which this water was added or removed.

30. INITIAL WATER LEVEL (ft): Enter the water level in the well at the beginning of the test.

31. PRESSURE TRANSDUCER SUBMERGENCE: Record the depth to which the transducer is submerged at the beginning of the test and the depth to the transducer at the end if the test. All depths will be recorded to the nearest 0.01 ft.

32. TIME: Record the time the test is begun and ended. Note whether 12- or 24-hour clock was used.

33. OBSERVED CHANGES IN ADJACENT WELLS: Note any changes in water levels in nearby wells.

34. RESULTS RECORDED ON DISKETTE #: Tracking number of the diskette on which these data are archived.

35. DISKETTE FILE NAME: Name of the file(s).

36. SIGNATURE: The person completing this form must sign the form at the end of the test

37. DATE: Date the form was signed.

3.6 GROUNDWATER LEVELS – MULTIPLE WELLS (ITEMS ON FIGURE SOP016-9)

1. CONTRACTOR: Organization performing the test.

2. SEQ. #: Enter page number of this set of forms (page # of #).

3. PROJECT NO.: Record the contractor assigned project number or the contract number.

4. PROJECT NAME: Record the name assigned by the contractor’s organization to the project.

5. LOCATION: Specific location.

6. FIELD PARTY CHIEF: Printed name of the person responsible for this particular field test.

7. CLIENT: Agency with the contract under which the work is being performed.

8. REMARKS: Any pertinent observations not specifically required above.

9. WELL: Record the well number as it appears on the well completion tag, affixed to the protector casing or well completion records.

10. DATE: Date this measurement was made.

11. TIME: Time this measurement was made. Note whether 12- or 24-hour clock was used.

12. DEPTH TO WATER: Depth from MP to top of groundwater table.

13. STICKUP: Enter the length of well casing extending above the average ground surface at the base of the protective casing.

14. MP ELEV.: Enter the elevation of the measuring point here. NOTE: This datum may require reference to tables and/or maps and may be added after completing the day's fieldwork.

15. MEAS. METH.: Method used to measure the water level in the well (see abbreviation key at the bottom of the data sheet).

16. REMARKS/MP: Describe the location and nature of the measuring point.

17. INITIALS: Initials of the person completing this form.

18. ABBREVIATION KEYS: Self-explanatory.

19. SIGNATURE: The person completing this form must sign the form at the end of the test.

20. DATE: Date the form was signed.

3.7 GROUNDWATER LEVELS – DATALOGGERS

1. CONTRACTOR: Organization performing the test.

2. SEQ. #: Enter page number of this set of forms (page # of #).

3. PROJECT NO.: Record the contractor assigned project number or the contract number.

4. WELL #: Record the well number as it appears on the well completion tag, affixed to the protector casing or well completion records.

5. PROJECT NAME: Record the name assigned by the contractor's organization to the project.

6. LOCATION: Specific location.

7. FIELD PARTY CHIEF: Printed name of the person responsible for this particular field test.

8. CLIENT: Agency with the contract under which the work is being performed.

Well Data

9. STICKUP: Enter the length of well casing extending above the average ground surface at the base of the protective casing.

10. MEASURED UP(+)/DOWN(-) FROM: Describe the starting point for the previous measurement.

11. MP ELEVATION: Enter the elevation of the measuring point here. NOTE: This datum may require reference to tables and/or maps and may be added after completing the day's fieldwork.

12. DATUM = MSL OR: Is the datum for the previous elevation Mean Sea Level? If not, what? Also tell whether it was derived from a map elevation (write "MAP") or survey data (write "SURVEY").

13. MEASURING POINT DESCRIPTION: Describe the point used as the origin for all down-hole (water table) measurements. NOTE: All Rhode Island wells are required to have a permanently marked reference (measuring) point (refer to SOP No. 019, Section 3.4).

14. REMARKS: Record any pertinent observations about the site/well conditions not specifically required in the preceding.

Datalogger (This section is a record of pertinent datalogger information)

15. MANUFACTURER: Record the manufacturer/brand name as stated on the datalogger.

16. MODEL: Enter the model number of the datalogger.

17. S/N: Enter the serial number of this datalogger.

18. TAG PROGRAMMED IN LOGGER: What is the identifier used in the datalogger's program to indicate that this unit was used to record a given data set?

Transducer (This section is a listing of pertinent information about the transducer used)

19. MANUFACTURER: Record the manufacturer/brand name as stated on the transducer.

20. MODEL: Enter the model number of the transducer.

21. S/N: Enter the serial number of this transducer.

22. INPUT/UNITS: What are the units this transducer uses?

23. RANGE: Record the pressure or depth range over which this transducer is certified.

Calibration

24. PRESSURE RATING: This is taken from the manufacturer's specifications for a given transducer (usually in psi, or kpa).

25. "SUBMERGENCE = ___ (V) / (MV)": Record the voltage returned by the transducer at a given depth of submergence. Indicate whether the reading is in volts (v), or millivolts (mv).

26. DATE: Date of each water level reading

27. TIME: Time of each water level reading. Note whether 12- or 24-hour clock was used.

28. LOGGING TIME INTERVAL: Time since test was begun.

29. WL FEET BELOW MP: Measured depth to the groundwater table from measuring point.

30. SUBMERGENCE: Depth of water above the transducer.

31. MEAS.METHOD: What device/method was used to measure the water level.

32. TAPE NO.: Record the tape identification number.

33. TRANSDUCER MOVED?: Was the transducer moved since the last water level reading?

34. REMARKS: Any pertinent remarks not otherwise specified.

35. INITIALS:

Data Transfer to Diskette

36. DATE: Date data were archived onto diskette.

37. TIME: Time stamp the computer assigns the data file.

38. FILE NAME: Name assigned the data file.

39. SOFTWARE USED FOR TRANSFER: Any special software, or computer operating system used to write the files to diskette. NOTE: If a “shareware” archiver which compresses files was used, and the archived file is not self-extracting, a copy of the unarchive program should be copied onto the diskette also.

40. OUTPUT FORMAT: What is the format of the output file? (DOS, UNIX, Binary, Compressed?)

41. INITIALS: Initials of the person who copied the data to diskette.

42. ABBREVIATION KEY: Self-explanatory.

4. MAINTENANCE

Not applicable.

5. PRECAUTIONS

None.

6. REFERENCES

None.

This page intentionally left blank

Figures

This page intentionally left blank

FIGURE SOP016-1
FIELD PARAMETER LOGBOOK
SOIL AND SEDIMENT SAMPLES

HIGH CONCENTRATION EXPECTED? HIGH HAZARD?

INSTALLATION/SITE ________________________________ AREA ___________________

INST CODE FILE NAME ____

SITE TYPE SITE ID
FIELD SAMPLE NUMBER

DATE (MM/DD/YY) / / TIME AM PM SAMPLE PROG.

DEPTH (TOP) DEPTH INTERVAL UNIT _____________

SAMPLING METHOD:

SPLIT SPOON AUGER SHELBY TUBE SCOOP OTHER

CHK	ANALYSIS	SAMPLE CONTAINER	NO.	REMARKS

TOTAL NUMBER OF CONTAINERS FOR SAMPLE

DESCRIPTION OF SITE AND SAMPLE CONDITIONS

SITE DESCRIPTION:____
SAMPLE FORM ______________________ COLOR _____________ ODOR _____________
PID (HNu) _______________________ UNUSUAL FEATURES ________________________

WEATHER/TEMPERATURE
SAMPLER

HIGH CONCENTRATION EXPECTED? HIGH HAZARD?

This page intentionally left blank

FIGURE SOP016-2
FIELD PARAMETER LOGBOOK
GROUNDWATER AND SURFACE WATER SAMPLES

INSTALLATION/SITE AREA
INST CODE FILE NAME SITE TYPE
SITE ID FIELD SAMPLE NUMBER
DATE (MM/DD/YY) / / TIME AM PM SAMPLE PROG.
DEPTH (TOP) DEPTH INTERVAL UNITS

SAMPLING MEASUREMENTS

CAL REF. pH TEMPERATURE C CONDUCTIVITY OTHER

CHK	ANALYSIS	SAMPLE CONTAINER	NO.	REMARKS

TOTAL NUMBER OF CONTAINERS FOR SAMPLE

DESCRIPTION OF SITE AND SAMPLE CONDITIONS

SITE DESCRIPTION
SAMPLING METHOD
SAMPLE FORM COLOR ODOR
PID (HNu)
UNUSUAL FEATURES
WEATHER/TEMPERATURE ____________________________ SAMPLER ___________________

This page intentionally left blank

FIGURE SOP016-3
MAP FILE LOGBOOK

SITE ID POINTER ____________________
DESCRIPTION/MEASUREMENTS
SKETCH/DIMENSIONS:

MAP REFERENCE
COORDINATE DEFINITION (X is Y is)
COORDINATE SYSTEM SOURCE ACCURACY
X-COORDINATE Y-COORDINATE UNITS
ELEVATION REFERENCE
ELEVATION SOURCE ACCURACY ELEVATION
UNITS

SAMPLER

This page intentionally left blank

FIGURE SOP016-4
MAP FILE AND PURGING LOGBOOK
GROUNDWATER SAMPLES

WELL COORD. OR ID SAMPLE NO.______________
WELL/SITE
DESCRIPTION____
____
X-COORD. Y-COORD. _______________ ELEV. UNITS
DATE ____/____/____ TIME AIR TEMP.

WELL DEPTH _________ ft _________ in. CASING HT. _________ ft _______ in.
WATER DEPTH __________ ft _________ in. WELL DIAMETER __________ in.
WATER COLUMN HEIGHT _________ ft _________ in. SANDPACK DIAM. _______ in.
EQUIVALENT VOLUME OF STANDING WATER ____________ (gal) (L)
VOLUME OF BAILER ___________ (gal) (L) <u>or</u> PUMP RATE ___________ (gpm) (lpm)
TOTAL NO. OF BAILERS (5 EV)___________ or PUMP TIME ___________ MIN.
WELL WENT DRY? [Yes] [No] NUM. OF BAILERS ________ or PUMP TIME_______MIN
VOL. REMOVED __________ (gal) (L) RECOVERY TIME __________ MIN
PURGE AGAIN? [Yes] [No] TOTAL VOL. REMOVED __________ (gal) (L)

Date and Time	Quantity Removed	Time Required	pH	Cond	Temp	ORD	Turb	DO	Character of water (color/ clarity/odor/partic.)
(before)									
(during)									
(during)									
(during									
(after)									

COMMENTS:____
____
____
____

____
SIGNATURE

This page intentionally left blank

FIGURE SOP016-5
FIELD CALIBRATION: pH, CONDUCTIVITY, TEMPERATURE, TURBIDITY, OXIDATION-REDUCTION POTENTIAL, AND DISSOLVED OXYGEN METERS

INITIAL CALIBRATION	FINAL CALIBRATION
DATE:	DATE:
TIME:	TIME:

pH METER CALIBRATION

CALIBRATION STANDARD REFERENCE NO: _______________

METER ID ______________________________

pH STANDARD	INITIAL READING	RECALIB. READING	FINAL READING
7.0			
10.0			
4.0			

CONDUCTIVITY METER CALIBRATION

CALIBRATION STANDARD REFERENCE NO: _______________

METER ID _________________

COND. STANDARD	INITIAL READING	RECALIB. READING	FINAL READING

TEMPERATURE METER CALIBRATION

METER ID ________________

TEMP. STANDARD	INITIAL READING	RECALIB. READING	FINAL READING
ICE WATER			
BOILING WATER			
OTHER			

FIGURE SOP016-5 *(continued)*

TURBIDITY METER CALIBRATION

CALIBRATION STANDARD REFERENCE NO: _______________

METER ID ________________

STANDARD	INITIAL READING	RECALIB. READING	FINAL READING

ORD METER CALIBRATION

CALIBRATION STANDARD REFERENCE NO: _______________

METER ID ________________

STANDARD	INITIAL READING	RECALIB. READING	FINAL READING

DISSOLVED OXYGEN METER CALIBRATION

CALIBRATION STANDARD REFERENCE NO: _______________

METER ID ____________________________

STANDARD	INITIAL READING	RECALIB. READING	FINAL READING

COMMENTS:____

____

____

____

____

SIGNATURE

FIGURE SOP016-6
FIELD PERMEABILITY TEST DATA SHEET

Contractor: **Seq. #** /

Project Name:	Project #:	
Location:	Client:	
Party Chief:	Contractor:	
Observation Well:		
Test Type: Rising/Falling Head w/Slug	Rising/Falling Head w/out Slug	

Start Date:								Discharge Rate		
Clock Time	**Elapsed Time (min)**	**Depth to GWL (ft)**	**Rec (ft)**	**Clock Time**	**Elapsed Time**	**Depth to GWL (ft)**	**Rec (ft)**	**Time**	**Flow Meter**	**Discharge Rate**

Signature: ____ **Date:** ______________________

This page intentionally left blank

FIGURE SOP016-7
GROUNDWATER LEVELS – SINGLE WELL

Contractor: **Seq. #** /

Project No.:
Project Name:
Field Party Chief:

WELL DATA:

Stickup: (ft)
MP Elevation:

Well No.: Site: Area:

up (+)/down (-) from: Datum = MSL or:

Measuring Point Description:

Datalogger:
Manufacturer: Model: S/N:
Tag No. Programmed in Logger:

Transducer: Manufacturer: Model: S/N:
Input/Units: Range:

Calibration:
Pressure Rating:
0 ft submergence = (v) / (mv) ft submergence = (v) / (mv)

Volume Water Added/Removed:
Discharge Rate:
Initial Water Level (ft):

Pressure Transducer Submergence
Initial (ft): Final(ft): Time:Start: End:
Observed Changes in Adjacent Wells:

Results Recorded on Diskette #:
Diskette File Name:

Signature: ________________________ **Date:** ______________

This page intentionally left blank

FIGURE SOP016-8
GROUNDWATER LEVELS – MULTIPLE WELLS

Contractor: **Seq. #** /

Project No.:
Project Name:
Field Party Chief:

WELL DATA:

Stickup: (ft)
MP Elevation:
Measuring Point Description:
Remarks:
Well No.:
Site: Area: up (+)/down (-) from:
Datum = MSL or:

Date	Time	Elapsed Time	Depth to Water	Water Elevation	Meas. Meth.	Tape No.	Well Status	Remarks	Initials

Measurement Method:
A = Airline
C = Chalk and tape
E = Electric tape
T = Tape with popper
X = Other (describe in remarks)

Well Status:
D = Dry
F = Flowing
P = Pumping
RP = Recently pumped
NP = Nearby well pumping
NRP = Nearby well recently
X = Obstructed

Signature: ______________________________ **Date:** ____________________

FIGURE SOP016-8 ***(continued)***

Contractor: **Seq. #** /

Project No.:
Project Name: Location:
Field Party Chief: Client:

Well	Date	Time	Depth to Water	Stickup	MP Elev.	Meas. Meth.	Tape No.	Remarks/MP	Initials

Measurement Method:
A = Airline
C = Chalk and tape
E = Electric tape
T = Tape with popper
X = Other (describe in remarks)

Well Status:
D = Dry
F = Flowing
P = Pumping
RP = Recently pumped
NP = Nearby well pumping
NRP = Nearby well recently
X = Obstructed

FIGURE SOP016-9
GROUNDWATER LEVELS DATALOGGERS

Contractor

Project No.: **Well No.:**
Project Name: **Site:**
Field Party Chief: **Area:**

WELL DATA: Stickup: **(ft)** **up (+)/down (-) from:**
MP Elevation: **Datum = MSL or:**

Measuring Point Description:
Remarks:

Datalogger:
Manufacturer: Model: S/N:
Tag No. Programmed in Logger:
Transducer: Manufacturer: Model: S/N:
Input/Units: Range:
Calibration: Pressure Rating:
0 ft submergence = (v) / (mv) ft submergence = (v)

Logging	Date	Time	Logging Time Interval	WL, ft Below MP	Submergence (logger reading)	Meas. Method	Tape No.	Well Status	Transducer Moved	Remarks	Initials
Start											
Stop											
Start											
Stop											

Data Transfer to Disk

Date	Time	File Name	Software Used for Transfer	Output Format	Initials

Measurement Method:
A = Airline
C = Chalk and tape
E = Electric tape
T = Tape with popper
X = Other (describe in remarks)

Well Status:
D = Dry
F = Flowing
P = Pumping
RP = Recently
NP = Nearby well pumping
NRP = Nearby well recently pumped
X = Obstructed

Signature **Date**

This page intentionally left blank

Standard Operating Procedure No. 019
for
Monitoring Well Installation

Prepared by

EA Engineering, Science, and Technology, Inc., PBC
225 Schilling Circle, Suite 400
Hunt Valley, Maryland 21031

Revision: 01
October 2019

PROJECT-SPECIFIC VARIANCE FORM

This form is to be completed to indicate if there are any client-, project-, or site-specific variances to this Standard Operating Procedure (SOP) (**also check Box A**), or if this SOP is being used with no changes (**only check Box B**).

☐ **A. Variances required; cite section(s) of the SOP to which there is a variance**

☐ **B. No variances**

SOP No. 019	
SOP Section	**Variance**

Project Manager (Name)

Project Manager (Signature) Date

CONTENTS

DOCUMENT REVISION HISTORY

ORIGINAL (MASTER) DOCUMENT REVISION HISTORY				
Revision Number	**Revision Date**	**Revision Summary**	**Revised By**	**Reviewed By**
01	October /2019	Updated various items associated with current practice and deeper (>100 feet) monitoring wells	Kevin Sharpe Ryan Guth	Matthew Bowman

1. SCOPE AND APPLICATION

The installation approach and details for monitoring wells are driven by the existing conditions at the project site and state and local regulatory requirements. The project team should carefully address these considerations as they may require some deviations for procedures described in this standard operating procedure (SOP). State and local regulatory requirements supersede the guidance prescribed herein. The purpose of this SOP is to delineate the quality control measures required to ensure the accurate installation of monitoring wells. The applicable site-specific Work Plan should be consulted for specific installation instructions. The term “monitoring wells,” as used herein, is defined to denote any environmental sampling well. An example Well Construction Log Form is provided in Attachment A. Alternate, equivalent forms are acceptable.

2. MATERIALS

2.1 DRILLING EQUIPMENT

The following drilling equipment may be required:

- Appropriately sized drill adequately equipped with augers, bits, drill stem, etc.
- Source of approved water
- Water level indicator
- Weighted steel tape measure
- Photoionization detector: RAE® Systems MiniRAE 3000 (or equivalent)
- Lower explosive limit – oxygen monitor
- Steel drums for intrusion-derived wastes (drill cuttings, contaminated personal protective equipment, decontamination solutions, etc.)
- Heavy plastic sheeting
- High temperature, high pressure sprayer and water obtained from approved source for decontaminating drilling equipment
- Sorbent pads and/or log.

2.2 WELL INSTALLATION MATERIALS[1]

The following well installation materials may be required:

- Well screen:[2]
  - Polyvinyl chloride (PVC): Johnson (or equivalent); PVC 0.010 slot; Schedule 40; flush-threaded (leak-proof) joints; PVC complies with ASTM International (ASTM) D2665, D1784, and F480; free of ink markings; and cleaned and prepackaged by manufacturer.
  - Stainless steel: Johnson (or equivalent); stainless steel 0.010 slot; 304 stainless steel[3]; ASTM F480 flush threads; cleaned, wrapped, and heat sealed by manufacturer.
- Riser pipe:
  - PVC: Johnson (or equivalent); STD; PVC; Schedule 40; flush-threaded (leak-proof) joints; PVC complies with ASTM, D1784, and F480; free of ink markings; and cleaned and prepackaged by manufacturer.
  - Stainless steel: Johnson (or equivalent); Schedule 5; 304 stainless steel; ASTM Type A312 material; 4-inch (in.) diameter; cleaned, wrapped, and heat sealed by manufacturer.
- Plugs/caps: Johnson (or equivalent); standard PVC or stainless steel.
- Filter pack: Morie, 100 well gravel (or equivalent). NOTE: Final gradation may vary as a function of the gradation of the formation.[2]
- Fine Silica or Ottawa sand (or equivalent).
- Bentonite seal: BAROID, bentonite pellets (3/8-in. diameter).
- Cement: Type II Portland cement (table below).

---

[1] Technical information on all installed materials (screens, riser pipe, filter pack, bentonite, cement, etc.) and representative samples of the proposed filter pack, bentonite powder, and bentonite pellets will be supplied to the Project Manager.

[2] Well screen slot size and filter pack gradation will be determined from sieve analysis of aquifer materials. Screen and casing material type will be determined based on field tests of groundwater chemistry and contaminants.

[3] Unless the sum of Cl-, F-, and Br- is >1,000 parts per million (ppm), in which case Type 316 should be used.

Cement Type	Special Characteristics	Recommended Usage
I	No special properties	General use as grout mix or cement plug (if sulfates <250 ppm), surface pad.
IA	Air-entraining Type I (Note that air entrainment properties can be achieved by chemical admixtures)	Air entrainment gives cement greater freeze-thaw resistance. Recommended for surface pads.
II	Moderate sulfate resistance, low heat of hydration	General use as grout mix or cement plug where groundwater sulfate >250 ppm and <1,500 ppm, surface pad.
IIA	Air-entraining Type II	See Type IA.
III	High early strength, high heat of hydration	Elevated temperature can damage well casing and fracture grout/cement plugs. NOT RECOMMENDED.
IIIA	Air-entraining Type III	NOT RECOMMENDED.
IV	Low heat of hydration	General use as grout mix or cement plug preferred type for well abandonment to ensure intact grout/cement plug.
V	High sulfate resistance	Use when groundwater sulfate levels >1,500 ppm.

NOTE: ppm = Part(s) per million.

- Bentonite powder: Baroid, Aquagel Gold Seal.
- Steel protective casing: Brainard-Kilman (or equivalent) zinc-plated steel, lockable, painted.[4]
- Geotextile: Milrafi (or equivalent); GTF 130; non-woven; 4 ounces.
- Coarse (blanket) gravel: Crushed stone aggregate.
- Containers for purged water, as required.
- Submersible pump or bailer of appropriate capacity, and surge block sized to fit well.
- Hach DREL 2000 portable laboratory (or equivalent).
- Conductivity, pH, oxidation-reduction potential (ORP), turbidity, dissolved oxygen, and temperature meters.
- Water level meter or interface probe
- Protective steel covers.

---

4. All painted components (protector casing, steel bollards/pickets) will be painted high-visibility orange and allowed to dry completely prior to being brought onsite.

- Portland Type IA cement (see previous table) alone, or as part of concrete mix for surface pad.

- Steel posts (bollards/pickets), painted (see footnote).

2.3 DOCUMENTATION

The following documents may be required by field staff supervising the installation of monitoring wells:

- Copy of appropriate Work Plan
- Copy of approved Health and Safety Plan
- Copies of well and excavation permits
- Boring log forms
- Well completion diagram form
- Well development form.

2.4 GEOLOGIST'S PERSONAL EQUIPMENT

The following equipment may be required for the geologist:

- 10 times magnifying hand lens
- Unified Soil Classification System chart
- Munsell soil color chart
- Sieve set (Keck model SS-81 or equivalent)
- Personal protective equipment as required by the Health and Safety Plan.

3. PROCEDURE

3.1 MATERIALS APPROVAL

Water sources for drilling, grouting, sealing, filter placement, well installation, and equipment decontamination must be approved by the Project Manager prior to arrival of the drilling equipment. Information required for the water source includes: water source, manufacturer/ owner, address and telephone number, type of treatment and filtration prior to tap, time of access, cost per gallon (if applicable), dates and results associated with all available chemical analyses over the past 2 years, and name and address of the analytical laboratory (if applicable).

Pure sodium bentonite with no additives (bentonite) will be the only drilling fluid additive allowed, and its use must be approved by the Project Manager prior to the arrival of the drilling equipment. The information required for evaluation includes: brand name, manufacturer, manufacturer's address and telephone number, product description, and intended use for the product.

Granular filter pack material must be approved by the Project Manager prior to drilling. A 1-pint representative sample must be supplied to the Project Manager. Information required includes: lithology, grain size distribution, brand name, source, processing method, and slot size of intended screen.

Screen and casing materials must be approved by the Project Manager prior to drilling. Materials for deep wells must have adequate strength to prevent collapse or damage. A collapsed well is an expensive and time-consuming mistake.

Portland Type II cement will be used for grout (see previous table).

3.2 DRILLING

The objective of the selected drilling technique is to ensure that the drilling method provides representative data while minimizing: (1) subsurface contamination, (2) cross-contamination of aquifers, and (3) drilling costs. The preferred drilling method for shallow (<100 feet [ft]) well installation is hollow-stem auger, although direct-push and sonic methods can also be considered, and other methods can be approved as conditions warrant. The method used at a specific site will be proposed in the work plan and evaluated by the Project Manager.

If the design depth of the well is >100 ft, other rotary drilling methods (mud rotary, air rotary, air rotary with downhole hammer, dual-tube reverse rotary, etc.) may be used to install wells. The following drilling fluids and methods are approved in the order listed: (1) rotary drilling with water from an approved source as drilling fluid (clays from the formations will tend to thicken the fluid and coat the walls of the borehole and this is acceptable); (2) rotary drilling with water as a fluid, advancing a temporary casing with the bit to maintain an open hole; and (3) mud rotary using water with additives as drill fluid. Due to the potential for aquifer contamination and plugging, mud rotary drilling is not recommended for monitoring wells. If, however, “running sands” are encountered and the aquifer is expected to have a relatively high flow rate, then mud rotary is considered an approved method. Pure sodium bentonite is the only approved additive. Mud rotary drilling must be halted at the last aquitard above the target aquifer. Casing must be set, all bentonite-bearing fluids flushed from the hole and drill rig, and drilling may be resumed using water only as the drill fluid until the target depth is reached. Rotary drilling with air is useful and efficient in bedrock drilling and is typically done with no additions to the air stream; however, additives (e.g., foam) can be considered if conditions warrant.

A site geologist will be present during all well drilling and installation activities and will fully characterize all tasks performed in support of these activities into the monitoring well logbook. The site geologist will be responsible at only one operating rig for: (1) logging of samples, (2) monitoring of drilling operations, (3) recording of water losses/gains and groundwater data, (4) preparing the boring logs and well diagrams, and (5) recording the well installation procedures of the rig. The site geologist will have onsite sufficient equipment in operable condition to perform efficiently his/her duties as outlined in the contractual documents. Items in the possession of each site geologist will include: (1) the approved Health and Safety Plan; (2) this SOP; (3) a hand lens (10 times); (4) a standard color chart; (5) grain-size chart;

(6) a weighted (with steel or iron) steel tape long enough to measure the deepest well, heavy enough to reach that depth, and small enough to fit readily within the annulus between the well and drill casing; and (7) a water level measuring device, preferably electrical.

Only anti-seizing compounds that are environmentally safe (i.e., commercial products for environmental drilling projects or solid vegetable shortening [e.g., Crisco®]) may be used on downhole drilling equipment. Compounds containing either lead or copper will not be allowed. In addition, polychlorinated biphenyls will not be permitted in hydraulic fluids or other fluids used in the drilling rig, pumps, and field equipment/vehicles.

Surface runoff or other fluids will not be allowed to enter any boring or well during or after drilling/construction. Steps in the form of grading or sandbagging can be taken to ensure that runoff is directed away from the borehole.

Antifreeze used to keep equipment from freezing will not contain rust inhibitors and sealants. Antifreeze is prohibited in areas in contact with drilling fluid. The ground surface at the well site will be protected from possible coolant, fuel, and hydraulic fluid spills and/or leakage by placement of plastic sheeting with raised edges; and draining into a lined catch basin large enough to contain spills and/or leakage from motors, radiators, or vehicle tanks. Sorbent pillows will be placed to catch obvious leaks from the drill rig. Sorbent logs may be used instead of, or in conjunction with, a lined catch basin to contain spills.

An accurate measurement of the water level will be made upon encountering water in the borehole and later upon stabilization (levels will have less usefulness during mud rotary drilling). Levels will be periodically checked throughout the course of drilling. Any unusual change in the water level in the hole (i.e., a sudden rise of a few inches may indicate artesian pressure in a confined aquifer) will be the basis for cessation of drilling. The geologist will immediately contact the Project Manager[5]. Particular attention for such water level changes will be given after penetrating any clay or silt bed, regardless of thickness, which has the potential to act as a confining layer.

Anticipated depths of wells are given in well-specific work plans. In case the previously defined criteria have not been met before the depth range for a given hole is reached, the geologist will stop the drilling and confer with the Project Manager. The current boring conditions (depth, nature of the stratigraphic unit, and water table depth) will be compared to those of other wells nearby to decide to continue drilling or terminate and complete the well.

If the well is to be installed in the surficial aquifer, drilling will be terminated before penetrating the basal aquitard. The basal aquitard is defined as the first 2 ft-thick clay below the water table, or below 5 ft in the case of a shallow aquifer.

If the well is to be installed in a lower, confined aquifer:

---

[5] The contract technical oversight will also be contacted for guidance.

- Penetrations of aquifers located lower than the water table aquifer will be limited to avoid cross-contamination.

- Placement of new upper confined aquifer wells will be initially limited to those areas where contamination has been confirmed.

- The location of upper confined aquifer wells will be based upon the findings of the water table aquifer investigation. Areas of known contamination will be targeted for installing upper confined aquifer wells for the purposes of delineating vertical contamination.

- Where possible, upper-confined aquifer wells will be located such that they afford triangulation with other wells within the same aquifer to allow for a determination of groundwater flow direction.

- Some upper-confined aquifer wells will be installed approximately 10-15 ft from water table wells to enable the accurate assessment of vertical hydraulic gradients. If the direction of groundwater flow is known, wells within a group will be located sidegradient of each other.

- The boring will be advanced until the base of the surficial aquifer is reached (Section 3.2).

- An outer surface casing will be set 2-5 ft into the confining layer to minimize the potential for cross-contamination from the unconfined aquifer during drilling activities.

- The surface casing will be driven into the confining bed and grouted into place. Grout will be tremied into the annulus around the outside of the casing to within 5 ft of the ground surface. A grout plug at least 2 ft thick will be tremied into the bottom of the surface casing. The grout will be permitted to cure for 24 hours. All drilling fluids within the surface casing will then be removed, and the casing will be flushed with clean potable water.

- The drilling equipment will be decontaminated, a smaller bit or auger selected, and the hole will be continued through the grout plug into the confined aquifer.

- If deeper aquifers are to be screened, repeat preceding steps until total depth is reached.

If dense non-aqueous phase liquid (DNAPL) contamination is detected during drilling, the well will be terminated and completed at the base of the aquifer as described in Section 3.4. Drilling will not continue through the confining unit.

3.3 LOGGING

All borings for monitoring wells will be logged by a geologist. Logs will be recorded in a field logbook and/or a boring log. If the information is recorded in a logbook, it will be transferred to boring log forms on a daily basis. Field notes are to include, at a minimum:

- Boring number
- Material description (as discussed below)
- Weather conditions
- Evidence of contamination
- Water conditions (including measured water levels)
- Daily drilling footage and quantities (for billing purposes)
- Notations on man-placed materials
- Drilling method and borehole diameter
- Any deviations from established field plans
- Blow counts for standard penetration tests
- Core and split-spoon recoveries.

Material description for soil samples must include:

- Classification
- Unified Soil Classification System symbol
- Secondary components and estimated percentages
- Color
- Plasticity
- Consistency
- Density
- Moisture content
- Texture/fabric/bedding and orientation
- Grain angularity
- Depositional environment and formation
- Incidental odors
- Photoionization detector reading(s)
- Staining.

A typical boring log entry will include: (1) Munsell color, (2) moisture content, (3) primary components, (4) secondary components, (5) Unified Soil Classification System symbol, and (6) other attributes (density, consistency, and others from the list above). The relative proportions of secondary components will be described with descriptive terms: trace (less than 5 percent), few (6-15 percent), little (16-30 percent), some (31-49 percent), and (36-50 percent).

Material description for rock samples must include:

- Classification
- Lithologic characteristics

- Bedding/banding characteristics
- Color
- Hardness
- Degree of cementation
- Texture
- Structure and orientation
- Degree of weathering
- Solution or void conditions
- Primary and secondary permeability
- Sample recovery
- Incidental odors
- Photoionization detector reading(s)
- Staining.

3.4 WELL CONSTRUCTION AND INSTALLATION

3.4.1 General

After the borehole is drilled and logged, the hole will be backfilled as required for proper screen placement. The integrity of the aquitard will be restored by placing a bentonite plug of an appropriate thickness, either to the top of the aquitard (normal well installation) or to within 0.3 ft of the top of the aquitard (DNAPL well). Aquifer fill will be clean filter pack.

The installation of monitoring wells in uncased or partially cased holes will begin within 12 hours of completion of drilling or, if the hole is to be logged, within 12 hours of well logging, and within 48 hours for holes fully cased with temporary drill casings. Once installation has begun, work will continue until the well has been grouted and the drill casing has been removed.

The construction of each well will be depicted as built in a well construction diagram. The diagram will be attached to the boring log and will graphically denote:

- Borehole depth
- Screen location and length
- Joint location
- Granular filter pack
- Seal
- Grout
- Cave-in
- Centralizers
- Height of riser
- Protective casing detail.
- Water level on the construction date

3.4.2 Well Casing and Screen Installation

Assemble appropriate decontaminated lengths of pipe and screen. Make sure these are clean and free of grease, soil, and residue. Lower each section of pipe and screen into the borehole, one at a time, screwing each section securely into the section below it. No grease, lubricant, polytetrafluoroethelyne tape, or glue may be used in joining the pipe and screen sections. If a well extends below 50 ft, centralizers will be installed at 50 ft and every 50 ft thereafter except within screened interval and bentonite seal. Centralizer material will be PVC, polytetrafluoroethelyne, or stainless steel. Determination of centralizer material will be based on the same criteria as screen and casing selection.

Normal screen placement for the water table (surficial) aquifer will extend from 2 ft above the static water level to no more than 6 in. from the bottom of the hole or backfill material, whichever is applicable. The bottom of the screen will rest no more than 6 in. from the bottom of the hole or backfill material, whichever is applicable.

NOTE: The end cap in DNAPL wells will rest on the bottom of the hole, or bentonite backfill if applicable (Section 3.2).

Screen placement for a confined aquifer well will normally be at the top of the confined aquifer.

Screen lengths will not normally exceed 10 ft. If it appears advantageous in a given situation (e.g., to screen an entire aquifer that is thicker than 10 ft), approval must be sought on a case-by-case basis from the appropriate regulatory agency. Otherwise, wells will be screened as follows:

Thickness of Aquifer	Action
<10 ft	Screen entire aquifer
>10 ft <30 ft	Screen top 10 ft; consider vertically nested well cluster
>30 ft	Install vertically nested well cluster

Plastic well screens, casings, and fittings will conform to National Sanitation Foundation Standard 14 or ASTM equivalent for potable water usage. These materials will bear the appropriate rating logo. If the logos are not present, a written statement from the manufacturer/supplier stating that the materials contain the appropriate rating must be obtained. Material used will be new and essentially chemically inert to the site environment.

Well screen and casing should be inert with respect to the groundwater; therefore, the selection of screen and casing material will be based on select field tests of aquifer chemistry and potential contaminants. The screen will be capped without sediment trap or DNAPL sampling cup, and lowered into the hole. The well casing will be pre-cut to extend 2-2.5 ft above ground surface. Prior to placement of the last piece of well casing, a notch or other permanent reference point will be cut, filed, or scribed into the top edge of the casing.

Screen slot size will be appropriately sized to retain 90-100 percent of the filter pack material, the size of which will be determined by sieve analysis of formational material.

Stainless steel screens will be used in DNAPL wells. The formation grain size will be multiplied by the higher factor (6) to determine filter pack grain size. This will ensure that the filter pack is sufficiently coarse to permit DNAPL to pass freely from the formation into the coarser filter pack, then into the open well (Cohen and Mercer 1993).

DNAPL sampling cups are prohibited. The well screen will be capped and set 0.3 ft (0.5 ft maximum) into the top of the confining bed and rest on the bottom of the hole or bentonite backfill (if used). No sand will be placed below the screen.

3.4.3 Filter Sand Installation

Place the appropriate filter pack. Monitor the rise within the annulus with a weighted tape to assure that bridging is not occurring. After the filter pack is in place, wait 3-5 minutes for the material to settle, tamp and level with a capped PVC pipe, and check its depth with a weighted steel tape.

Filter pack material will be placed, lightly tamped, and leveled. Filter pack will extend from the bottom of the hole to a height of 1-2 ft above the top of the screen. The filter pack will be capped with a minimum of 1 ft of fine (e.g., Ottawa-type) sand to prevent the bentonite seal (placed as pellets) from infiltrating the filter pack. If the bentonite seal is placed as a slurry, a minimum of 2 ft of fine sand will be required.

If the hole is less than 20 ft deep, the filter pack may be poured into the annulus directly. If the hole is deeper than 20 ft, the filter pack must be tremied into place.

Granular filter packs will be chemically and texturally clean, inert, and siliceous.

Filter pack grain size will be based on formation grain size analysis. The D30 (70 percent retained) sieve size multiplied by a factor of not less than 3 nor greater than 6 will be used to determine the appropriate grain size.

Calculations regarding filter pack volumes will be entered into the field logbook along with any discrepancies between calculated and actual volumes used. If a discrepancy of greater than 10 percent exists between calculated and actual volumes exists, an explanation for the discrepancy will also be entered in the field logbook.

3.4.4 Bentonite Installation

Install the bentonite seal (2- to 5-ft thick) by placing bentonite pellets into the hole gradually. If the well is deeper than 20 ft, a tremie pipe will be used to place either bentonite pellets or slurry. Tamp and level pellets. If the well is within 20 ft deep, tamp with a capped PVC pipe; if >20 ft, tamping may be accomplished with the weighted end of the tape. In either case, check the depth to the top of the seal with a weighted tape as above.

If the bentonite pellets are of poor quality, they may have a tendency to hydrate and swell inside the tremie pipe and bridge. This situation may be solved by the following procedure:

1. Use a different brand of pellets. Different brands may have longer hydration times.
2. Freeze the pellets[6]. Note that this will require a longer wait time to allow proper hydration after the pellets thaw.
3. Place the bentonite seal as a slurry using a side-discharge tremie pipe as though installing grout. Note (Section 3.4) this will require that a minimum of 2 ft of fine sand be placed as a cap on top of the filter pack material.

Wait for the pellets to hydrate and swell. Hydration times will be determined by field test or by manufacturer's instructions. Normally this will be 30-60 minutes. Document the hydration time in the field notebook. If the pellets are above the water level in the hole, add several buckets of clean water to the boring. Document the amount of water added to the hole.

The final depth to the top of the bentonite seal will be measured and recorded.

3.4.5 Grout Installation

Mix an appropriate cement-bentonite grout (described below). Be sure the mixture is thoroughly mixed and as thick as is practicable.

Lower a side discharge tremie pipe into the annulus to the level of the pellet seal.

Pump the grout slurry into the annulus while withdrawing the tremie pipe and temporary casing. Stop the grout fill at 5 ft below the ground surface. Allow to cure for not less than 12 hours. If grout settles more than 6 in., add grout to bring level back up to within 5 ft of ground surface. Place approximately 2 ft of bentonite pellets (minimum 0.5 ft) in annulus. Seat the protective casing in the bentonite seal, allowing no more than 0.2 ft between the top of the well casing and the bottom of the protective casing cap. Fill inner annulus (between well casing and protective casing) with bentonite pellets to the level of the ground surface. Cover bentonite pellets with 1 ft of clean granular material (coarse sand or pea gravel filter pack). Fill the outer annulus (between the protective casing and the borehole) with neat cement. Allow the cement to mound above ground level and finish to slope away from the casing. Lock the cap.

---

[6] Bentonite pellets may be "flash-frozen" by brief immersion in liquid nitrogen (LN2). This can be accomplished by pouring LN2 over a small quantity (0.25-0.5 bucket) of pellets, allowing the LN2 to boil off, then pouring the pellets into the tremie pipe. NOTE: Use of LN2 is an additional jobsite hazard and must be addressed in the contractor's Health and Safety Plan. This contingency must be covered before drilling starts in order to avoid delays in well installation.

– OR –

Continue the grout fill to the ground surface. Seat the protective casing in the grout, allowing no more than 0.2 ft between the top of the well casing and the bottom of the protective casing cap. Lock the cap.

– AND –

Allow the grout slurry to set overnight.

Fill the outer annulus (between the casing and the borehole) with neat cement. Allow the cement to mound above ground level and finish to slope away from the casing.

Grout used in construction will be composed by weight of:

- 20 parts cement (Portland cement, Type II) (see previous table)
- 0.4-1 part (maximum) (2-5 percent) bentonite
- 8 gallons (maximum) of approved water per 94-pound bag of cement.

Neither additives nor borehole cuttings will be mixed with the grout. Bentonite will be added after the required amount of cement is mixed with the water.

All grout material will be combined in an aboveground container and mechanically blended to produce a thick, lump-free mixture. The mixed grout will be recirculated through the grout pump prior to placement. Grout placement will be performed using a commercially available grout pump and a rigid, side discharge tremie pipe.

The following will be noted in the field logbook: (1) calculations of predicted grout volumes; (2) exact amounts of cement, bentonite, and water used in mixing grout; (3) actual volume of grout placed in the hole; and (4) any discrepancies between calculated and actual volumes used. If a discrepancy of greater than 10 percent exists between calculated and actual volumes exists, an explanation for the discrepancy will also be entered in the field logbook.

Well protective casings will be installed around all monitoring wells on the following day as the initial grout placement around the well. Any annulus formed between the outside of the protective casing and the borehole will be filled to ground surface with cement.

3.4.6 Surface Completion

Cut the riser with a pipe cutter approximately 2-2.5 ft above grade. All pipe cuts MUST be square to ensure that the elevation between the highest and lowest point of the well casing is less than or equal to 0.02 ft. Notch, file, or otherwise permanently scribe a permanent reference point on the top of the casing.

Torches and saws may not be used to cut the riser. Care must be taken that all filings or trimmings cut from the reference point fall outside the riser rather than into the well. **Under no circumstances will a permanent marker or paint pencil be used to mark the reference point**.

The tops of all well casings will be capped with covers composed of materials compatible with the products used in the well installation. Caps may either be vented, or a telescopic fit, constructed to preclude binding to the well casing caused by tightness of fit, unclean surfaces, or weather conditions. In either case, it should be secure enough to preclude the introduction of foreign material into the well yet allow pressure equalization between the well and the atmosphere (e.g., avoid the use of unvented well plugs).

In some locations, safety requirements may mandate that a well be flush-mounted with no stickup. If a flush-mounted well is required at a given location, an internal pressure cap must be used instead of a vented cap to ensure that rainwater cannot pool around the wellhead and enter the well through the cap.

Slope the ground surface away from the casing for a distance of 2 ft, at a rate of no less than 1 in. in 2 ft. Surface this sloping pad with a geotextile mat covered by 6 in. of coarse gravel.

– OR –

Frame and pour a 4-ft square × 6-in. thick (4 ft × 4 ft × 6 in.) concrete pad centered around the protective casing.

– AND –

Set pre-painted protective steel pickets (3 or 4) evenly around and 4 ft out from the well. These pickets will be set into 2 ft deep holes, the holes will then be filled with concrete; and, if the pickets are not capped, they will also be filled with concrete.

3.5 WELL DEVELOPMENT

Well development is the process by which drilling fluids, solids, and other mobile particulates within the vicinity of the newly installed monitoring well have been removed while restoring the aquifer hydraulic conductivity. Development corrects any damage to or clogging of the aquifer caused by drilling, increases the permeability of the aquifer in the vicinity of the well, and stabilizes the formation and filter pack sands around the well screen.

Well development will be initiated after 48 consecutive hours but no longer than 7 calendar days following grouting and/or placement of surface protection.

Two well development techniques, over pumping and surging, will be employed in tandem. Over pumping is simply pumping the well at a rate higher than recharge. Surging is the operation of a plunger-like device (e.g. surge block) up and down within the well casing similar to a piston in a cylinder.

3.5.1 Materials Required

The following materials will be required for well development:

- Well Development Form
- Boring Log and Well Completion Diagram for the well
- Submersible pump or bailer of appropriate capacity, and surge block
- Conductivity, pH, ORP, turbidity, dissolved oxygen, and temperature meters
- Water-level meter or interface probe, as appropriate
- Containers for purged water, if required.

3.5.2 Summary of Procedures and Data Requirements

Pump or bail the well to ensure that water flows into it, and to remove some of the fine materials from the well. Removal of a minimum of one equivalent volume is recommended at this point. The rate of removal should be high enough to stress the well by lowering the water level to approximately half its original level. If well recharge exceeds 15 gallons per minute, the requirement to lower the head will be waived.

Slowly lower a close-fitting surge block into the well until it rests below the static water level, but above the screened interval. (NOTE: This latter is not required in the case of a light non-aqueous phase liquid well.)

Begin a gentle surging motion that will allow any material blocking the screen to break up, go into suspension, and move into the well. Continue surging for 5-10 minutes, remove surge block, and pump or bail the well, rapidly removing at least one equivalent volume.

Repeat previous step at successively lower levels within the well screen until the bottom of the well is reached. Note that development should always begin above, or at the top of, the screen and move progressively downward to prevent the surge block from becoming sand locked in the well casing. As development progresses, successive surging can be more vigorous and of longer duration as long as the amount of sediment in the screen is kept to a minimum.

Development is expected to take at least 2 hours in a small well installed in a clean sand, and may last several days in large wells, or in wells set in silts with low permeabilities.

Development will continue until little or no sediment can be pulled into the well, and target values for parameters listed below are met.

At a minimum, development will remove 3-5 well volumes of water. One development volume is defined as (1) equivalent volume, plus (2) the amount of fluid lost during drilling, plus (3) the volume of water used in filter pack placement.

1. Monitor water quality parameters (turbidity, pH, conductivity, ORP, dissolved oxygen, and temperature) before beginning development procedures, and after removing 2, 2.5, and 3 well volumes of water.

2. If these parameters have stabilized over the three readings, the well will be considered developed.

3. If the parameters have not stabilized after these three readings, continue pumping the well to develop, but stop surging. Monitor the stabilization parameters every half development volume.

4. When the parameters have stabilized over three consecutive readings at half development volume intervals, the well will be considered developed.

All water removed must be disposed of as directed by the Work Plan.

Record all data as required on a Field Record of Well Development Form (Attachment B), which is made a part of the complete well record. These data include:

- Depths and dimensions of the well, casing, and screen obtained from the well diagram.

- Water losses and uses during drilling, obtained from the boring log for the well.

- Depth-to-water measurements.

- Measurements of the following indicator parameters: turbidity, pH, conductivity, ORP, dissolved oxygen, and temperature.

- Target values for the indicator parameters listed above are as follows: pH – stabilize, conductivity – stabilize, ORP – stabilize, dissolved oxygen –- stabilize, temperature – stabilize, and turbidity – 5 nephelometric turbidity units or stabilize. A value is considered to have stabilized when three consecutive readings taken at half development volume intervals are within 10 percent of each other.

- Notes on characteristics of the development water.

- Data on the equipment and technique used for development.

- Estimated recharge rate and rate/quantity of water removal during development.

3.6 TEMPORARY WELLS

Temporary wells typically differ from permanent installations in the following ways: (1) the wells are typically shallow and have small diameters; (2) installation methods tend to be driving, direct-push, but could be any of the rotary methods or sonic; and (3) the wells tend to have limited surface completions with no protective casing, concrete pad, or bollard posts. Keep in mind that temporary wells may still require well permits and perhaps reporting on abandonment. The installation should follow steps to allow for expedited abandonment after a limited timeframe, meaning: (1) the casing should be amenable to pulling or ripping, (2) the borehole should be limited in diameter to expedite filling, and (3) surface disturbance should be minimized to allow for quick site restoration and possible reseeding.

3.7 WELL SURVEY

Newly installed monitoring wells will typically be surveyed by a state-registered surveyor to determine the geographical coordinates and elevations. Typical standards for the survey are surveying the well to vertical accuracy of 0.010 U.S. survey ft using the 1988 North American Vertical Datum and a horizontal accuracy to within 0.10 ft tied to site datum (World Geodetic System 1984 Universal Transverse Mercator Zone 11 North). The elevations for the natural ground surface (not the top of the grout collar) and the highest point on the riser casing rim of the uncapped well casing, and the protective casing for each well will be surveyed. A survey mark will be indicated by a small groove or other permanent marking in the well riser casing.

4. MAINTENANCE

Not applicable.

5. PRECAUTIONS

Refer to the site-specific Health and Safety Plan for discussion of physical and chemical hazards and preventive measures to be used during well installation and development activities.

6. REFERENCES

Cohen, R.M. and J.W. Mercer. 1993. DNAPL Site Evaluation, CRC Press, Inc.

This page intentionally left blank

Attachment A

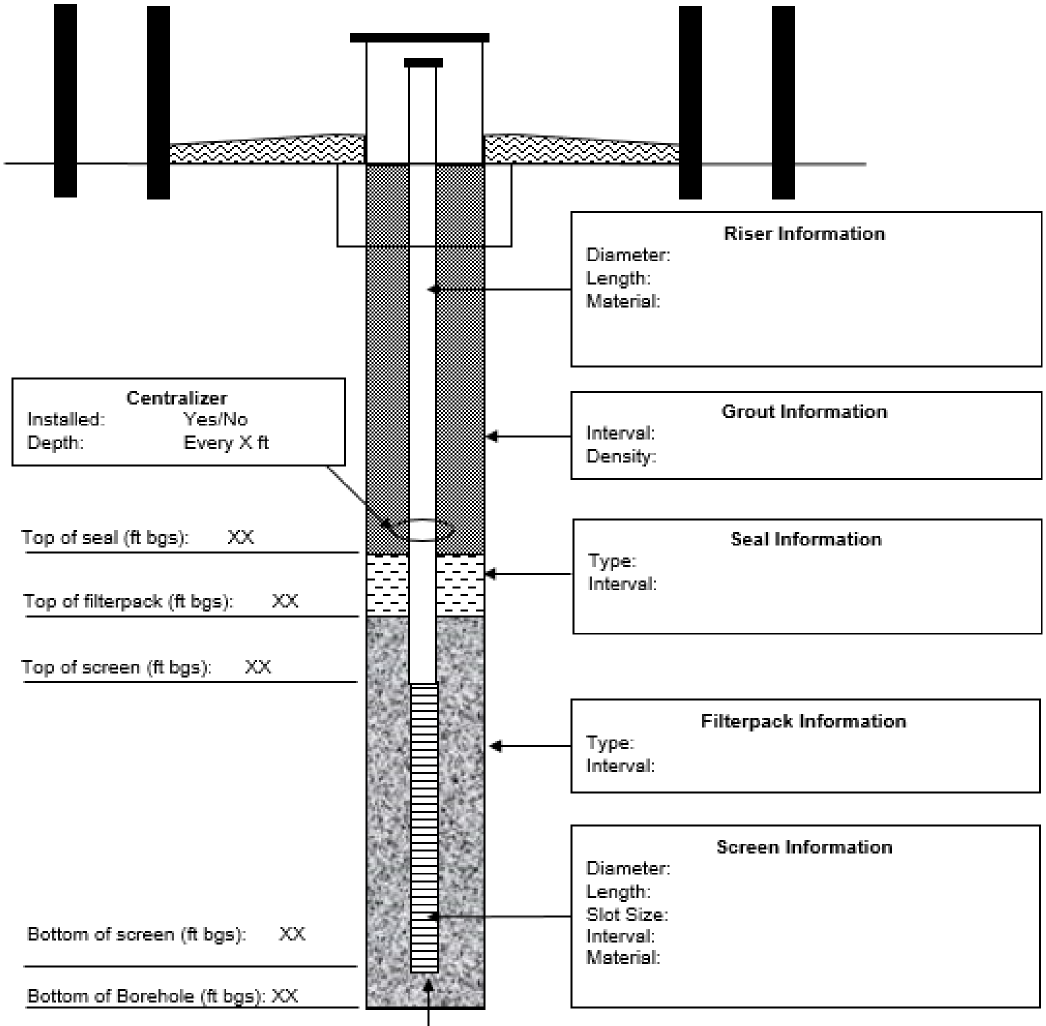
Well Construction Log Form

This page intentionally left blank

WELL CONSTRUCTION LOG

EA Engineering, Science, and Technology, Inc., PBC	**Monitoring Well ID No.:** [Coordinates] Not Yet Surveyed [Aquifer Type]
Project Name/ Project No.:	
Location:	

All footages indicated are below ground surface (bgs).



Riser Information
Diameter:
Length:
Material:

Centralizer
Installed: Yes/No
Depth: Every X ft

Grout Information
Interval:
Density:

Top of seal (ft bgs): XX

Seal Information
Type:
Interval:

Top of filterpack (ft bgs): XX

Top of screen (ft bgs): XX

Filterpack Information
Type:
Interval:

Screen Information
Diameter:
Length:
Slot Size:
Interval:
Material:

Bottom of screen (ft bgs): XX

Bottom of Borehole (ft bgs): XX

Notes:
Features not to scale.
Borehole diameter and bit info:

Sump Information
Sump: Yes/No
Interval: XX-XX

This page intentionally left blank

Attachment B

Field Record of Well Development Form

This page intentionally left blank

FIELD RECORD OF WELL DEVELOPMENT

Project Name:	Project No:	Date:
EA Personnel:	Development Method:	
Weather/Temperature/Barometric Pressure:		Time:

Well No.:	Well Condition:
Well Diameter:	Measurement Reference:
Well Volume Calculations	
A. Depth To Water (ft):	D. Well Volume/ft:
B. Total Well Depth (ft):	E. Total Well Volume (gal)[C*D]:
C. Water Column Height (ft):	F. Five Well Volumes (gal):

Parameter	Beginning	1 Volume	2 Volumes	3 Volumes	4 Volumes	5 Volumes
Time (min)						
Depth to Water (ft)						
Purge Rate (gpm)						
Volume Purged (gal)						
pH						
Temperature (°F)						
Conductivity (µmhos/cm)						
Dissolved Oxygen						
Turbidity (NTU)						
ORP (mV)						
Parameter	6 Volumes	7 Volumes	8 Volumes	9 Volumes	10 Volumes	End
Time (min)						
Depth to Water (ft)						
Purge Rate (gpm)						
Volume Purged (gal)						
pH						
Temperature (°F)						
Conductivity (µmhos/cm)						
Dissolved Oxygen						
Turbidity (NTU)						
ORP (mV)						

NOTE: NTU = Nephelometric turbidity unit.
ORP = Oxidation-reduction potential.

COMMENTS AND OBSERVATIONS:

FIELD RECORD OF WELL DEVELOPMENT

Project Name:	Project No:	Date:
EA Personnel:	Development Method:	
Weather/Temperature/Barometric Pressure:		Time:

Well No.:	Well Condition:
Well Diameter:	Measurement Reference:

Parameter	Beginning	1 Volume	2 Volumes	3 Volumes	4 Volumes	5 Volumes
Time (min)						
Depth to Water (ft)						
Purge Rate (gpm)						
Volume Purged (gal)						
pH						
Temperature (°F)						
Conductivity (µmhos/cm)						
Dissolved Oxygen						
Turbidity (NTU)						
ORP (mV)						
Parameter	6 Volumes	7 Volumes	8 Volumes	9 Volumes	10 Volumes	End
Time (min)						
Depth to Water (ft)						
Purge Rate (gpm)						
Volume Purged (gal)						
pH						
Temperature (°F)						
Conductivity (µmhos/cm)						
Dissolved Oxygen						
Turbidity (NTU)						
ORP (mV)						

Standard Operating Procedure No. 028
for
Well and Boring Abandonment

Prepared by

EA Engineering, Science, and Technology, Inc., PBC
225 Schilling Circle, Suite 400
Hunt Valley, Maryland 21031

Revision 1
January 2021

This page intentionally left blank

PROJECT-SPECIFIC VARIANCE FORM

This form is to be completed to indicate if there are any client-, project-, or site-*specific* variances to this Standard Operating Procedure (SOP) (**also check Box A**), or if this SOP is being used with no changes (**only check Box B**).

☐ **A. Variances required; cite section(s) of the SOP to which there is a variance**

☐ **B. No variances**

SOP No. 028	
SOP Section	**Variance**

Project Manager (Name)

Project Manager (Signature) Date

This page intentionally left blank

CONTENTS

Page

DOCUMENT REVISION HISTORY

ORIGINAL (MASTER) DOCUMENT REVISION HISTORY				
Revision Number	**Revision Date**	**Revision Summary**	**Revised By**	**Reviewed By**
1	January 2021	Systematic review and update	Luis Vega Michael Kelly	Matthew Bowman

1. SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure is to establish the protocols by which all wells and borings will be safely abandoned. The primary objective of well abandonment is to ensure that the abandoned well or boring does not provide a conduit for the vertical migration of contamination between aquifers. This Standard Operating Procedure applies to boreholes and monitoring wells.

2. MATERIALS

The following materials may be required:

Drill rig	Bentonite pellets (seal)
Filter pack material	Cement (Portland Type II or V)
Pure sodium bentonite with no additives (bentonite) powder (grout)	Approved water

3. PROCEDURE

The procedures used in boring abandonment will ideally accomplish two objectives: (1) protect aquifers from cross-contamination by sealing the borehole, and (2) restore the strata in the borehole to nearly original conditions by selective placement of fill material.

State and local regulations often apply to well and boring abandonment requiring notifications, permits, and licensing. A thorough review of state and local regulations and requirements should be performed while planning well and boring abandonment activities. Be aware that multiple regulatory jurisdictions may apply depending on the location and type of well abandonment activity.

3.1 GROUT

Grout used in construction will be composed, by weight, of the following:

- Twenty parts cement (Portland cement, Type II or V)
- 0.4-1 part (maximum) (2-5 percent) bentonite
- Eight gallons (maximum) of approved water per 94-pound bag of cement.

Neither additives nor borehole cuttings will be mixed with the grout. Bentonite will be added after the required amount of cement is mixed with the water.

All grout material will be combined in an aboveground container and mechanically blended to produce a thick, lump-free mixture. The mixed grout will be recirculated through the grout pump prior to placement.

Grout placement will be performed using a commercially available grout pump and a rigid tremie pipe removal; and grouting will be accomplished in stages, aquifer by aquifer, sealing the boring from the bottom to ground surface. This will be accomplished by placing a grout pipe to the bottom and pumping grout through the pipe until undiluted grout reaches the bottom of the next higher section of casing or, for the top-most section, until grout comes to 3 feet (ft) of the ground surface, then monitored for settlement and finished with mounded cement. Efforts will be made to grout incrementally as the casing is removed.

After 24 hours, the abandoned drilling site will be checked for grout settlement. On that day, any settlement depression will be filled with grout and rechecked 24 hours later. This process will be repeated until firm grout remains at the ground surface.

3.2 BORINGS

The term “Borings” as used in this Standard Operating Procedure applies to any drilled hole made during the course of a remedial investigation that is not completed as a well. This includes soil test borings, soil sampling borings, and deep stratigraphic borings. Whether completed to the planned depth or aborted for any reason prior to reaching that depth, borings will be grouted and normally closed within 4 hours, or within 4 hours of completion of logging.

3.2.1 Shallow Borings Not Penetrating Water Table

Shallow borings made for the collection of subsurface soil samples will be abandoned by backfilling the hole with cuttings from the hole, **if and only if the boring does not penetrate the water table.** Clean sand will be used to make up any volume not filled by the cuttings.

3.2.2 Borings Penetrating the Water Table

Shallow borings made for the collection of subsurface soil samples **that penetrate the water table** will be abandoned by grouting the hole from the bottom to the top.

3.2.3 Deep Stratigraphic Borings

Deep stratigraphic borings will normally be located in areas that, by virtue of the historical record, are presumed relatively uncontaminated. Therefore, these borings are usually over 100 ft from any sampling well locations. Any boring located within 10 ft of a proposed well location, or located directly upgradient or downgradient (on anticipated flow line) of a proposed well location, will be abandoned by placing clean sand in the aquifer intervals and bentonite or grout in aquitard intervals as described below. If the boring is over 10 ft from and/or not upgradient of a proposed well location, the boring will be completely filled with grout.

3.3 WELLS

The following procedure applies to wells aborted prior to completion and existing wells determined to be no longer required for its original purpose, ineffective, or otherwise in need of closure.

If the well is within 10 ft of another monitoring well in the same aquifer, or a replacement well is to be installed within 10 ft of the well, casing will be pulled, drilled out, or thoroughly pierced. Using tremie pipe, the hole will then be backfilled with filter pack material opposite sand strata and bentonite or grout opposite substantial (2 ft or thicker) clay and silt strata. Where sand as backfill approaches the ground surface, 2 ft of bentonite will be placed above the sand and below the concrete plug near the surface. Backfill materials will be placed from the bottom of the hole to within 3 ft of the ground surface. These materials will be allowed to settle for 24 hours. The remainder of the hole will be filled with concrete. The surface of the concrete will be mounded, smoothed, and inscribed with “ABD,” for abandoned, any assigned well or boring designation, and the date the hole was abandoned. All boring logs, samples, completion records, and abandonment procedures will be included in the records of work on the site cluster.

If the well is not within 10 ft of another monitoring well, and is not to be replaced by another well within 10 ft of the original location, casing will be pulled, drilled out, or thoroughly pierced. Using tremie pipe, grout will be placed from the bottom of the hole to within 3 ft of the ground surface, and allowed to settle for 24 hours. The remainder of the hole will be filled with concrete. The surface of the concrete will be mounded, smoothed, and inscribed with “ABD,” for abandoned, any assigned well or boring designation, and the date the hole was abandoned. All boring logs, samples, completion records, and abandonment procedures will be included in the records of work on the site cluster.

4. REPLACEMENT WELLS

Replacement wells (if any) will normally be offset at least 10 ft from any abandoned well in a presumed upgradient or crossgradient groundwater direction. Site-specific conditions may necessitate variation to this placement.

5. PRECAUTIONS

None.

This page intentionally left blank

Standard Operating Procedure No. 039
for
Sample Preservation and Container Requirements

Prepared by

EA Engineering, Science, and Technology, Inc., PBC
225 Schilling Circle, Suite 400
Hunt Valley, Maryland 21031

Revision 2
September 2018

This page intentionally left blank

PROJECT-SPECIFIC VARIANCE FORM

This form is to be completed to indicate if there are any client-, project-, or site-specific variances to this Standard Operating Procedure (SOP) (**also check Box A**), or if this SOP is being used with no changes (**only check Box B**).

☐ **A. Variances required; cite section(s) of the SOP to which there is a variance**

☐ **B. No variances**

SOP No. 039	
SOP Section	**Variance**

Project Manager (Name)

Project Manager (Signature) Date

This page intentionally left blank

CONTENTS

DOCUMENT REVISION HISTORY

ORIGINAL (MASTER) DOCUMENT REVISION HISTORY				
Revision Number	**Revision Date**	**Revision Summary**	**Revised By**	**Reviewed By**
2	25 September 2018	Add notes about incremental sampling and minor changes	Daniel Hinckley, Sanita Corum	Matthew Bowman

1. PURPOSE AND SCOPE

The purpose of this Standard Operating Procedure (SOP) is to define the preservatives and techniques to be employed in preserving environmental samples between collection and analysis.

2. MATERIALS

The following materials may be required:

- Containers (Section 3 provides a description)
- Nitric acid
- Sulfuric acid
- Sodium hydroxide
- Ice chests
- Ice.

3. DEFINITION OF CONTAINER TYPES

Listed below are the definitions of various container types.

Type	Container	Closure	Septum
A	80-ounce amber glass, ring handle bottle/jug, 38-millimeter (mm) neck finish	White polypropylene or black phenolic, baked polyethylene cap, 38-430 size, 0.015-mm polytetrafluoroethelyne (PTFE) liner	
B	40-milliliter glass vial, 24-mm neck finish	White polypropylene or black phenolic, open top, screw cap, 15-mm opening, 24-400 size	24-mm disc of 0.005-inch) PTFE bonded to 0.120-inch silicon for total thickness of 0.125 inches
C	1-liter high density polyethylene, cylinder-round bottle, 28-mm neck finish	White polyethylene cap, white ribbed, 28-410 size; F217 polyethylene liner	
D	120-milliliter wide mouth glass vial, 48-mm neck finish	White polyethylene cap, 40-480 size; 0.015-mm PTFE liner	
E	250-milliliter Boston round glass bottle	White polypropylene or black phenolic, open top, screw cap	Disc of 0.005-inch PTFE bonded to 0.120-inch silicon for total thickness of 0.125 inches
F	8-ounce short, wide mouth, straight-sided, flint glass jar, 70-mm neck finish	White polypropylene or black phenolic, baked polyethylene cap, 48-400 size; 0.030-mm PTFE liner	
G	4-ounce tall, wide mouth, straight-sided, flint glass jar, 48-mm neck finish	White polypropylene or black phenolic, baked polyethylene cap, 48-400 size; 0.015-mm PTFE liner	

Type	Container	Closure	Septum
H	1-liter amber, Boston round, glass bottle, 33-mm pour-out neck finish	White polypropylene or black phenolic, baked polyethylene cap, 33-430 size; 0.015-mm PTFE liner	
K	4-liter amber glass ring handle bottle/jug, 38-mm neck finish.	White polypropylene or black phenolic, baked polyethylene cap, 38-430 size; 0.015-mm PTFE liner	
L	500-milliliter high-density polyethylene, cylinder bottle, 28-mm neck finish	White polypropylene, white ribbed, 28-410 size; F217 polyethylene liner	

4. PROCEDURE

All containers described in Section 3 must be certified clean (SOP Number [No.] 031), with copies of laboratory certification furnished upon request. There may be circumstances when alternative containers will be used (e.g., aluminum foil around tissue samples placed in plastic bags, plastic buckets or bags for large soil/sediment samples, etc.) for which laboratory certification may not be available. Such containering should be appropriately decontaminated or verified appropriately clean prior to using.

Water samples will be collected into pre-preserved containers appropriate to the intended analyte as documented in the Quality Assurance Project Plan. Samples taken for volatile organic compounds will be collected in accordance with SOP No. 003, Section 3.3.8. Samples taken for metals analysis will be verified in the field to a pH <2. The container should be tightly capped, then swirled to thoroughly mix the sample. The cap will then be loosened to release any excess pressure that this operation may have generated. Samples taken for total phosphorous content will be verified in the field to a pH <2. The container should be tightly capped and swirled to thoroughly mix the sample. The cap will then be loosened to release any excess pressure that this operation may have generated. Samples taken for cyanide will be verified for a pH >12. Most other samples do not require added preservation; however, there are analytes that may require special preservation, (i.e., sulfide that requires a zinc acetate preservation). Preservation must be performed as documented in the project-specific Quality Assurance Project Plan. These samples will be immediately placed on ice and cooled to 4±2 degrees Celsius (°C).

Soil and sediment samples will be collected into containers appropriate to the intended analyte as documented in the Quality Assurance Project Plan. Samples taken for volatile organic compound analysis will collected in accordance with the site-specific SOP. Samples taken for metals analysis will be tightly capped, placed on ice, and maintained at a temperature of 4°C. Samples taken for total phosphorous content will be tightly capped, placed on ice, and maintained at a temperature of 4°C. Large (1-2 kilograms) soil/sediment samples taken for incremental samples (SOP No. 057) can be placed in pre-cleaned (SOP No. 005) gallon plastic bags or plastic buckets. Under most circumstances, no preservatives will be added to soil or sediment samples; follow project-specific requirements as documented in the Quality Assurance Project Plan. These samples will be immediately placed on ice and cooled to 4±2°C.

5. MAINTENANCE

Not applicable.

6. PRECAUTIONS

Note that acidifying a sample containing cyanide may liberate hydrogen cyanide gas.

- Avoid breathing any fumes emanating from acidified samples.
- Acidify samples only in the open, rather than in closed spaces (i.e., a vehicle).
- Hold suspected hydrogen cyanide-generating sample away from body and downwind while manipulating it.
- See the Health and Safety Plan for other safety measures.

7. REFERENCES

U.S. Environmental Protection Agency (EPA). 1986. Test Methods for Evaluating Solid Waste, SW-846.

———. 1987. A Compendium of Superfund Field Operations Methods, EPA 540-P87-001.

———. 1991. A Compendium of ERT Soil Sampling and Surface Geophysics Procedures.

This page intentionally left blank

Standard Operating Procedure No. 042
for
Disposal of
Investigation-Derived Material

Prepared by

EA Engineering, Science, and Technology, Inc., PBC
225 Schilling Circle, Suite 400
Hunt Valley, Maryland 21031

Revision 1
December 2014

This page intentionally left blank

PROJECT-SPECIFIC VARIANCE FORM

This form is to be completed to indicate if there are any client-, project-, or site-specific variances to this standard operating procedure (SOP) (**also check Box A**), or if this SOP is being used with no changes (**only check Box B**).

☐ **A. Variances required; cite section(s) of the SOP to which there is a variance**

☐ **B. No variances**

SOP No. 042	
SOP Section	**Variance**

Project Manager (Name)

Project Manager (Signature) Date

This page intentionally left blank

CONTENTS

DOCUMENT REVISION HISTORY

ORIGINAL (MASTER) DOCUMENT REVISION HISTORY				
Revision Number	**Revision Date**	**Revision Summary**	**Revised By**	**Reviewed By**

1. SCOPE AND APPLICATION

The purpose of this standard operating procedure is to define the required steps for disposing of investigation-derived material (IDM) generated during field activities.

IDM, as used herein, includes soil cuttings, drilling muds, extraneous sediment, purged groundwater, decontamination fluids, and disposable personal protective equipment. For the sake of clarity and ease in use, this Standard Operating Procedure is subdivided into procedures for disposal of liquid IDM and solid IDM as follows:

- Liquid IDM (Section 3.2) includes the following materials:
    - Water from initial development of new wells and the redevelopment of existing wells
    - Purge water from groundwater sampling
    - Decontamination fluids (Section 3.4)
- Solid IDM (Section 3.3) consists of the following materials:
    - Soil drill cuttings from monitoring well installation
    - Sediment remaining after collection of the required sample volume
    - Grout, a mixture of cement and bentonite, generated during installation of monitoring wells
    - Disposable personal protective equipment (Section 3.4).

2. MATERIALS

The following materials may be required:

- Any additional equipment that may be dictated by project or site-specific plans
- Bar codes
- Chain-of-custody forms
- Department of Transportation 17C specification metal containers
- Hazardous waste labels
- Permanent marker
- Field logbook (bound)
- Waste identification labels

3. PROCEDURE

3.1 GENERAL

No container will be labeled as a "Hazardous Waste" unless the contents are in fact known to be hazardous as defined by 40 Code of Federal Regulation 261.

IDM may be disposed onsite if it is: (1) initially screened, or evaluated to determine whether it is contaminated; (2) not abandoned in an environmentally unsound manner; and (3) not inherently waste-like.

IDM is to be considered contaminated if: (1) it is visually or grossly contaminated; (2) it has activated any field monitoring device that indicates that the level exceeds standard Level 1; (3) it has previously been found to exhibit levels of contamination above environmental quality standards; and (4) the responsible party and/or appropriate regulator deem(s) that records of historical uses indicate that additional testing of the IDM is needed, or additional caution is warranted handling IDM from a given site.

3.2 PROCEDURES FOR LIQUID INVESTIGATION-DERIVED MATERIAL DISPOSAL

Listed below are the procedures for the disposal of liquid IDM:

1. All water from the initial development of new wells, and purge water generated during the first round of groundwater sampling, will be containerized in Department of Transportation approved 55-gallon drums. Decontamination fluids may be bulk-containerized until completion of the field task.

2. Label all containers as to type of media, date the container was sealed, point-of-generation, and points-of-contact. The well number and container number will be identified on the container.

3. The contractor/support personnel will log all media generated onsite into a bound Field Logbook. Media information should include the following: date of generation, contents of containers, number of containers with the same contents (if applicable), location of containers, well number the media is associated with, personnel sampling the media, sampling dates, and sampling results.

4. Containers of well development water and purge water may be stored at the well site pending the first round analytical results.

---

1. This value is defined as two times background, where "background" values are to be determined as follows: (1) regional background values will be used where they are available; and (2) if regional values are not available, background may be empirically determined at uncontaminated sampling sites using onsite sensors such as organic vapor analyzers (photoionization detector or flame ionization detector), scintillometers, etc.

5. Laboratory turnaround time must be no greater than 30 days. Upon receipt of the analytical results, a copy will be furnished to the client within 3 working days. Both the client and contractor will evaluate the data to determine disposal requirements, per state and local regulations. A disposal decision is required within 10 days of receipt of sampling results. Appropriate disposal must be performed no later than 50 days from the decision date unless prevented by inclement weather (e.g., rain and muddy conditions may preclude site access, freezing weather may freeze media).

   Dispose of media in accordance with Steps 6 and 7 of this procedure, as appropriate.

6. If the first round analytical data of the liquid media are below the Maximum Contaminant Levels established by the Federal Safe Drinking Water Act, the water may be gradually infiltrated into the ground at least 50 feet downgradient of the well.

   If the well location has no downgradient area, the water will be infiltrated into the ground in an area deemed appropriate by the client and the contractor/support personnel.

   Disposal locations must allow percolation of the water and prohibit "ponding."

   Upon completion of water discharge to ground, enter type of media, amount of media, date of disposal, and discharge point(s) in a bound Field Logbook and provide this information to the client.

   Empty containers are to be properly decontaminated, stored, and reused by the appropriate personnel.

   If the liquid media sampling results do not meet the required Maximum Contaminant Levels and cannot be discharged to the ground, then determine if the waste meets the sanitary sewer discharge criteria (National Pollutant Discharge Elimination System standards).

7. If, at any time, visual contamination of purge/development water is observed, or if organic vapor monitor readings (HNu, photoionization detector) register more than 5 parts per million above background and/or radiological meters register more than twice the background mrems, then the liquid will be drummed and a composite sample will be taken that day. A disposal decision will be based on the analytical results of this sample rather than the first round of analytical results.

3.3 PROCEDURES FOR SOLID INVESTIGATION-DERIVED MATERIAL DISPOSAL

Listed below are the procedures for the disposal of solid IDM:

1. If the conditions outlined in Section 3.1 are met, proceed to Section 3.3, Step 2; otherwise, proceed to Section 3.3, Step 7.

2. During soil drilling operations or sediment sampling, the resulting cuttings, mud, and/or extraneous sediment will be discharged onto the ground (or waterbody for sediment) near the well (or sample location for sediment) if the following conditions are met: (1) no visual contamination is observed, (2) organic vapors are less than 5 parts per million above background, (3) radiological meter readings (if applicable) are under two times background, and (4) the medium has been screened and found to be less than two times background if the potential for contamination exists.

   Proper sediment and erosion control measures will be implemented as follows:

   - Soil drill cuttings will be uniformly spread and contoured to blend with the surroundings of the site.
   - If amount of solid IDM exceeds 5,000 square feet or 100 cubic yards of material, a sediment and erosion control plan is required.
   - If the amount of solid IDM is under 5,000 square feet or 100 cubic yards, the site will be stabilized as soon as possible. Stabilization includes mulch, seed, and tack.
   - Critical areas require stabilization within 7 days from the date of well completion. Critical areas include swales, water sources, drainage ditches, etc.
   - All other disturbed areas require stabilization within 14 days from the date of well completion.

3. If the well location is in or near a wetland, the soil drill cuttings will be drummed and transported away from the site for spreading.

4. Label all IDM containers that will not be spread on the day of generation. Each container should be labeled with the type of media, date the container was sealed, point-of-generation, and name of the contact person. The well number or sample location and container number should be identified on the container.

5. The contractor/support personnel will log all media generated onsite into a bound Field Logbook. Media information should include: date of generation, contents in containers, number of containers with the same contents, location of containers, and well number or sample location the media is associated with.

6. Containers will be staged at the well site until contractor/support personnel spread the cuttings in the appropriate locations, using proper sediment and erosion control measures per Section 3.3.

7. If soil drilling mud, cuttings, or sediment show visible contamination, or organic vapor readings are more than 5 parts per million above background levels, or radiological meter

readings (if applicable) show greater than two times background levels, or if the potential for contamination exists (levels greater than two times background), media will immediately be containerized, labeled appropriately (Section 3.2), and sampled on the same day.

8. The solid IDM should be sampled and appropriate Toxicity Characteristic Leaching Procedure analyses conducted prior to determining disposition. Laboratory turn-around time must be no greater than 30 days. Upon receipt of analytical results, a copy will be furnished to the client within 3 working days. The contractor will evaluate the data to determine disposal requirements within 10 days. Appropriate disposal must be performed no later than 50 days after the decision date if weather permits (Section 3.2).

   - If the solid IDM is determined to be non-hazardous and uncontaminated, proceed to Section 3.3.

   - If the solid IDM is determined to be non-hazardous but contaminated, proceed to Section 3.3.

   - If the solid IDM is found to be hazardous wastes, proceed to Section 3.3.

9. If the solid IDM is not a hazardous waste **and** analytical data show contaminant concentrations below the U.S. Environmental Protection Agency Region 3 (or applicable Region where work is being performed) Risk-Based Concentrations, contact the appropriate federal, state, or local agency for approval to discharge onto the ground or back to the waterbody near the site of generation.

   - Follow steps detailed in Section 3.3, Step 2 (above) pertaining to sediment and erosion control.

   - Upon completion of the solid IDM discharge to the ground or waterbody (for sediment), enter type of media, amount of media, date of disposal, and discharge point(s) in a bound Field Logbook. This information must be provided to the client.

   - Empty containers are to be properly decontaminated, stored, and reused by appropriate personnel.

10. If the intrusive media is not a hazardous waste but analytical data show concentrations above the screening criteria, dispose of the IDM according to state and local regulations.

   - Ensure that the waste containers are properly labeled as applicable in accordance with Section 3.3, Step 4.

   - Inform the client of the type and amount of waste, and location of the waste.

- When the waste is removed, enter the type of waste, amount of waste, date of pickup, and destination of the waste in a bound Field Logbook. This information must be provided to the client.

3.4 PROCEDURES FOR DECONTAMINATION SOLUTION AND PERSONAL PROTECTIVE EQUIPMENT DISPOSAL

Decontamination solutions include catch water from steam-cleaning operations performed on large sampling equipment, drill rigs, and drums, as well as smaller quantities of soapy water and rinse solutions used in decontaminating field sampling equipment. At the completion of the field event, a composite sample of the decontamination solution will be taken. The decontamination solution will be treated as liquid IDM pending results (Section 3.2).

Personal protective equipment will be containerized onsite, appropriately labeled, and disposed in a designated trash receptacle.

4. MAINTENANCE

The waste manifest document and bill of lading should be uploaded to the project file as soon as possible in either hard copy or electronic format. Refer to EA's Records Retention Policy for archiving information.

5. REFERENCES

Environment Article Section 7-201(t).

U.S. Environmental Protection Agency. 1991. Management of Investigation-Derived Wastes during Site Inspections PB91-921331, OERR Directive 9345.3-02. Office of Emergency and Remedial Response U.S. Environmental Protection Agency, Washington, D.C. May.

Standard Operating Procedure No. 043 for Multi-Probe Water Quality Monitoring Instruments

Prepared by

EA Engineering, Science, and Technology, Inc., PBC
225 Schilling Circle, Suite 400
Hunt Valley, Maryland 21031

Revision No. 2
June 2020

This page intentionally left blank

PROJECT-SPECIFIC VARIANCE FORM

This form is to be completed to indicate if there are any client-, project-, or site-specific variances to this Standard Operating Procedure (SOP) (**also check Box A**), or if this SOP is being used with no changes (**only check Box B**).

☐ **A. Variances required; cite section(s) of the SOP to which there is a variance**

☐ **B. No variances**

SOP No. 043	
SOP Section	**Variance**

Project Manager (Name)

Project Manager (Signature) Date

This page intentionally left blank

CONTENTS

DOCUMENT REVISION HISTORY

ORIGINAL (MASTER) DOCUMENT REVISION HISTORY				
Revision Number	**Revision Date**	**Revision Summary**	**Revised By**	**Reviewed By**
2	June 2020	Systematic review and update. Combined with previously separate SOPs for pH, temperature, specific conductivity, turbidity, dissolved oxygen, and redox potential.	Eddie Meadows Catherine Maxwell	Matthew Bowman

1. PURPOSE AND SCOPE

The purpose of this Standard Operating Procedure (SOP) is to delineate protocols for field operation of multi-probe water quality instruments. The instrument can monitor a variety of basic parameters including dissolved oxygen, percent saturation, temperature, pH, conductivity, specific conductivity, resistivity, salinity, total dissolved solids, turbidity, oxidation reduction potential (ORP), level, and depth.

The use of brand names in this SOP is not intended as endorsement or mandate that a given brand be used. Alternate equivalent brands of detectors, sensors, meters, etc. are acceptable. If alternate equipment is to be used, the vendor must provide applicable and comparable SOPs for the maintenance and calibration from the specific manufacturer of the instrument being used.

2. MATERIALS

The following materials may be required:

- Multi-probe instrument
- Probe/sonde with appropriate cables
- Appropriate standards/calibration fluids
- Accessories (batteries, charger, case, etc.)
- Decontamination materials or laboratory wipes
- Deionized water and distilled water (as needed for calibration and decontamination)
- Instrument logbook
- Manufacturer’s Operations Manual.

3. CALIBRATION PROCEDURE

Calibration must be performed or verified daily at a minimum before using the instrument. Calibration may be performed in the laboratory or in the field. Detailed step-by-step calibration procedures for the equipment described below are provided in the most recent version of the manufacturer’s Operations Manual. Documentation includes at a minimum: time, date, analyst, standard, primary standard/calibration fluid lot number, secondary standard/calibration fluid lot number, and expiration dates of standards/calibration fluids. An example calibration log is provided in Attachment A.

Fill the calibration cup with the appropriate standard as follows:

• Temperature:	None required
• Specific Conductance:	Conductivity standards
• pH:	pH 7 buffer plus pH 4 and/or pH 10 buffer
• Dissolved Oxygen:	Saturated air or saturated water
• ORP:	Quinhydrone (Zobell’s Solution) or other standard

- Turbidity: Nephelometric turbidity unit (NTU) standards
- Salinity: Calibration for specific conductance
- Depth/Level: Set zero in air.

3.1 CONDUCTIVITY CALIBRATION

Conductivity meters are calibrated at least once per day to at least one standard. The standard should be selected in accordance with the range expected to be measured (e.g., 1.0 microSiemans per centimeter [µS/cm]) standard should not be used to calibrate meters being used in saltwater). See manufacturer's recommendations in the Operations Manual for additional information on calibration standard selection. Calibration information is recorded in conjunction with the data collected for that sampling event.

3.2 PH CALIBRATION

The pH meters are calibrated at least once per day to a minimum of two standard buffers (pH 4 and 7, or pH 7 and 10) in accordance with the range expected to be measured. The calibration is verified using a fresh solution of pH 7 buffer post-calibration. The probe should be rinsed in distilled water between standards. Calibration information is recorded in conjunction with the data collected for that sampling event.

3.3 DISSOLVED OXYGEN CALIBRATION

Dissolved oxygen meters are saturated-air or saturated-water calibrated at least once per day. Each method requires the true barometric pressure to be input or collected from the instrument prior to calibration.

- ***Saturated Air Method***—Dip the calibration chamber (i.e., probe storage cup) into distilled or tap water at ambient temperature, pour out excess water, and then insert dissolved oxygen probe into the wet chamber. This ensures that the air inside the chamber is saturated with water vapor. CAUTION: Be sure that the membrane/probe has no droplets of water adhering to it since this would reduce the rate of oxygen diffusion through the membrane and would produce erroneous results. Do not fully thread the probe storage cup on the probe during equilibration.

- ***Saturated Water Method***—To make a 100 percent (%) air-saturated calibration standard, fill a container (e.g., a 1-liter or 1-gallon container with a closed top) three-quarters full with distilled water or clean (conductivity of less than 500 µS/cm) tap water. Let the water temperature reach equilibrium with the calibration environment. Then shake the container vigorously for approximately 30 seconds. This makes 100% air-saturated water. Place the air-saturated water into the probe storage cup and allow to equilibrate. Do not fully thread the probe storage cup on the probe during equilibration.

Calibration information is recorded in conjunction with the data collected for that sampling event.

3.4 OXIDATION REDUCTION POTENTIAL CALIBRATION

ORP meters are calibrated at least once per day to at least one standard. It is recommended that Zobell's Solution is used; however, another solution can be used as long as it meets the manufacturer's specifications for calibration. Note that the standard value for Zobell's Solution is dependent on temperature. Calibration information is recorded in conjunction with the data collected for that sampling event.

3.5 TURBIDITY CALIBRATION

The turbidity meters are calibrated at least once per day to a minimum of two standards (0 NTU and 100 or 200 NTUs recommended) in accordance with the range expected to be measured. Calibration information is recorded in conjunction with the data collected for that sampling event.

3.6 DEPTH/LEVEL CALIBRATION

The depth and level calibration is performed with the depth sensor module in the air and not immersed in any solution. The appropriate correction for height above the water surface is inputted into the meter. Calibration information is recorded in conjunction with the data collected for that sampling event.

3.7 ADDITIONAL CALIBRATIONS

Additional measurements may be taken with the multi-probe water quality instruments. For any of these measurements, the calibration procedures will be conducted in accordance with the manufacturer's specifications. Calibration information is recorded in conjunction with the data collected for that sampling event.

4. FIELD OPERATION

4.1 SETUP OF MULTI-PROBE WATER QUALITY INSTRUMENT

Post-calibration and prior to sampling, the multi-probe water quality instrument should be inspected, cleaned, and set up for data collection. If the cables have been unattached, they will be reconnected to the transmitter (if applicable) and the display. Once all cables are attached, the meter will be turned on and allowed to warm up for a few seconds in order to allow the display screen to load. The unit should be allowed to come to ambient air temperature if it has been stored in a hotter or colder environment prior to use.

4.2 SURFACE WATER

Prior to sampling, check the condition of the probes before each deployment. When sampling in surface water, the sensor must be in an amount of water sufficient for all probes to be submerged. Data values displayed on the display screen are recorded in a field logbook, a dedicated project field form (i.e., an EA Purging and Sampling Record, or on an EA-provided iPad on an approved GoFormz), and accepted into the instrument's data logger (if used). Post-data collection, the sensor will be retrieved and rinsed for use at the next sample location. If travel time between sample locations is significant, the display is to be turned off. When all sampling is completed, disconnect all equipment, clean probes and the instrument in accordance with the manufacturer's instructions, attach a solid protective cap, and return it to its proper storage location.

4.3 GROUNDWATER

Prior to sampling, check the condition of the probes before each deployment. When sampling groundwater, mount sampler on a flow-through cell. Start sampler pump and allow pump/hose system to be purged of air bubbles. Required parameters should be recorded every 3-5 minutes (unless otherwise specified in the sampling plan). Record the monitored values in the appropriate field logbook, on a dedicated project field form (i.e., an EA Purging and Sampling Record, or on an EA provided iPad on an approved GoFormz) to ensure against inadvertent data loss. If travel time between sample locations is significant, the display is to be turned off. When all sampling is completed, disconnect all equipment, clean probes and the instrument in accordance with the manufacturer's instruction, remove flow-through cell and attach solid protective cap, and return it to its proper storage location. If a flow-through cell cannot be used (e.g., groundwater sampling using a bailer), bailed water should be poured into a clean container for collecting readings over standard intervals of volume purged or time.

5. MAINTENANCE

All maintenance should be performed in accordance with the manufacturer's Operations Manual.

6. PRECAUTIONS

Check the condition of the probes frequently between sampling. Do not force pins into connections; note keying sequence. If field readings are outside the expected range, check for bubbles on, or damage to, the probes. If there are no bubbles or damage, recalibrate the sensor.

7. REFERENCES

Not applicable.

Attachment A

Equipment Calibration Log

This page intentionally left blank

ATTACHMENT A

EQUIPMENT CALIBRATION LOG

Site Name:		**Client:**		
Job Number:		**Calibration Performed by:**		Page ______ of ______

Date and Time	Instrument Name	Instrument Make and Model	Instrument Serial Number	Standard Value	Calibrated Value	Percent Deviation	Bump Check (if applicable)	Standard/ Calibration Fluid Lot Number and Expiration Date	Comments or Adjustments Made

This page intentionally left blank

Standard Operating Procedure No. 048
for
Low-Flow Sampling

Prepared by

EA Engineering, Science, and Technology, Inc., PBC
225 Schilling Circle, Suite 400
Hunt Valley, Maryland 21031

Revision 0
December 2014

This page intentionally left blank

PROJECT-SPECIFIC VARIANCE FORM

This form is to be completed to indicate if there are any client-, project-, or site-specific variances to this standard operating procedure (SOP) (**also check Box A**), or if this SOP is being used with no changes (**only check Box B**).

☐ **A. Variances required; cite section(s) of the SOP to which there is a variance**

☑ **B. No variances**

SOP No. 048	
SOP Section	**Variance**

Project Manager (Name)

Project Manager (Signature) Date

This page intentionally left blank

CONTENTS

DOCUMENT REVISION HISTORY

ORIGINAL (MASTER) DOCUMENT REVISION HISTORY				
Revision Number	Revision Date	Revision Summary	Revised By	Reviewed By

1. GROUNDWATER SAMPLING BY LOW-FLOW PURGE AND SAMPLING METHOD USING DEDICATED PUMPS

1.1 SCOPE OF APPLICATION

The purpose of this standard operating procedure (SOP) is to establish the protocol for collecting groundwater samples using dedicated pump systems. The procedure is designed to permit the collection of groundwater samples with minimum turbidity.

1.2 EQUIPMENT/MATERIALS

- Work Plan.
- Well construction data, location map, and field data from last sampling event.
- Field logbook and Field Record of Well Gauging, Purging, and Sampling forms (Figure SOP048-1).
- Electric water level measuring device, 0.01 ft accuracy for monitoring water level during pumping operations.
- Pumps: adjustable rate, submersible pumps constructed of stainless steel and Teflon®.
- Tubing: Teflon or Teflon-lined polyethylene must be used to collect samples for organic analysis. For samples collected for inorganics analysis, Teflon or Teflon-lined polyethylene tubing will be used.
- Flow measurement supplies (e.g., graduated cylinder and stop watch).
- Power source (generator, etc.).
- Water quality indicator parameter monitoring instruments—pH, turbidity, specific conductance, and temperature. Optional indicators—Eh and dissolved oxygen.
- Flow-through cell (preferred) or clean container for water quality probes.
- Decontamination supplies (for monitoring instrumentation).
- Sample bottles and sample preservation supplies (as required by the analytical methods).
- Sample tags or labels.
- Cooler with bagged ice for sample bottles.
- Drum for purge water containment.

1.3 PRELIMINARY SITE ACTIVITIES

The following site activities are required prior to performing well purging and groundwater sampling. Field logbooks and sampling forms should be filled out as the procedure is being performed, as noted:

- Enter the following information in the field logbook and sampling form, as appropriate: site name, project number, field personnel, well identification, weather conditions, date and time, equipment used, and quality assurance/quality control data for field instrumentation.

- Check well for damage or evidence of tampering, record pertinent observations in field logbook and sampling form.

- Lay out sheet of polyethylene for monitoring and sampling equipment.

- Unlock well and remove well cap (if applicable).

- Measure VOCs with an ionization detector (flame or photo) instrument at the rim of the well and in the breathing zone, and record the readings in the field logbook and the sampling form.

- Measure and record the height of protective casing above the concrete pad or ground surface, as appropriate. This reading is compared to that recorded during well installation as an indication of possible well damage or settling that may have occurred.

- Dedicated sampling pumps should be positioned with the pump intake mid-point in the screened interval. If non-dedicated equipment is used, care will be taken to position pump or sampling hose intake at the screen mid-point.

- Measure and record the depth to water (to 0.01 ft) in the well to be sampled before purging begins. If the well casing does not have a reference point (usually a v-cut or indelible mark in the well casing), make one. If a reference point is made, it will be noted in the field logbook. Care should be taken to minimize disturbance of any particulate attached to the sides or at the bottom of the well. The depth to well bottom will be measured following the completion of sampling because of the potential to stir up sediment at the bottom of the well.

- Prepare the pump by checking electrical connections, discharge tubing, and motor (Grundfos Redi-Flo2). Locate the generator (if applicable) downwind of the well; connect the power converter to the generator and to the pump.

1.4 WELL PURGING AND SAMPLING PROCEDURE

The following general procedure should be followed to obtain representative groundwater samples. Field logbooks and sampling forms should be filled out as the procedure is being performed, as noted:

- Enter the following information in the field logbook and sampling form, as appropriate, prior to purging: purge date and time, purge method, and total well depth.

- Connect the flow-through cell or clean container containing the instrumentation header to the pump discharge and begin purging the well at 0.2-0.5 L/min, unless a different purge rate has been previously established for that well. Fill the flow cell completely. Care should be taken not to cause entrapment of air in the system. Record the purge start time and purge rate.

- Establish that the water level has not dropped significantly such that the pump is dry (bubbles in discharge) or water is heard cascading down the inside of the well. Ideally, the pump rate should cause little or no water level drawdown in the well (>0.5 ft and the water level should stabilize). The water level should be monitored every 3-5 minutes (or as appropriate) during pumping. Record pumping rate adjustments and depths to water. Pumping rates should, if needed, be reduced to the minimum capabilities of the pump (e.g., 0.1-0.2 L/min) to avoid pumping the well dry and/or to ensure stabilization of indicator parameters. If water levels continue to drop with the pump on the lowest flow rate, the pump will be shut off and the well will be allowed to recharge to prevent the well from going dry. **The well will not be purged to dryness prior to sampling to prevent erroneous field parameters and groundwater samples.** Sampling will commence as soon as the well has recharged to a sufficient level to collect the appropriate volume of samples with the pump.

- During purging of the well, monitor the water quality indicator parameters (turbidity, temperature, specific conductance, pH, etc.) every 3-5 minutes (or as appropriate). Record purge rate, volume purged, depth to water, water quality indicator parameters values, and clock time at 3- to 5-minute intervals in field logbook and sampling record. Purging of the standing well water is considered complete when three consecutive readings of the water quality indicator parameters agree within approximately 10 percent. Turbidity readings consistently below 10 nephelometric turbidity units (NTU) are considered to represent stabilization of discharge water for this parameter. If the parameters have stabilized, but the turbidity is not in the range of the 10 NTU goal, the pump flow rate should be decreased and measurement of the parameters should continue every 3-5 minutes.

- Purge water at a well will be containerized if a well has exceeded the MEG or MCL in previous sampling events. Any purge water that is collected will be treated at the groundwater treatment plant.

- Prior to sampling, disconnect the discharge tubing from the flow-through cell. If the water discharged by the pump is silty, wait for the water to clear before sampling. Ensure that bubbles are not observed in the discharge tubing. Record pertinent observations in field logbook and sampling records.

- Begin filling sample containers by allowing the pump discharge to flow gently down the inside of the container with as little agitation or aeration as possible. Collect the samples in the order below, as applicable:

  — VOCs
  — Inorganics.

- VOC samples requiring pH adjustment will have their pH checked to assure that the proper pH has been obtained. This will require that a test sample be collected to determine the amount of preservative that needs to be added to the sample containers prior to sampling. Details on sample preservation are discussed in Section 1.5.

- Label each sample as collected. Those samples (VOCs, etc.) requiring cooling will be placed into an ice cooler for delivery to the laboratory. Inorganic samples, after preservation, do not need to be cooled.

- After collection of the samples, restore the dedicated pumping assembly to the well by hanging the tube, electric line, and support cable inside the well by the specially-designed PVC well cap assembly. Lock well.

- Complete remaining portions of Field Record of Well Gauging, Purging, and Sampling form (Figure SOP048-1) after each well is sampled, including sample date and time, total quantity of water removed, well sampling sequence, types of sample bottles used, sample identification numbers, preservatives used, parameters requested for analysis, and field observations of sampling event.

1.5 SAMPLE PRESERVATION

The following preservation procedures are examples of typical preservation protocols specific to the indicated analyses. Pre-preserved bottles will be used if possible. Minimum sample preservation requirements for each parameter group are summarized below:

- **VOCs—**Aqueous VOC samples must be collected as specified below. Each VOC sample is taken in duplicate:

  — Uncap the sample bottle, taking care not to touch the Teflon-faced septum. If the septum is contaminated in any way, it should be replaced.

  — Fill a sample bottle, preserve with HC1, and check the pH. Adjust the volume of HC1 to assure pH<2.

- — Add the amount of HC1 determined in the above step, and fill the sample vial slowly from the tubing, minimizing air entrainment, until the vial slightly overflows.

- — Place the Teflon-faced silicon rubber septum on the convex meniscus, Teflon side (shiny side) down and screw cap on.

- — Invert the bottle, tap lightly, and check for air bubbles.

- — If air bubbles are present, open the bottle, add sample to eliminate air bubbles, and reseal. Repeat this procedure until the bottle is filled and no air bubbles are detected.

- — Place samples on ice until shipment.

- **Inorganics**—Fill the sample bottle, preserve the sample to pH<2 with nitric acid (HNO_3), seal container, and place sample on ice for shipment.

Disposable pipettes should be used to introduce chemicals into the samples if necessary. Chemicals used for preserving should be poured into a 150-ml beaker. They should not be drawn directly from the preservative bottles because the bottle may become contaminated. Measurements for pH and temperature should not be taken from the sample containers. When preserving samples to a required pH, pH paper should be used to check the resultant pH. The sample should be poured across the pH paper. Never place pH paper directly into sample.

NOTE: Shipping regulations limit the amount of preservative which can be added. For a 1-L sample, this is generally 1.5 ml of acid preservative.

1.6 FIELD QUALITY CONTROL

Quality control samples are required to verify that the sample collection and handling process has not affected the quality of the groundwater samples. All field quality control samples must be prepared exactly as regular investigation samples with regard to sample volume, containers, and preservation. The following quality control samples will be collected for each sample delivery group (SDG) (an SDG may not exceed 20 samples) at the frequency noted:

- Field Duplicate—Required at a frequency of 10 percent per SDG.

- Matrix Spike/Matrix Spike Duplicate—Required at a frequency of 5 percent.

- Equipment Rinsate Blank—Required once prior to installation of dedicated pump systems.

- Source Water Blank—Required at a frequency of once per source per sampling event when equipment (rinsate) blank is required.

- Trip Blank—Required for VOC samples at a frequency of one per sample shipment.

1.7 DECONTAMINATION

Non-dedicated sampling equipment and field monitoring equipment will be decontaminated prior to use and following sampling of each well. This equipment will be decontaminated by the procedure listed below. Alternative procedures must be approved by the Project Manager prior to sampling event. Decontamination fluids will be collected in a 5-gal bucket and treated at the groundwater treatment plant.

The following decontamination procedure will be used:

- Flush the equipment with potable water
- Flush with non-phosphate detergent solution
- Flush with tap water to remove all of the detergent solution
- Flush with distilled/deionized water
- Flush with isopropyl alcohol
- Flush with distilled/deionized water.

It is recommended that the detergent and isopropyl alcohol used in the above sequence be used sparingly.

2. GROUNDWATER SAMPLING BY LOW-FLOW PURGE AND SAMPLING METHOD USING PERISTALTIC PUMPS

2.1 SCOPE OF APPLICATION

The purpose of this SOP is to establish the protocol for collecting groundwater samples using peristaltic pump systems. The procedure is designed to permit the collection of groundwater samples with minimum turbidity, and is intended to be used in conjunction with the analyses for the most common types of groundwater contaminants (VOCs and inorganic compounds).

2.2 EQUIPMENT/MATERIALS

- Work Plan.

- Well construction data, location map, field data from last sampling event.

- Field logbook and Field Record of Well Gauging, Purging, and Sampling forms (Figure SOP048-1).

- Water level measuring device, 0.01 ft accuracy (electronic preferred) for monitoring water level drawdown during pumping operations.

- Peristaltic pump.

- In-well tubing: Teflon or Teflon-lined polyethylene must be used to collect samples for organic analysis. For samples collected for inorganics analysis, Teflon or Teflon-lined polyethylene, PVC, Tygon, or polyethylene tubing may be used.

- Pump head tubing: Silicon tubing must be used to in the pump head assembly.

- Flow measurement supplies (e.g., graduated cylinder and stop watch).

- Power source (battery, etc.).

- Water quality indicator parameter monitoring instruments – pH, turbidity, specific conductance, and temperature. Optional indicators – Eh and dissolved oxygen.

- Flow-through cell (preferred) or clean container for water quality probe.

- Decontamination supplies (for monitoring instrumentation).

- Sample bottles and sample preservation supplies (as required by the analytical methods).

- Sample tags or labels.

- Cooler with bagged ice for sample bottles.

- Drum for purge water containment.

2.3 PRELIMINARY SITE ACTIVITIES

The following site activities are required prior to performing well purging and groundwater sampling. Field logbooks and sampling forms should be filled out as the procedure is being performed, as noted:

- Enter the following information in the field logbook and sampling form, as appropriate: site name, project number, field personnel, well identification, weather conditions, date and time, equipment used, and quality assurance/quality control data for field instrumentation.

- Check well for damage or evidence of tampering, record pertinent observations in field logbook and sampling form.

- Unlock well and remove well cap (if applicable).

- Measure VOCs with an ionization detector (photo or flame) instrument at the rim of the well and in the breathing zone and record the readings in the field logbook and the sampling form.

- Measure and record the height of protective casing above the concrete pad, or ground surface, as appropriate. This reading is compared to that recorded during well installation as an indication of possible well damage or settling that may have occurred.

- Measure and record the depth to water (to 0.01 ft) in the well to be sampled before purging begins. If the well casing does not have a reference point (usually a v-cut or indelible mark in the well casing), make one. If a reference point is made, it will be noted in the field logbook. Care should be taken to minimize disturbance of any particulate attached to the sides or at the bottom of the well. The depth to well bottom will not be measured following the completion of sampling because of the potential to stir up sediment at the bottom of the well.

- Position the intake of the sampling hose at the mid-point of the screened interval.

- Prepare the pump by checking electrical connections and discharge tubing. Locate the battery downwind of the well; connect the peristaltic pump to the battery.

2.4 WELL PURGING AND SAMPLING PROCEDURES

The following general procedure should be followed to obtain representative groundwater samples. Field logbooks and sampling forms should be filled out as the procedure is being performed, as noted:

- Enter the following information in the field logbook and sampling form, as appropriate, prior to purging: purge date and time, purge method, and total well depth.

- Measure the water level with the pump in well before starting the pump. Begin purging the well at 0.3-0.5 L/min, unless a different purge rate has been previously established for that well.

- If well diameter permits, establish that the water level has not dropped significantly such that the pump is dry (air in discharge) or tubing suction is broken. Ideally, the pump rate should cause little or no water level drawdown in the well (>0.5 ft and the water level should stabilize). The water level should be monitored every 3-5 minutes (or as appropriate) during pumping. Care should be taken not to cause pump suction to be broken, or entrainment of air in the pump system. Record pumping rate adjustments and depths to water. Pumping rates should, if needed, be reduced to the minimum capabilities of the pump (e.g., 0.3 L/min) to avoid pumping the well dry and/or to ensure stabilization of indicator parameters. If water levels continue to drop with the pump on the lowest flow rate, the pump will be shut off and the well will be allowed to recharge to prevent the well from going dry. **The well will not be purged to dryness prior to sampling to prevent erroneous field parameters and groundwater samples.** Sampling will commence as soon as the well has recharged to a sufficient level to collected the appropriate volume of samples with the pump.

- During purging of the well, monitor the field indicator parameters (turbidity, temperature, specific conductance, pH, etc.) every 3-5 minutes (or as appropriate). Purging of the standing well water is considered complete when three consecutive readings of the water quality indicator parameters agree within approximately 10 percent. Turbidity readings consistently below 10 NTU are considered to represent stabilization of discharge water for this parameter. If the parameters have stabilized, but the turbidity is not in the range of the 10 NTU goal, the pump flow rate should be decreased and measurement of the parameters should continue every 3-5 minutes.

- Purge water at a well will be containerized if a well has exceeded the MEG or MCL in previous sampling events. Any purge water that is collected will be treated at the groundwater treatment plant.

- Prior to sampling, disconnect the sample discharge tubing from the flow-through cell. If the water discharged by the pump is silty, wait for the water to clear before sampling. Ensure that bubbles are not observed in the discharge tubing.

- Collect groundwater samples directly from the silicon tubing into preserved (when appropriate) sample containers. Begin filling sample containers from the pump discharge, allowing the water to fill the containers by allowing the pump discharge to flow gently down the inside of the container with as little agitation or aeration as possible. Collect the samples in the order below, as applicable:

  — VOCs
  — Inorganics.

- VOC samples requiring pH adjustment will have their pH checked to assure that the proper pH has been obtained. This will require that a test sample be collected to determine the amount of preservative that needs to be added to the sample containers prior to sampling. Detail on sample preservation are discussed in Section 2.5.

- Label each sample as collected. Those samples (VOCs, etc.) requiring cooling will be placed into an ice cooler for delivery to the laboratory. Inorganic samples, after preservation, do not need to be cooled.

- After collection of the samples, restore the dedicated tubing assembly to the well by hanging the tube inside the well by the specially-designed PVC well cap assembly. Lock well.

- Complete remaining portions of Field Record of Well Gauging, Purging, and Sampling form (Figure SOP048-1) after each well is sampled, including: sample date and time, total quantity of water removed, well sampling sequence, types of sample bottles used, sample identification numbers, preservatives used, parameters requested for analysis, and field observations of sampling event.

- The silicon tubing used in the peristaltic pump will be changed after use at each well.

2.5 SAMPLE PRESERVATION

The following preservation procedures are examples of typical preservation protocols specific to the indicated analyses. Pre-preserved bottles will be used if possible. Minimum sample preservation requirements for each parameter group are summarized below:

- **VOCs**—Aqueous VOC samples must be collected as specified below. Each VOC sample is taken in duplicate:

  — Uncap the sample bottle, taking care not to touch the Teflon-faced septum. If the septum is contaminated in any way, it should be replaced.

  — Fill a sample bottle, preserve with HCL, and check the pH. Adjust the volume of HCL to assure pH<2.

  — Add the amount of HCL determined in the above step, and fill the sample vial slowly from the tubing, minimizing air entrainment, until the vial slightly overflows.

  — Place the Teflon-faced silicon rubber septum on the convex meniscus, Teflon side (shiny side) down, and screw cap on.

  — Invert the bottle, tap lightly, and check for air bubbles.

  — If air bubbles are present, open the bottle, add sample to eliminate air bubbles, and reseal. Repeat this procedure until the bottle is filled and no air bubbles are detected.

  — Place samples on ice until shipment.

- **Inorganics**—Fill the sample bottle, preserve the sample to pH<2 with nitric acid (HNO_3), seal container, and place sample on ice for shipment.

Disposable pipettes should be used to introduce chemicals into the samples if necessary. Chemicals used for preserving should be poured into a 150-ml beaker. They should not be drawn directly from the preservative bottles because the bottle may become contaminated. Measurements for pH and temperature should not be taken from the sample containers. When preserving samples to a required pH, pH paper should be used to check the resultant pH. The sample should be poured across the pH paper. Never place pH paper directly into sample.

NOTE: Shipping regulations limit the amount of preservative that can be added. For a 1-L sample, this is generally 1.5 ml of acid preservative.

2.6 FIELD QUALITY CONTROL

Quality control samples are required to verify that the sample collection and handling process has not affected the quality of the groundwater samples. All field quality control samples must be prepared exactly as regular investigation samples with regard to sample volume, containers, and preservation. The following quality control samples will be collected for each SDG (an SDG may not exceed 20 samples) at the frequency noted:

- Field Duplicate—Required at a frequency of 10 percent per SDG
- Matrix Spike/Matrix Spike Duplicate—Required at a frequency of 5 percent
- Equipment (Rinsate) Blank—Required once prior to installation of dedicated sample tubing
- Source Water Blank—Required at a frequency of one per source per sampling event
- Trip Blank—Required for VOC samples at a frequency of one per sample shipment.
- Temperature Blank—Required at a frequency of once per sample shipment container.

2.7 DECONTAMINATION

Non-dedicated sampling and field monitoring equipment will be decontaminated prior to use and following sampling of each well. This equipment will be decontaminated by the procedure listed below. Alternate procedures must be approved by the Project Manager prior to the sampling event. Decontamination fluids will be collected in a 5-gal bucket and treated at the groundwater treatment plant.

The following decontamination procedure will be used:

- Flush the equipment with potable water
- Flush with non-phosphate detergent solution
- Flush with tap water to remove all of the detergent solution
- Flush with distilled/deionized water
- Flush with isopropyl alcohol
- Flush with distilled/deionized water.

It is recommended that the detergent and isopropyl alcohol used in the above sequence be used sparingly.

3. SURFACE WATER AND LEACHATE SEEP SAMPLING PROCEDURE

3.1 SCOPE OF APPLICATION

The purpose of this SOP is to establish the protocol for collecting surface water and leachate seep samples. The procedure is designed to permit the collection of representative surface water and leachate seep samples, and has been adapted from the procedure outlined in the Work Plan. This SOP is suitable for collecting surface water and seep samples requiring analyses for the most common types of surface water contaminants (VOCs and inorganic compounds).

3.2 EQUIPMENT/MATERIALS

- Work Plan.
- Location map, field data from last sampling event.
- Field logbook and Field Record of Surface Water and Sediment Sampling forms (Figure SOP048-2).
- Water quality indicator parameter monitoring instruments – pH, turbidity, specific conductance, and temperature. Optional indicators – Eh and dissolved oxygen.
- Decontamination supplies (for monitoring instrumentation).
- Dedicated, pre-cleaned 1-L wide-mouth or volatile organic analyte sample container (for sample collection).
- Sample bottles and sample preservation supplies (as required by the analytical methods).
- Sample tags or labels.
- Cooler with bagged ice for sample bottles.

3.3 PRELIMINARY SITE ACTIVITIES

The following site activities are required prior to performing surface water or leachate seep sampling. Field logbooks and sampling forms should be filled out as the procedure is being performed, as noted:

- Enter the following information in the field logbook and sampling form, as appropriate: site name, project number, field personnel, sample station identification, weather conditions, date and time, equipment used, and quality assurance/quality control data for field instrumentation.

- Visually inspect sample station for evidence of changes in physical condition; record pertinent observations in field logbook and sampling form.

- Measure VOCs with a flame ionization detector instrument in the breathing zone and record the reading in the field logbook and sampling form.

3.4 SAMPLING PROCEDURE

The technique for surface water and leachate seep sampling must be selected after addressing such items as:

- Depth of waterbody
- Depth of sample
- Stratification
- Seasonal variations
- Analytical parameters of interest.

The following general procedure should be used to obtain representative surface water and leachate seep samples. Field logbooks and sampling forms should be filled out as the procedure is being performed, as noted:

- Enter the following information in the field logbook and sampling form, as appropriate, prior to sampling: date and time, sample method, and sample depth.

- Collect the sample from the surface water, within several tenths of a foot of the streambed, by immersing a new, dedicated 1-L glass or volatile organic analyte sample container into the waterbody. If a stream is being sampled, collect the sample upstream of the sampler with the opening of the sampling device oriented upstream but avoiding floating debris.

- Directly fill the appropriate sample containers from the 1-L or volatile organic analyte sampling device.

- Collect the samples in the order below, as applicable:

  — VOCs
  — Inorganics.

- Water sample containers are generally filled directly from the source or sampler without special considerations. The exception is the collection of aqueous VOC samples requiring pH adjustment. VOC samples will have their pH checked to assure that the proper pH has been obtained. This will require that a test sample be collected to determine the amount of preservative that needs to be added to the sample containers prior to sampling. Details on sample preservation methods are discussed in Section 3.6.

- Label each sample as collected. Those samples (VOCs, etc.) requiring cooling will be placed into an ice cooler for delivery to the laboratory. Inorganic samples, after preservation, do not need to be cooled.

- Measure water quality indicator parameters, if possible, by direct immersion of instrument probes into the waterbody immediately following sample collection. If direct measurement is not possible, measure these parameters from water remaining in the sampling device or another sample bottle. Record this information in the field logbook and sample data record.

- Complete remaining portions of the Field Record of Surface Water and Sediment Sampling form (Figure SOP048-2) after each station is sampled, including: time of sample collection, types of sample bottles used, sample identification numbers, preservatives used, parameters requested for analysis, and field observations of sampling event.

3.5 SAMPLE PRESERVATION

The following preservation procedures are examples of typical preservation protocols specific to the indicated analyses. Minimum sample preservation requirements for each parameter group are summarized below:

- **VOCs**—Aqueous VOC samples must be collected as specified below. Each sample is taken in duplicate:

  — Uncap the sample bottle, taking care not to touch the Teflon-faced septum. If the septum is contaminated in any way, it should be replaced.

  — Fill a sample bottle, preserve with HC1, and check the pH. Adjust the volume of HC1 to assure pH<2.

  — Add the amount of HC1 determined in the above step, and fill the sample vial slowly from the 1-L container, minimizing air entrainment, until the vial slightly overflows.

  — Place the Teflon-faced silicon rubber septum on the convex meniscus, Teflon side (shiny side) down and screw cap on.

  — Invert the bottle, tap lightly, and check for air bubbles.

  — If air bubbles are present, open the bottle, add sample to eliminate air bubbles, and reseal. Repeat this procedure until the bottle is filled and no air bubbles are detected.

  — Place samples on ice until shipment.

- **Inorganics**—Fill the sample bottle, preserve the sample to pH<2 with nitric acid (HNO_3), seal container, and place sample on ice for shipment.

Disposable pipettes should be used to introduce chemicals into the samples. Chemicals used for preserving should be poured into a 150-ml beaker. They should not be drawn directly from the preservative bottles because the bottle may become contaminated. Measurements for pH and temperature should not be taken from the sample containers. When preserving samples to a required pH, pH paper should be used to check the resultant pH. The sample should be poured across the pH paper. Never place pH paper directly into sample.

NOTE: Shipping regulations limit the amount of preservative which can be added. For a 1-L sample, this is generally 1.5 ml of acid preservative.

3.6 FIELD QUALITY CONTROL

Quality control samples are required to verify that the sample collection and handling process has not affected the quality of the surface water and leachate seep samples. All field quality control samples must be prepared exactly as regular investigation samples with regard to sample volume, containers, and preservation. The following quality control samples will be collected for each SDG (an SDG may not exceed 20 samples) at the frequency noted:

- Field Duplicate—Required at a frequency of 10 percent per SDG.

- Matrix Spike/Matrix Spike Duplicate—Required at a frequency of 5 percent.

- Equipment (Rinsate) Blank—Required at a frequency of once per day per media sampled.

- Source Water Blank—Required at a frequency of once per source per sampling event when equipment (rinsate) blank is required.

- Trip Blank—Required for VOC samples at a frequency of one per sample shipment.

3.7 DECONTAMINATION

Field monitoring equipment will be decontaminated prior to use and following sampling of each station by the procedure listed below. Laboratory pre-cleaned, dedicated 1-L glass sample collection containers are used once and discarded and, therefore, do not undergo any decontamination. Decontamination fluids will be collected in a 5-gal bucket and treated at the groundwater treatment plant.

The following decontamination procedure will be used:

- Flush the equipment with potable water
- Flush with non-phosphate detergent solution
- Flush with tap water to remove all of the detergent solution
- Flush with distilled/deionized water
- Flush with isopropyl alcohol
- Flush with distilled/deionized water.

It is recommended that the detergent and isopropyl alcohol used in the above sequence be used sparingly.

4. REFERENCES

U.S. Environmental Protection Agency. 1996. Groundwater Issue-Low Flow Sampling (Minimal Drawdown) Groundwater Sampling Procedures. April.

FIELD RECORD OF WELL GAUGING, PURGING, AND SAMPLING

Site Name:		Project Number:	
Well ID:		Well Lock Status:	
Well Condition:		Weather:	

Gauge Date:		Gauge Time:	
Sounding Method:		Measurement Ref:	
Stick Up/Down (ft):		Well Diameter (in.):	

Purge Date:		Purge Time:	
Purge Method:		Field Personnel:	
Ambient Air VOCs (ppm):		Well Mouth VOCs (ppm):	

WELL VOLUME

A. Well Depth (ft):		D. Well Volume/ft (L):	
B. Depth to Water (ft):		E. Well Volume (L) (C*D):	
C. Liquid Depth (ft) (A-B)		F. Three Well Volumes (L) (E*3):	

G. Measurable LNAPL? Yes ________ /ft No ________

Parameter	Beginning	1	2	3	4	5
Time (min.)						
Depth to Water (ft)						
Purge Rate (L/min)						
Volume Purged (L)						
pH						
Temperature (°C)						
Conductivity (µmhos/cm)						
Dissolved Oxygen (mg/L)						
Turbidity (NTU)						
eH (mV)						

FIELD RECORD OF WELL GAUGING, PURGING, AND SAMPLING

Total Quantity of Water Removed (L):
Samplers:
Sampling Time (Start/End):
Sampling Date:
Decontamination Fluids Used:
Sample Type:
Sample Preservatives:
Sample Bottle IDs:
Sample Parameters:

Site Name:
Project Number:
Date:
Well ID:
Field Personnel:

Parameter	6	7	8	9	10	11
Time (min.)						
Depth to Water (ft)						
Purge Rate (L/min)						
Volume Purged (L)						
pH						
Temperature (°C)						
Conductivity (µmhos/cm)						
Dissolved Oxygen (mg/L)						
Turbidity (NTU)						
eH (mV)						

Parameter	12	13	14	15	16	17
Time (min.)						
Depth to Water (ft)						
Purge Rate (L/min)						
Volume Purged (L)						
pH						
Temperature (°C)						
Conductivity (µmhos/cm)						
Dissolved Oxygen (mg/L)						
Turbidity (NTU)						
eH (mV)						

FIELD RECORD OF WELL GAUGING, PURGING, AND SAMPLING

Comments and Observations:

This page intentionally left blank

FIELD RECORD OF SURFACE WATER AND SEDIMENT SAMPLING

Site Name:			Project Number:
Sample Location ID:			Date:
Time:	Start:	End:	Sample Team Members:

SURFACE WATER INFORMATION

Type of Surface Water:
( ) Stream ( ) River
( ) Pond/Lake ( ) Seep

Water Depth and Sample Location _________ (ft)

Depth of Sample from Top of Water ________ (ft)

Equipment Used for Collection:
( ) None, Grab into Bottle
( ) Bomb Sampler
( ) Pump _____________

Decontamination Fluids Used:
( ) Isopropyl Alcohol
( ) ASTM Type II Water
( ) Deionized Water
( ) Liquinox Solution
( ) Hexane
( ) HNO_3 Solution
( ) Potable Water
( ) None

Water Quality Parameters
( ) Temperature ____
( ) Conductivity ___ µmhs/cm
( ) pH ____ units
( ) Dissolved oxygen ____ mg/L
( ) Turbidity ____ NTU
( ) Eh ____ mv

Velocity Measurements Obtained? ( ) No ( ) Yes, See Flow Measurement Data Record
____

Field QC Data: ( ) Field Duplicate Collected Sample Location Sketch: Method
Used:
Duplicate ID ____________ ( ) Yes ( ) Winkler
( ) MS/MSD ( ) No ( ) Probe

SEDIMENT INFORMATION

Type of Sample Collected:
( ) Discrete
( ) Composite

Sediment Type:
( ) Clay
( ) Sand
( ) Organic
( ) Gravel

Equipment Used for Collection:
( ) Gravity Corer
( ) Stainless Steel Split Spoon
( ) Dredge
( ) Hand Spoon/Trowel
( ) Aluminum Pans
( ) Stainless Steel Bucket
( ) ____________________________

Decontamination Fluids Used:
( ) Isopropyl Alcohol
( ) ASTM Type II Water
( ) Deionized Water
( ) Liquinox Solution
( ) Hexane
( ) HNO_3 Solution
( ) Potable Water
( ) None

Sample Observations:
( ) Odor ____
( ) Color

Field QC Data: ( ) Field Duplicate Collected ( ) MS/MSD
Duplicate ID ___________________________

FIELD RECORD OF SURFACE WATER AND SEDIMENT SAMPLING

SAMPLES COLLECTED

Check if Required at this Location	Matrix		Check if Preserved with Acid/Base	Volume Required	Check if Sample Collected	Sample Bottle IDs			
	Surface Water	Sediment							

NOTES/SKETCH

SOP-A

Iron, Ferrous

DOC316.53.01049

1,10-Phenanthroline Method[1]

Method 8146

0.02 to 3.00 mg/L Fe^{2+}

Powder Pillows or AccuVac® Ampuls

Scope and application: For water, wastewater, seawater, brine solutions, produced waters and hydraulic fracturing waters.

---

[1] Adapted from Standard Methods for the Examination of Water and Wastewater, 15th ed. 201 (1980).

Test preparation

Instrument-specific information

Table 1 shows sample cell and orientation requirements for reagent addition tests, such as powder pillow or bulk reagent tests. Table 2 shows sample cell and adapter requirements for AccuVac Ampul tests. The tables also show all of the instruments that have the program for this test.

To use the table, select an instrument, then read across to find the applicable information for this test.

Table 1 Instrument-specific information for reagent addition

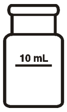
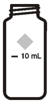
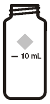
Instrument	Sample cell orientation	Sample cell
DR 6000 DR 3800 DR 2800 DR 2700 DR 1900	The fill line is to the right.	2495402 
DR 5000 DR 3900	The fill line is toward the user.	
DR 900	The orientation mark is toward the user.	2401906 

Table 2 Instrument-specific information for AccuVac Ampuls

Instrument	Adapter	Sample cell
DR 6000 DR 5000 DR 900	—	2427606 
DR 3900	LZV846 (A)	
DR 1900	9609900 or 9609800 (C)	
DR 3800 DR 2800 DR 2700	LZV584 (C)	2122800 

Before starting

Samples must be analyzed immediately after collection and cannot be preserved for later analysis.
Install the instrument cap on the DR 900 cell holder before ZERO or READ is pushed.
For the best results, measure the reagent blank value for each new lot of reagent. Replace the sample with deionized water in the test procedure to determine the reagent blank value. Subtract the reagent blank value from the sample results automatically with the reagent blank adjust option.
Review the Safety Data Sheets (MSDS/SDS) for the chemicals that are used. Use the recommended personal protective equipment.
Dispose of reacted solutions according to local, state and federal regulations. Refer to the Safety Data Sheets for disposal information for unused reagents. Refer to the environmental, health and safety staff for your facility and/or local regulatory agencies for further disposal information.

Items to collect

Powder pillows

Description	Quantity
Ferrous Iron Reagent Powder Pillows, 25-mL	1
Sample cells. (For information about sample cells, adapters or light shields, refer to Instrument-specific information on page 1.)	2

Refer to Consumables and replacement items on page 6 for order information.

AccuVac Ampuls

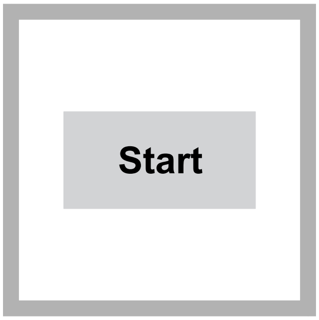
Description	Quantity
Ferrous Iron Reagent AccuVac Ampuls	1
Beaker, 50-mL	1
Sample cells (For information about sample cells, adapters or light shields, refer to Instrument-specific information on page 1.)	1
Stopper for 18-mm tubes and AccuVac Ampuls	1

Refer to Consumables and replacement items on page 6 for order information.

Sample collection

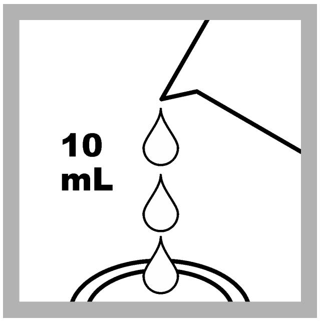
- Samples must be analyzed immediately after collection and cannot be preserved for later analysis.
- Collect samples in clean glass or plastic bottles with tight-fitting caps. Completely fill the bottle and immediately tighten the cap.
- Prevent agitation of the sample or exposure to air.

Powder pillow procedure

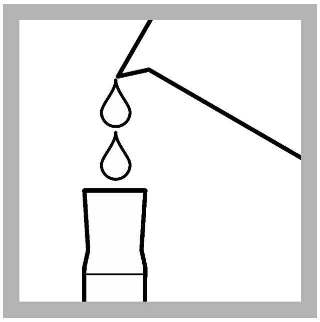


1. Start program **255 Iron, Ferrous**. For information about sample cells, adapters or light shields, refer to Instrument-specific information on page 1.

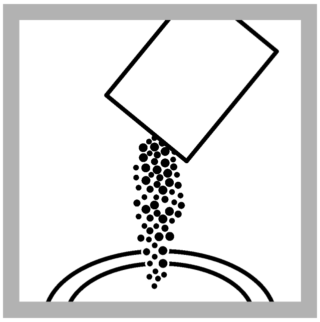
***Note:** Although the program name can be different between instruments, the program number does not change.*



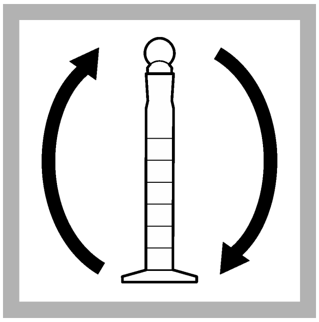
2. Prepare the blank: Fill the sample cell with 10 mL of sample.



3. Prepare the sample: Fill a mixing cylinder to the 25-mL line with sample.

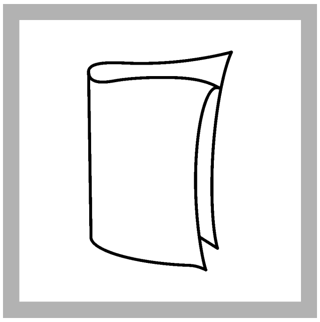


4. Add the contents of one Ferrous Iron Reagent Powder Pillow to the mixing cylinder.
An orange color shows if ferrous iron is present in the sample

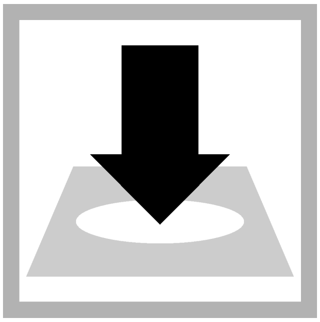


5. Put the stopper on the mixing cylinder. Invert the mixing cylinder several times to mix.
Undissolved powder does not affect accuracy.

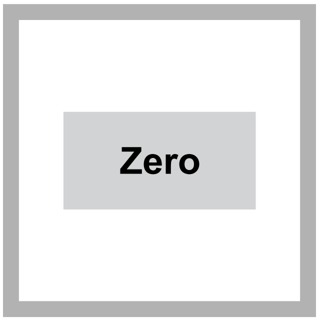
6. Start the instrument timer. A 3-minute reaction time starts.



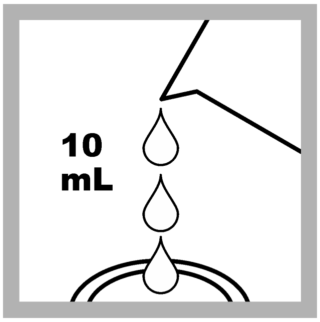
7. When the timer expires, clean the blank sample cell.



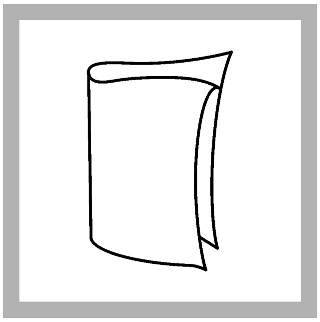
8. Insert the blank into the cell holder.



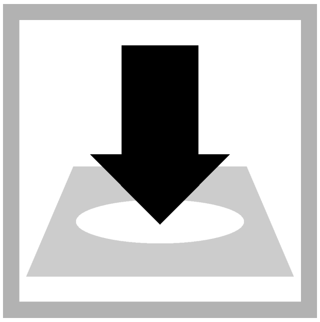
9. Push **ZERO**. The display shows 0.00 mg/L Fe^{2+}.



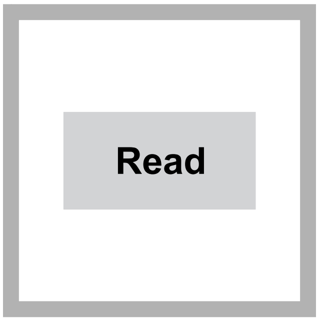
10. Fill a second sample cell with 10 mL of the reacted prepared sample.



11. Clean the prepared sample cell.

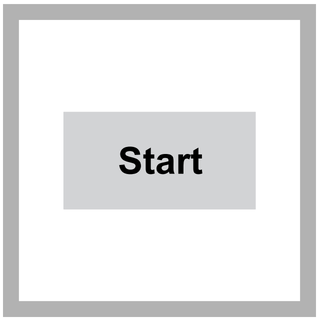


12. Insert the prepared sample into the cell holder.



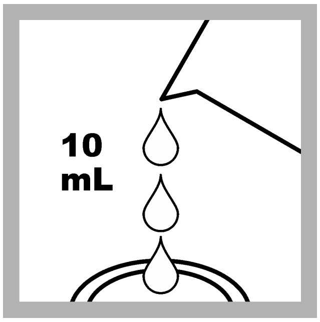
13. Push **READ**. Results show in mg/L Fe^{2+}.

AccuVac Ampul procedure

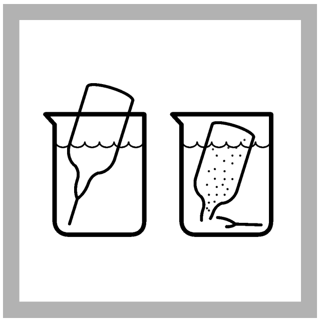


1. Start program **257 Iron, Ferrous AV**. For information about sample cells, adapters or light shields, refer to Instrument-specific information on page 1.

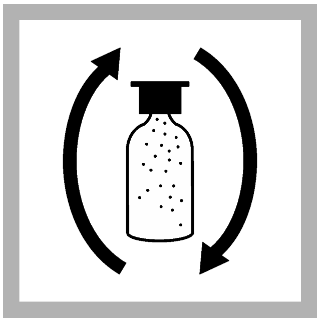
***Note:** Although the program name can be different between instruments, the program number does not change.*



2. Prepare the blank: Fill the sample cell with 10 mL of sample.

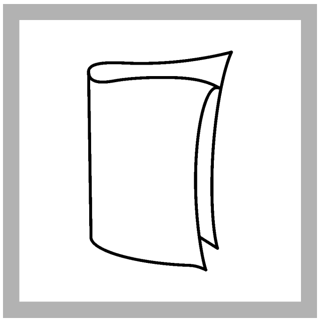


3. Prepare the sample: Collect at least 40 mL of sample in a 50-mL beaker. Fill the AccuVac Ampul with sample. Keep the tip immersed while the AccuVac Ampul fills completely.

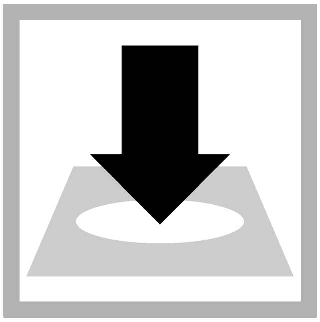


4. Quickly invert the AccuVac Ampul several times to mix.

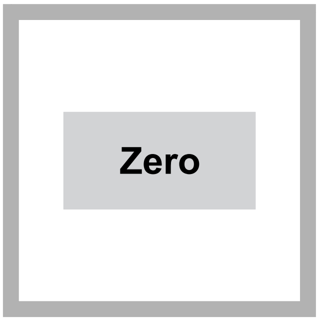
5. Start the instrument timer. A 3-minute reaction time starts.



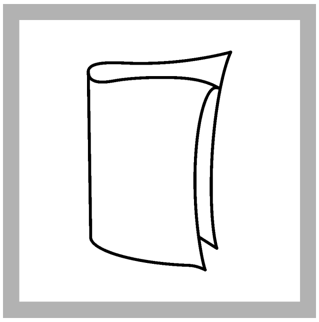
6. When the timer expires, clean the blank sample cell.



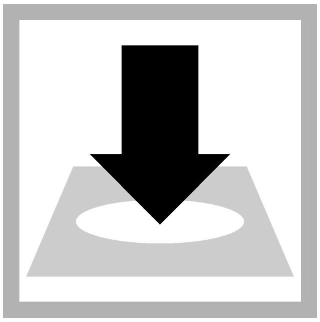
7. Insert the blank into the cell holder.



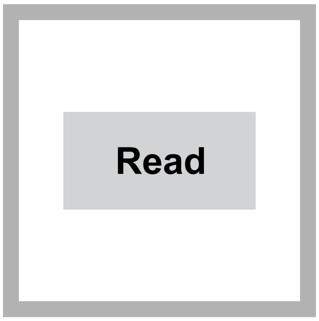
8. Push **ZERO**. The display shows 0.00 mg/L Fe^{2+}.



9. Clean the AccuVac Ampul.



10. Insert the prepared sample AccuVac Ampul into the cell holder.



11. Push **READ**. Results show in mg/L Fe^{2+}.

Accuracy check

Standard solution method

Use the standard solution method to validate the test procedure, the reagents and the instrument.

Items to collect:

- Ferrous Ammonium Sulfate, hexahydrate
- 1-L volumetric flask, Class A
- 100-mL volumetric flask, Class A
- 2-mL volumetric pipet, Class A and pipet filler
- Deionized water

1. Prepare a 100-mg/L Fe^{2+} ferrous iron stock solution as follows:
   a. Add 0.7022 g of ferrous ammonium sulfate, hexahydrate into a 1-L volumetric flask.
   b. Dilute to the mark with deionized water. Mix well.
2. Prepare a 2-mg/L ferrous iron standard solution as follows:
   a. Use a pipet to add 2.00 mL of the 100-mg/L Fe^{2+} ferrous iron stock solution into a 100-mL volumetric flask.
   b. Dilute to the mark with deionized water. Mix well. Prepare the standard solution immediately before use.
3. Use the test procedure to measure the concentration of the prepared standard solution.
4. Compare the expected result to the actual result.

   Note: *The factory calibration can be adjusted slightly with the standard adjust option so that the instrument shows the expected value of the standard solution. The adjusted calibration is then used for all test results. This adjustment can increase the test accuracy when there are slight variations in the reagents or instruments.*

Method performance

The method performance data that follows was derived from laboratory tests that were measured on a spectrophotometer during ideal test conditions. Users can get different results under different test conditions.

Program	Standard	Precision (95% Confidence Interval)	Sensitivity Concentration change per 0.010 Abs change
255	2.00 mg/L Fe^{2+}	1.99–2.01 mg/L Fe^{2+}	0.021 mg/L Fe^{2+}
257	2.00 mg/L Fe^{2+}	1.98–2.02 mg/L Fe^{2+}	0.023 mg/L Fe^{2+}

Summary of method

The 1,10-phenanthroline indicator in the Ferrous Iron Reagent reacts with ferrous iron (Fe^{2+}) in the sample to form an orange color in proportion to the iron concentration. Ferric iron (Fe^{3+}) does not react. The ferric iron concentration can be determined by subtracting the ferrous iron concentration from the results of a total iron test. The measurement wavelength is 510 nm for spectrophotometers or 520 nm for colorimeters.

Consumables and replacement items

Required reagents

Description	Quantity/test	Unit	Item no.
Ferrous Iron Reagent Powder Pillow, 25-mL	1	100/pkg	103769
OR			
Ferrous Iron Reagent AccuVac® Ampul	1	25/pkg	2514025

Required apparatus

Description	Quantity/test	Unit	Item no.
Beaker, 50-mL	1	each	50041H
Stoppers for 18-mm tubes and AccuVac Ampul	1	6/pkg	1448000

Recommended standards and apparatus

Description	Unit	Item no.
Balance, analytical, 80 g x 0.1 mg 100–240 VAC	each	2936701
Ferrous Ammonium Sulfate, hexahydrate, ACS	113 g	1125614
Flask, volumetric, Class A, 1000-mL glass	each	1457453
Pipet filler, safety bulb	each	1465100
Pipet, volumetric, Class A, 1.00-mL	each	1451535
Water, deionized	4 L	27256
Wipes, disposable	280/pkg	2097000

FOR TECHNICAL ASSISTANCE, PRICE INFORMATION AND ORDERING:
In the U.S.A. – **Call toll-free 800-227-4224**
Outside the U.S.A. – **Contact the HACH office or distributor serving you.**
On the Worldwide Web – **www.hach.com**; E-mail – **techhelp@hach.com**

HACH COMPANY
WORLD HEADQUARTERS
Telephone: (970) 669-3050
FAX: (970) 669-2932

07/2014, Edition 10

SOP-A2

Manganese

DOC316.53.01058

USEPA[1] Periodate Oxidation Method[2]

Method 8034

HR (0.1 to 20.0 mg/L)

Powder Pillows

Scope and Application: For soluble manganese in water and wastewater

[1] USEPA Approved for reporting wastewater analyses (digestion required). *Federal Register*, 44(116)34 193 (June 14, 1979)

[2] Adapted from *Standard Methods for the Examination of Water and Wastewater.*

Test preparation

How to use instrument-specific information

The *Instrument-specific information* table displays requirements that may vary between instruments. To use this table, select an instrument then read across to find the corresponding information required to perform this test.

Table 1 Instrument-specific information

Instrument	Sample cell	Cell orientation
DR 5000	2495402	Fill line faces user
DR 3900	2495402	Fill line faces user
DR 3800, DR 2800, DR 2700	2495402	Fill line faces right

Before starting the test:

Digestion is required for reporting wastewater analyses.
If only dissolved manganese is to be determined, filter the sample before acid addition.
For more accurate results, determine a reagent blank value for each new lot of reagent. Follow the procedure using deionized water in place of the sample. Subtract the reagent blank value from the final results or perform a reagent blank adjust.

Collect the following items:

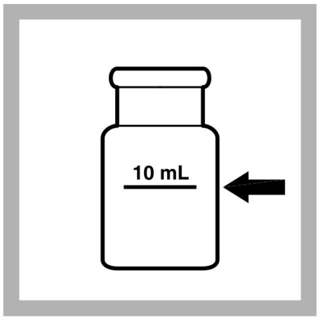
Description	Quantity
High Range Manganese Reagent Set	1
Sample Cells (see *Instrument-specific information*)	2

See *Consumables and replacement items* for reorder information.

Periodate Oxidation method for powder pillows

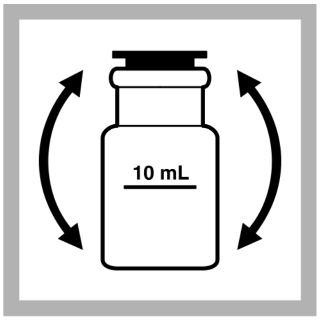
1. Select the test.

Insert an adapter if required (see *Instrument-specific information*).

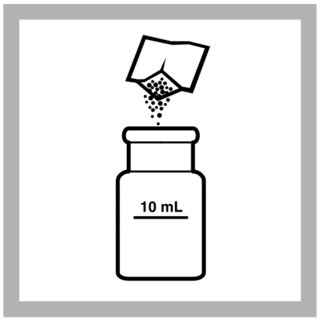


2. Prepared Sample: Fill a sample cell with 10 mL of sample.

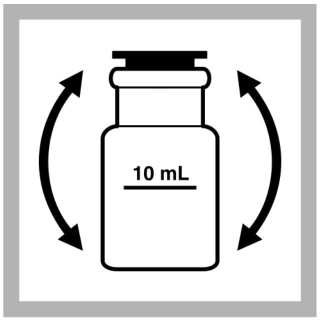
3. Add the contents of one Buffer Powder Pillow, Citrate Type for Manganese.



4. Stopper or cap and invert to mix.



5. Add the contents of one Sodium Periodate Powder Pillow to the sample cell.

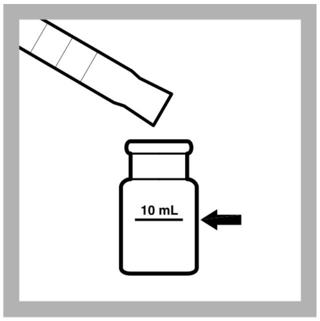


6. Stopper or cap and invert to mix.

A violet color will develop if manganese is present.

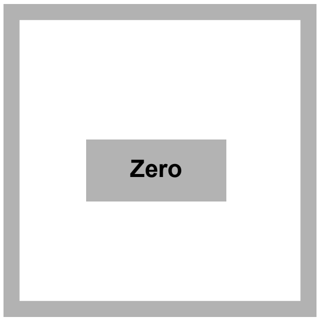
7. Start the instrument timer.

A two-minute reaction time will begin.



8. Blank Preparation: Fill a second sample cell with 10 mL of sample.

9. When the timer expires, insert the blank into the cell holder.

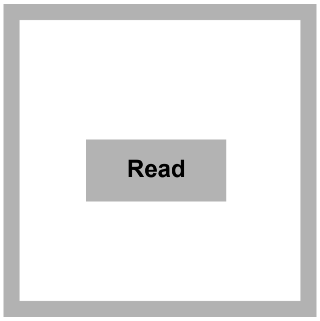


10. ZERO the instrument.

The display will show:

0.0 mg/L Mn

11. Within eight minutes after the timer expires, insert the sample into the cell holder



12. READ the results in mg/L Mn.

Interferences

Table 2 Interfering substances

Interfering substance	Interference level
Calcium	700 mg/L
Chloride	70,000 mg/L
Iron	5 mg/L
Magnesium	100,000 mg/L
pH	Highly buffered samples or extreme sample pH may exceed the buffering capacity of the reagents and require sample pretreatment.

Sample collection, preservation and storage

- Collect samples in acid-washed plastic bottles. Do not use glass containers due to possible adsorption of Mn to glass.
- If samples are acidified, adjust the pH to 4–5 with 5.0 N Sodium Hydroxide before analysis.
- Do not exceed pH 5, as manganese may precipitate.
- Correct the test result for volume additions.

Accuracy check

Standard additions method (sample spike)

Required for accuracy check:

- Manganese Voluette® Ampule Standard, 250 mg/L Mn
- Ampule breaker
- TenSette Pipet

1. After reading test results, leave the sample cell (unspiked sample) in the instrument.
2. Select Options>More>Standard Additions from the instrument menu.
3. Accept the default values for standard concentration, sample volume and spike volumes. After the values are accepted, the unspiked sample reading will appear in the top row. See the user manual for more information.
4. Open the standard solution ampule.
5. Use the TenSette Pipet to prepare spiked samples: add 0.1 mL, 0.2 mL and 0.3 mL of standard to three 10-mL portions of fresh sample. Mix thoroughly.
6. Follow the *Periodate Oxidation method for powder pillows* test procedure for each of the spiked samples using the powder pillows, starting with the 0.1 mL sample spike. Measure each of the spiked samples in the instrument.
7. Select **GRAPH** to view the results. Select **IDEAL LINE** (or best-fit) to compare the standard addition results to the theoretical 100% recovery.

Standard solution method

Note: *Refer to the instrument user manual for specific software navigation instructions.*

Required for accuracy check:

- Manganese Standard Solution, 1000 mg/L
- Deionized water

- 1 L Class A volumetric flask
- Class A volumetric pipet, 10 mL
- Pipet filler, safety bulb

1. Prepare a 10.0 mg/L manganese standard solution as follows:
    - **a.** Pipet 10.0 mL of Manganese Standard, 1000 mg/L, into a 1000 mL (1 liter) volumetric flask.
    - **b.** Dilute to the mark with deionized water. Mix well. Prepare this solution daily.
2. Use this solution in place of the sample. Follow the *Periodate Oxidation method for powder pillows* test procedure.
3. To adjust the calibration curve using the reading obtained with the standard solution, select Options>More>Standard Adjust from the instrument menu.
4. Turn on the Standard Adjust feature and accept the displayed concentration. If an alternate concentration is used, enter the concentration and adjust the curve to that value.

Method performance

Program	Standard	Precision 95% Confidence Limits of Distribution	Sensitivity Concentration change per 0.010 Abs change	
			Portion of Curve	Concentration
295	10.0 mg/L Mn	9.6–10.4 mg/L Mn	Entire curve	0.1 mg/L Mn

Summary of method

Manganese in the sample is oxidized to the purple permanganate state by sodium periodate, after buffering the sample with citrate. The purple color is directly proportional to the manganese concentration. Test results are measured at 525 nm.

Consumables and replacement items

Required reagents

Description	Quantity/Test	Unit	Catalog number
Manganese Reagent Set, High Range (100 tests), includes:	—	—	2430000
Buffer Powder Pillows, citrate type for Manganese	1	100/pkg	2107669
Sodium Periodate Powder Pillows for Manganese	1	100/pkg	2107769

Required apparatus

Description	Quantity	Unit	Catalog number
Sample cell, 10 mL square, matched pair	2	2/pkg	2495402
Stopper, rubber	1	6/pkg	173106

Recommended standards

Description	Unit	Catalog number
Manganese Standard Solution, 1000 mg/L Mn	100 mL	1279142
Manganese Standard Solution, 250 mg/L Mn, 10-mL Voluette® ampule	16/pkg	1425810
Water, deionized	4 L	27256
Voluette Ampule breaker	each	2196800

Optional reagents and apparatus

Description	Unit	Catalog number
Manganese Standard Solution, 2 mL PourRite® Ampule, 25 mg/L	20/pkg	2112820
Manganese Standard Solution, 2 mL PourRite® Ampule, 10 mg/L	20/pkg	2605820
pH paper, 0–14	100/pkg	2601300
Pipe filler, safety bulb	each	1465100
Pipet, TenSette®, 0.1–1.0 mL	each	1970001
Pipet Tips, for TenSette Pipet 1970001	50/pkg	2185696
Pipet Tips, for TenSette Pipet 1970001	1000/pkg	2185628
Pipet, TenSette, 1.0–10.0 mL	each	1970010
Pipet Tips, for TenSette Pipet 1970010	250/pkg	2199725
Pipet Tips, for TenSette Pipet 1970010	50/pkg	2199796
PourRite® Ampule breaker	each	2484600
Sodium Hydroxide, 5.0 N	100 mL	245032
Volumetric flask, Class A, 1000 mL	each	1457453
Volumetric pipet, Class A, 10 mL	each	1451538

FOR TECHNICAL ASSISTANCE, PRICE INFORMATION AND ORDERING:
In the U.S.A. – **Call toll-free 800-227-4224**
Outside the U.S.A. – **Contact the HACH office or distributor serving you.**
On the Worldwide Web – **www.hach.com**; E-mail – **techhelp@hach.com**

HACH COMPANY
WORLD HEADQUARTERS
Telephone: (970) 669-3050
FAX: (970) 669-2932

Edition 6

Appendix E

Accident Prevention Plan

This page intentionally left blank

ACCIDENT PREVENTION PLAN
REVISION 0

Long-Term Monitoring/Land Use Control Management
Former Seneca Army Depot,
Romulus, New York

PREPARED FOR:

U.S. ARMY CORPS OF ENGINEERS,
ENGINEERING AND SUPPORT CENTER,
HUNTSVILLE
5021 Bradford Drive East
Huntsville, Alabama 35805

CONTRACT NO. W912DY22D0131
TASK ORDER NO. W912DY22F0374

PREPARED BY:

EA Engineering, Science, and Technology, Inc., PBC
225 Schilling Circle, Suite 400
Hunt Valley, Maryland 21031

January 2023

Accident Prevention Plan
Long-Term Monitoring/Land Use Control Management
Former Seneca Army Depot
Romulus, New York

Contract No. W912DY22D0131
Task Order No. W912DY22F0374

Prepared for

U.S. Army Corps of Engineers
Engineering and Support Center
Huntsville
5021 Bradford Drive East
Huntsville, Alabama 35805

Prepared by

EA Engineering, Science, and Technology, Inc., PBC
225 Schilling Circle, Suite 400
Hunt Valley, Maryland 21031

January 2023

Revision Tracking

Date	Revision	Description and Chapters Affected
January 2023	0	

This page left intentionally blank

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ATTACHMENTS

LIST OF ACRONYMS AND ABBREVIATIONS

°F	Degrees Fahrenheit
AAPP	Abbreviated Accident Prevention Plan
ABIH	American Board of Industrial Hygiene
ACGIH	American Conference of Governmental Industrial Hygienists
AHA	Activity Hazard Analysis
APP	Accident Prevention Plan
ASP	Associate Safety Professional
CAF	Clothing adjustment factor
CDT	Central Daylight Time
CEHNC	USACE Engineering and Support Center Huntsville
CENAN	USACE-New York District
CFR	Code of Federal Regulations
CHMM	Certified Hazardous Materials Manager
CIH	Certified Industrial Hygienist
COC	Contaminant of concern
COR	Contract Officer’s Representative
COVID-19	Coronavirus Disease 2019
CPR	Cardiopulmonary resuscitation
CQA	Certified Quality Auditor
CSP	Certified Safety Professional
CST	Central Standard Time
dBA	Decibels on the A-weighted scale
EA	EA Engineering, Science, and Technology, Inc., PBC
EDT	Eastern Daylight Time
EM	Engineer Manual
EMR	Experience Modification Rate
EPA	U.S. Environmental Protection Agency
EST	Eastern Standard Time
ft	Foot (feet)
GFCI	Ground fault current interrupter
HAZWOPER	Hazardous Waste Operations and Emergency Response
IDW	Investigation-derived waste
KO	Contracting Officer
LTM	Long-term monitoring

LIST OF ACRONYMS AND ABBREVIATIONS (continued)

LUC	Land use control
MEC	Munitions and explosives of concern
NA	Not applicable
NFPA	National Fire Protection Association
NIOSH	National Institute for Occupational Safety and Health
No.	Number
NOAA	National Oceanic and Atmospheric Administration
NRR	Noise reduction ratio
NYSDEC	New York State Department of Environmental Conservation
OSHA	Occupational Safety and Health Administration
PDT	Pacific Daylight Time
PE	Professional Engineer
PG	Professional Geologist
PhD	Doctor of Philosophy
PM	Project Manager
PMP	Project Management Professional
PPE	Personal protective equipment
PWS	Performance Work Statement
QA	Quality assurance
QC	Quality control
RAC	Risk Assessment Code
ROD	Record of Decision
SEAD	Former Seneca Army Depot
SDS	Safety data sheet
SHM	Safety and Health Manager
SOW	Scope of Work
SSHO	Site Safety and Health Officer
SSHP	Site Safety and Health Plan
TO	Task Order
TRIR	Total Recordable Incident Rate
USACE	U.S. Army Corps of Engineers
VOC	Volatile organic compound

1. INTRODUCTION

1.1 This Accident Prevention Plan (APP) has been prepared by EA Engineering, Science, and Technology, Inc., PBC (EA) (The Contractor) for the project sites known as the Former Seneca Army Depot (SEAD), located in Romulus, New York. The scope of this Contract is to provide Long-Term Monitoring (LTM) and Land Use Control (LUC) Management and to provide LTM and LUC optimization in compliance with the Comprehensive Environmental Response, Compensation, and Liability Act, as amended, in accordance with current Department of Defense, Army, and U.S. Army Corps of Engineers (USACE) Regulations and Guidance and all applicable Data Item Descriptions for the whole SEAD Site. Work conducted under this contract will be performed in accordance with applicable federal, state, and local safety and occupational health laws and regulations including: Occupational Safety and Health Administration (OSHA) standards (including 29 Code of Federal Regulations [CFR] 1910 and 1926) as well as the USACE Safety and Health Requirements Manual (Engineer Manual [EM] 385-1-1, 30 November 2014). The contents of this APP are subject to review and revision as new or additional information becomes available.

1.2 This APP is consistent with, and work will be performed in accordance with, applicable federal, state, local, and site-specific health and safety requirements. This APP and has been prepared in accordance with:

- USACE EM 385-1-1, Safety and Health Requirements Manual, dated 30 November 2014
- Data Item Description 001.03, Project Planning Documents
- 29 CFR 1904, 1910, and 1926 (Recording and Reporting Occupational Injuries and Illnesses, Occupational Safety and Health Standards, and Safety and Health Regulations for Construction, respectively).

1.3 The APP interfaces with the contractor’s Corporate Safety and Health Program in all chapters. This APP was provided to USACE for review prior to initiation of the activities described herein and will be on-site during active phases of work. The contents of the APP are subject to review and revision as additional information becomes available. Site-specific information will be added to this document through the APP addendum process described in Chapter 1.5 prior to initiation of field activities.

1.4 SIGNATURE SHEET

1.4.1 Plan Preparer:

1.4.1.1 This APP has been prepared by a Qualified Person:

Adrian Hughes, V

16 January 2023

Name: Adrian Hughes Date
Certified Safety Professional (CSP) Number (No.) 37456
Associate Safety Professional (ASP)
Professional Geologist (PG)
Title: Safety and Health Manager (SHM)
Company: EA Science and Technology
Telephone: 410-584-7000

1.4.2 Plan Approvals:

1.4.2.1 An officer of the company with the authority to obligate the company has approved this APP:

16 January 2023

Name: Robert Casey Date
Title: Vice President
Operations Manager
Company: EA Science and Technology
Telephone: 315-565-6550

1.4.2.2 An American Board of Industrial Hygiene (ABIH) – Certified Industrial Hygienist (CIH) and a CSP has supervised the preparation of, and reviewed and approved this APP:

16 January 2023

Name: Robert Marcase Date
Certified Hazardous Materials Manager (CHMM) No. 15935
Certified Industrial Hygienist (CIH) No. 9283
CSP No. 21609
Title: Director of Safety and Health
Company: EA Science and Technology
Telephone: 410-329-5192

1.4.3 Certification/Concurrence:

1.4.3.1 Project and program management has concurred with the elements of this APP. Site worker concurrence will be documented through signature on an APP/Site Safety and Health Plan (SSHP) review form.

16 January 2023

Name:	Rick Hanoski Project Management Professional (PMP) Certified Quality Auditor (CQA)	Date
Title:	Vice President, Deputy Program Manager	
Company:	EA Science and Technology	
Telephone:	410-584-7000	

16 January 2023

Name:	Tim Reese, PE	Date
Title:	Project Manager (PM)	
Company:	EA Engineering, P.C.	
Telephone:	315-565-6555	

1.5 REVISIONS

1.5.1 Changes in the Performance Work Statement (PWS), field changes, or unanticipated site conditions may require APP modification and approval to retain field safety. Changes will be made by the Plan Preparer with input from other qualified personnel familiar with the types of work involved and current site safety issues. The revisions and/or APP addenda will also be submitted to USACE Engineering and Support Center, Huntsville (CEHNC) for acceptance. Revisions will be tracked and presented in a tracking table that follows the cover page. Qualifications of personnel are described in Chapter 4.

1.5.2 Personnel qualifications and resumes will be submitted under separate cover for government review as an entire project field and management team.

This page intentionally left blank

2. BACKGROUND INFORMATION

2.1 This chapter presents a brief description of the project including site description, PWS, and phases of work.

2.2 CONTRACTOR:

EA Engineering, Science, and Technology, Inc., PBC

2.3 CONTRACT NUMBER:

Contract: W912DY-22-D-0131
Task Order: W912DY-22-F-0374

2.4 PROJECT NAME:

Long-Term Monitoring **(**LTM) and Land Use Controls (LUC) Management and to provide LTM/LUC optimization for Former Seneca Army Depot, Romulus, New York (**Figure 2-1**).

2.5 PROJECT DESCRIPTION AND LOCATION

2.5.1 Fieldwork will occur under a subsequently-presented Accident Prevention Plan (APP).

2.5.2Within the SEAD property, there are eight zones with separate land use designations. The parcel originally consisted of approximately 10,600 acres (**Figure 2-2**). Since SEAD was decommissioned in 2000, the U.S. Army has served as a caretaker of the site throughout the processes of environmental assessments and remedial activities. Throughout the close-out process of SEAD, approximately 8,250 acres of the land has been transferred to new ownership.

2.5.3 SEAD was built in 1941 and was commissioned as a U.S. Army facility. It was utilized as a munitions storage and disposal facility by the U.S. Army from 1941 until the 1990s. In 1995, SEAD was listed in the Base Realignment and Closure Commission before its formal shut down in 2000. Since, the site has undergone site assessment and clean-up activities, and until 2019, U.S. Army personnel were stationed at the base to allow access to Administrative Record and Permanent Record documents stored on the property (the Administrative Record is now web-based). The parcel originally consisted of approximately 10,600 acres. Since SEAD was decommissioned in 2000, the U.S. Army has served as a caretaker of the site throughout the processes of environmental assessments and remedial activities. Approximately 8,250 acres of the land has been transferred to new ownership. All the sites at SEAD have existing Records of Decision (RODs) and are in either LTM or LUC (or both). EA will conduct a reevaluation of each ROD, as many are quite old and in need of revision with the current state of the SEAD.

2.5.4 SEAD currently consists of 42 sites, each designated with respective SEAD identification numbers, in addition to several privately held parcels. This includes the following sites: SEAD 1, 2, 5, 12, 13, 16, 17, 23, 25, 26, 27, 39, 40, 41, 43, 44A, 44B, 46, 52, 56, 59, 62, 64A, 64B, 64C, 64D, 66, 67, 69, 71, 121C, 121I, 122B, 122E, 002-R-01, 003-R-01, 007-R-01, and the Ash Landfill Operable Unit (SEADs 3, 6, 8, 14, and 15).

2.6 PROJECT TASKS

2.6.1 The scope of this task order (TO) includes four primary objectives: Of these four primary objectives, activities requiring AHAs are presented in **Table 2-1** .

1) Perform site assessments for all 42 sites under LTM/LUC at SEAD to determine if the conclusions of the ROD continue to be the best option for the Department of Defense

2) Continue all LTM/LUCs activities (to include all required reporting, programmatic, etc. for anything related to the LTM/LUC program at SEAD

3) Develop and submit either an Explanation of Significant Difference or No Action ROD amendment for any sites where site assessments support altering the LTM/LUCs

4) Prepare and conduct two 5-Year Reviews for SEAD (2025 and 2030)

2.6.2 General phases expected at any of the 42 sites include:

- Mobilization and demobilization
- Groundwater sampling
- Soil boring direct-push technology investigation
- Install new monitoring wells and geotechnical analysis
- Collect soil, groundwater, sediment, and surface water samples
- Investigation-derived waste (IDW) disposal
- Vapor intrusion study.

Table 2-1. SEAD Site-Specific Activities and Hazards

Work Phase	MEC Hazards	Soil Borings	Groundwater Sampling	Surface water Sampling	Sediment Sampling	Sub Slab or Indoor Air Sampling	LUC Inspections	LTM Program
SEAD-1		X	X					X
SEAD-2		X	X					X
SEAD-002-R-01	X						X	
SEAD-003-R-01	X						X	
SEAD-007-R-01	X						X	
SEAD-3			X				X	
SEAD-5		X	X					X
SEAD-6			X				X	
SEAD-8			X				X	
SEAD-12		X	X			X	X	
SEAD-13		X	X	X	X			X
SEAD-14			X				X	
SEAD-15			X				X	
SEAD-16		X	X					X
SEAD-17		X	X					X
SEAD-23	X	X	X	X	X		X	
SEAD-25		X	X				X	
SEAD-26		X					X	
SEAD-27			X				X	
SEAD-39			X					X
SEAD-40			X					X
SEAD-41			X					X
SEAD-43								X
SEAD-44A								X
SEAD-44B		X	X					X
SEAD-46	X						X	
SEAD-52		X	X					X
SEAD-56								X
SEAD-59			X					X
SEAD-62								X
SEAD-64A		X	X					X
SEAD-64B		X	X				X	
SEAD-64C								X
SEAD-64D		X	X					X
SEAD-66			X					X
SEAD-67			X					X
SEAD-69								X
SEAD-71			X					X
SEAD-121C			X					X
SEAD-121I			X					X
SEAD-122B		X	X				X	
SEAD-122E		X	X				X	

Notes:
Cell colors pertain to general site locations detailed below:

PID/Warehouse Area	Airfield Parcel
Prison Area	Ash Landfill Operable Unit
Other SEADs with LUC Requirements North End Barracks Area	Former Munitions Response Sites

Table 2-2. Scope of Work and Site-Specific Activity Hazard Analyses

Work Phase	Site Mobilization	Groundwater Sampling	Well Installation	Soil Sampling	Sediment Sampling	Surface Water Sampling	IDW Handling	Site Demobilization	Vapor Intrusion Study
Mobilization/Demobilization	✓							✓	
COVID-19 Hazard Mitigation	✓	✓	✓	✓	✓	✓	✓	✓	
Drilling and Well Installation	✓		✓				✓	✓	
Groundwater Sampling		✓					✓	✓	
Sediment Sampling					✓		✓	✓	
Soil Sampling				✓			✓	✓	
Surface Water Sampling						✓	✓	✓	
Vapor Intrusion Study								✓	✓

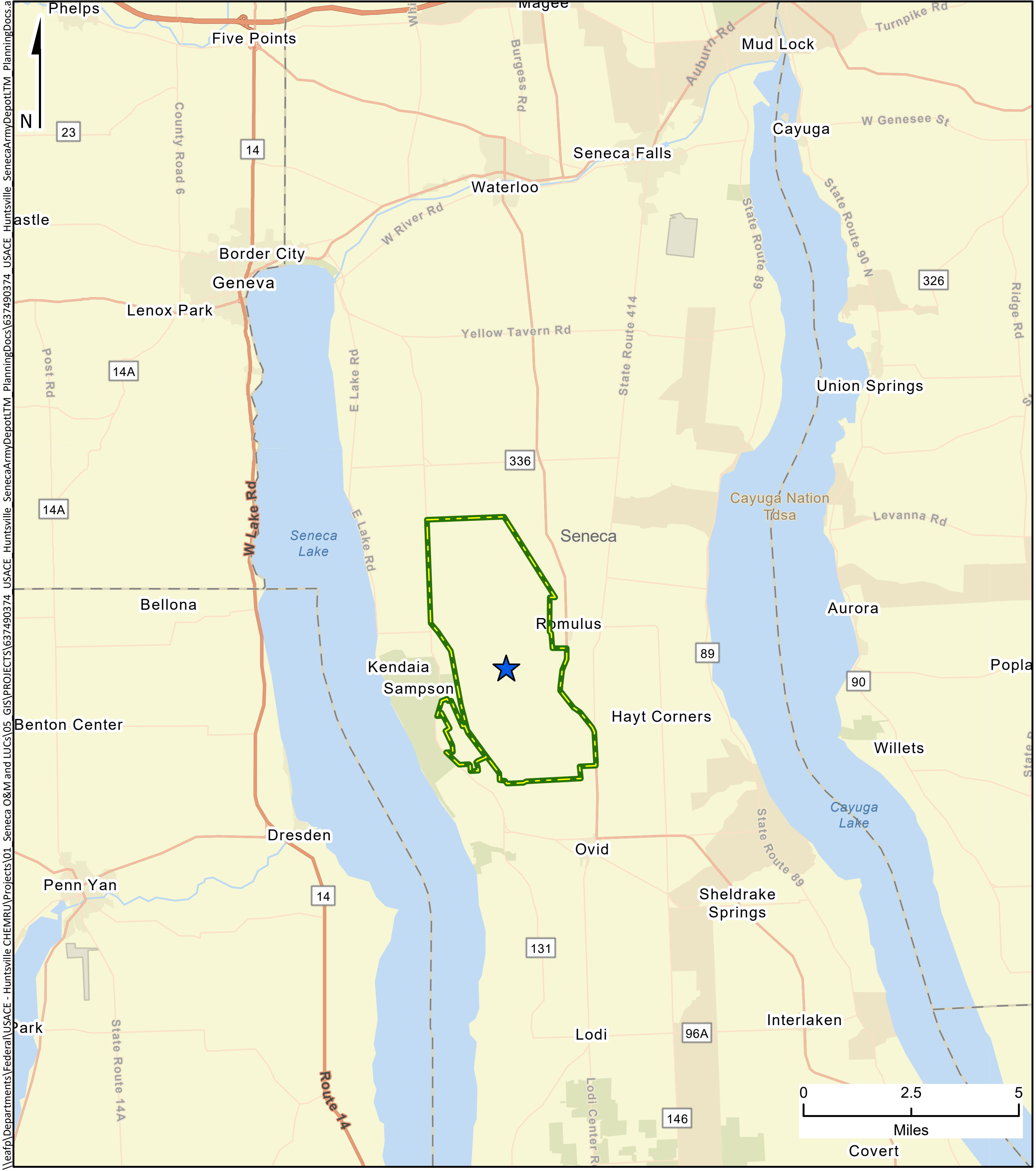
Notes:
COVID-19 = Coronavirus Disease 2019

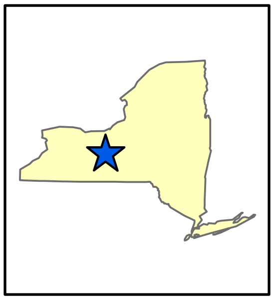
2.6.3 Detailed descriptions of the work and field tasks are presented in the Uniform Federal Policy‒Quality Assurance Project Plan developed for this project. All activities of anticipated work are with a dedicated Activity Hazard Analysis (AHA) (**Attachment A**).

2.6.4 Significant changes or additional tasks will be submitted through APP addenda. For example, optional work under this contract includes completion of an additional remedial action at the site if groundwater sampling results indicate one is necessary. If an injection is warranted, an APP addendum will be submitted to USACE for review. If additional phases of work are added, or if unforeseen activities will occur during this project, additional (or revised) AHAs will be prepared and provided for review. Task-specific required equipment is listed on each AHA. Risk Assessment Codes (RACs) for the AHAs required to complete the PWS do not indicate high risk activities will occur. AHAs will be field-edited by the Site Safety and Health Officer (SSHO), with consultation by the SHM unless the RAC increases and/or additional residual risk is identified. If this occurs, the AHA will be resubmitted.

2.7 ACTIVITY HAZARD ANALYSIS SUBMITTAL PROCESS

2.7.1 As part of this APP, the USACE AHA process has been and will be used to evaluate potential hazards related to the specific work tasks and to identify measures that will be used to help minimize, monitor, and control the probability and/or impact of incidents. Within the major tasks identified in Chapter 2.6, activities requiring AHAs are presented in **Table 2-1**. Based on EM 385-1-1, the AHAs for the activities, tasks, or definable features of work) at the SEAD are presented in **Attachment A**. Resubmission of AHAs is required if the RAC changes and full revisions are required to the APP and associated sub-plans.





Legend

★ Site Location

🟩 SEAD Boundary

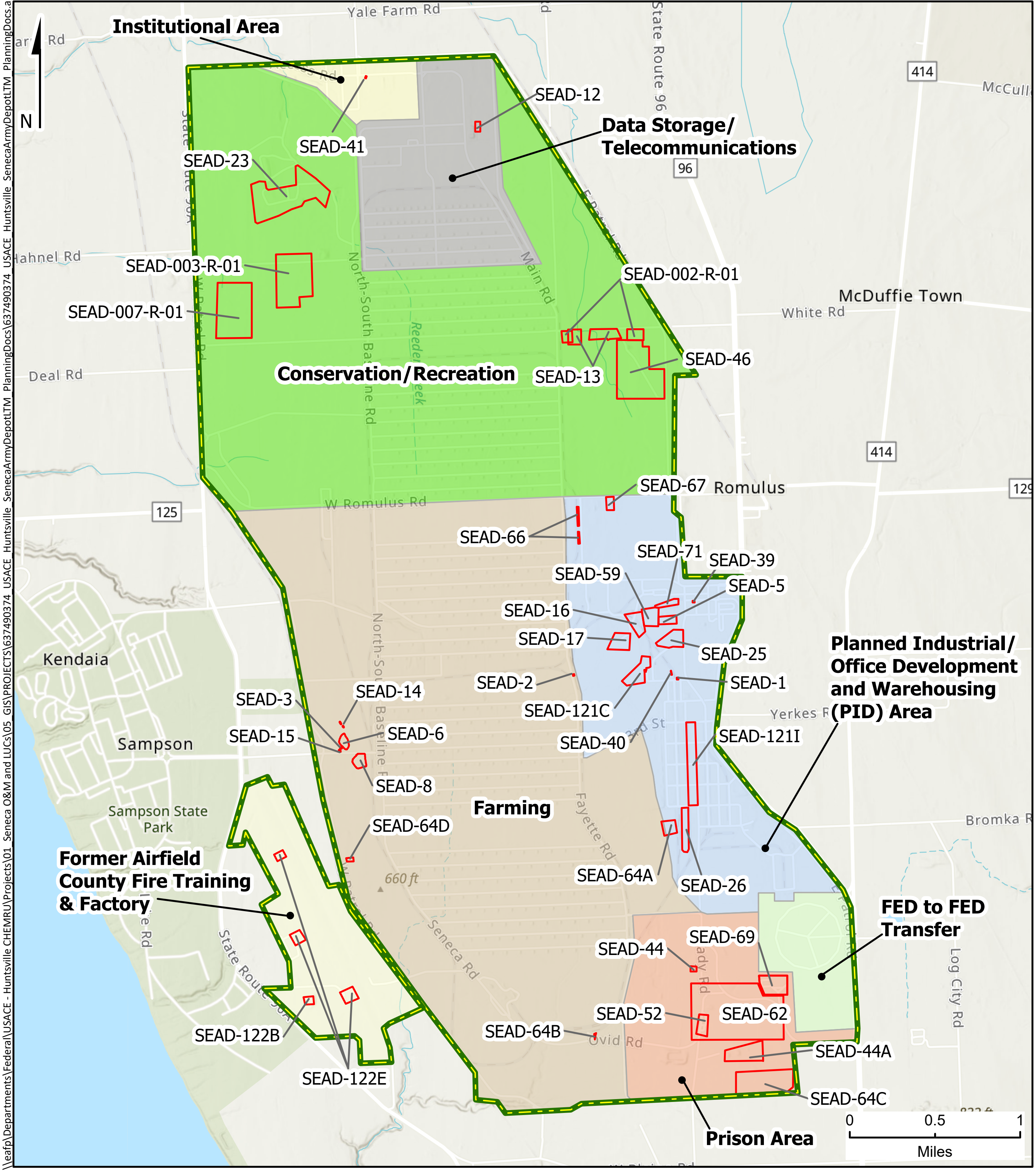
Figure 2-1
Site Location
Seneca Army Depot (SEAD)
Romulus, Seneca County, New York

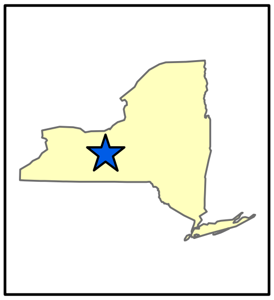
Map Date:12/5/2022 10:20 AM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

\\eafp\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01_Seneca O&M and LUCs\05_GIS\PROJECTS\637490374_USACE_Huntsville_SenecaArmyDepotLTM_PlanningDocs\637490374_USACE_Huntsville_SenecaArmyDepotLTM_PlanningDocs.aprx

This page intentionally left blank





Legend

🟥 SEAD Sites

🟩 SEAD Boundary

★ Site Location

Figure 2-2
Site Features
Seneca Army Depot (SEAD)
Romulus, Seneca County, New York

Map Date:12/5/2022 10:20 AM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

This page intentionally left blank

3. STATEMENT OF SAFETY AND HEALTH POLICY

3.1 The contractor’s Corporate Safety and Health policy is as follows:

3.2 “*The safety and health of its employees, clients, and visitors and the prevention of work-related accidents and illnesses and property loss to be of the highest priority. Proactively implemented, a comprehensive and systematic safety and health program will result in more efficient and profitable operations by improving employee health and morale, and by reducing Worker’s Compensation costs, lost time, fire and liability insurance premiums, and property damage*.”

3.3 The objectives of the contractor’s Safety and Health Program for this Contract are to ensure:

- Sound safety and health practices and conditions necessary for the protection of the health and welfare of employees, clients, and visitors

- Compliance with this APP, and federal and state safety and health regulations and standards

- Effective safety and fire prevention practices necessary for protection of company-owned or operated and site property.

3.4 The contractor is committed to the overall goal of having no workplace injuries or safety incidents.

3.5 CONTRACTOR SAFETY INFORMATION

3.5.1 The contractor’s OSHA recordable incident and lost-workday rates are comparable with the industry average. In addition, the insurance industry has developed an experience-rating system as an equitable means of determining premiums for Workers’ Compensation insurance (the experience modification rate). This rating is based on a comparison of firms doing similar types of work, with the employer rated against the average expected performance in each work classification. For the past 7 years, the contractor has been below the industry average. The last 5 years are provided in the **Table 3-1.**

3.5.2 The contractor uses its accident/incident reports and near miss reports as “lessons learned” tools. These reports are discussed during weekly corporate and business unit level staff meetings. In addition, monthly, the contractor’s Corporate Health and Safety Director, will disseminate this information to health and safety representatives in each office via teleconference. These reports are then subsequently used, as appropriate, during daily safety meetings on sites where similar activities may be occurring. These reports may also trigger, on a case-by-case basis, revisions to site AHAs, which are an integral part of this APP. The OSHA 300 forms for the contractor are presented in **Attachment B**.

Table 3-1. Contractor Safety Information

Metrics	2021	2020	2019	2018	2017	2016
Experience Modification Rate (EMR)[1]	0.65	0.66	0.67	0.78	0.74	0.78
Number of Recordable Cases[2]	5	4	2	7	5	4
Total Recordable Incident Rate (TRIR)[3]	0.98	0.71	0.38	1.31	0.95	0.79
Total Hours Worked	1,231,888	1,123,596	1,062,015	1,072,638	1,055,170	1,008,144

Notes:

1. EMR: Proprietary insurance industry standard which normalizes average to 1.0; therefore, an EMR less than 1 indicates a risk level less than the industry average.
2. TRIR: Calculated as (200,000 x number of recordables)/ total hours worked.
3. Industry average TRIR for remediation services (N…. 562910) is 1.5; therefore, EA has maintained a TRIR of less than industry average during this timeframe.

4. RESPONSIBILITIES AND LINES OF AUTHORITY

4.1 STATEMENT OF EMPLOYER RESPONSIBILITY

4.1.1 The contractor is responsible for the implementation of a safety and occupational health program for protection of employees in the workplace, and as addressed in this APP, on project sites. As such, the contractor has established roles and responsibilities for implementing the safety program at the corporate, project management, and field/task level. This APP presents the site-specific requirements that will ensure compliance with the contractor's corporate programs while maintaining compliance with federal and client requirements. The contractor will retain full responsibility for the implementation of the APP. Site personnel are responsible for adherence to this APP during the performance of their work. No person may work in a manner that conflicts with the intent of, or the inherent safety and environmental precautions expressed in, these procedures. Furthermore, employees working on-site will report unsafe conditions/activities, prevent avoidable accidents, and work in a safe manner. The safety role of subcontractors is discussed in Chapter 5.2.

4.2 CORPORATE AND PROJECT LEVEL IDENTIFICATION AND ACCOUNTABILITY OF PERSONNEL FOR SAFETY

4.2.1 Personnel required for completion of the PWS to be performed under this APP include corporate, management, technical, and safety personnel. The key roles and respective personnel filling those roles for the proposed work are presented in the chapters below. As demonstrated in the responsibilities required of each role, and as discussed in subsequent subchapters, the contractor maintains separate lines-of-authority for technical task management and safety to limit conflicts of interest between the need to maintain project deliverables, budget, and schedule, and safety. Contact information for key personnel is presented in Chapter 9 and addenda. Competency in performing several of the roles listed below is detailed on resumes and certifications provided in **Attachment C** and meets or exceeds requirements presented in EM 385-1-1 01.A.17. **Table 4-1** presents project personnel, their involvement on the project, responsibilities, and the organization these individuals represent.

4.2.2 Program Manager

4.2.2.1 The Program Manager will provide program management communication and the point-of-contact for the delivery order and will review safety plans, ensure client-specific safety and health requirements are followed, periodically monitor field operations, and communicate with safety personnel.

4.2.3 Business Unit Director

4.2.3.1 The Business Unit Director is accountable for implementation of the safety and health program; may contractually obligate the company; ensures time and budget are applied to training; conducts periodic reviews of safety and health procedures; ensures employees follow safety and health procedures; and requires PMs to implement corrective actions, if necessary.

4.2.4 Project Manager

4.2.4.1 The PM is accountable for allocating resources to the project to develop and implement this APP; direct corrective actions, if required; review/investigate work-related injuries and illnesses; and report accidents/incidents in accordance with requirements presented in Chapter 9. The PM will assist in submission of safety-related documents for acceptance.

4.2.5 Safety and Health Manager

4.2.5.1 The SHM is accountable for development and enforcement of this APP/SSHP through oversight and implementation, audits and inspections, remaining available for project emergencies, modifications, evaluation of exposure monitoring, and approval of safety documents. The SHM is also accountable for providing expertise, opinion, and resolution to safety issues from employees; ensuring the contractor has a program in place for required safety and health training for workers within their region(s) of responsibility; assisting with investigation of accidents and near-misses; ensuring the contractor has a medical surveillance program in place that meets requirements and is followed; and conducting hazard assessments documented through the generation of site-specific AHAs.

4.2.6 Site Safety and Health Officer

4.2.6.1 The SSHO is accountable for ensuring on-site adherence to the APP/SSHP by contractor employees and subcontractors; mitigating unsafe work conditions; proper application of monitoring equipment; leading initial on-site investigations of accidents, near misses, and occupational illnesses; providing incident reports to project management; confirming qualifications and training of on-site personnel; performing on-site safety-related briefings; coordinating health and safety monitoring and APP compliance with subcontractors; inspections; and investigating on-site hazardous conditions.

4.2.6.2 The SSHO may designate a supporting collateral duty Designated Representative from each individual subcontractor for appropriate communication of safety-related hazards, controls, and process revisions. The resume and certifications for the SSHO are provided in **Attachment C**.

4.2.7 Supervisors and Employees

4.2.7.1 Supervisors are accountable for ensuring employees receive training in hazard recognition and safe work practices, periodically monitoring activities to ensure conformance with training, investigating/reporting incidents, investigating employee reports of hazardous conditions, and mitigating hazardous conditions. Employees, including subcontractors, are accountable for following the training, following safe work practices, notifying the SSHO and supervisors of new hazardous conditions, reporting incidents, and participating in pre-task/pre-entry/on-site training. Specific safety responsibilities of subcontractors are addressed in Chapter 5.

4.3 TRAINING REQUIREMENTS AND EQUIVALENCIES

4.3.1 Training and competency requirements for site personnel are presented in Chapter 6. This includes the applicability of the OSHA 30-Hour classes, requirements stated in EM 385-1-1 Chapter 01.A.17, and ensuring that training includes the following topics or equivalent topics: (a) OSHA Act/General Duty Clause; (b) 29 CFR 1904, Recordkeeping; (c) Subparts C, CC, D, E, F, K, and M of OSHA; and (d) Rigging, load handling equipment, welding and cutting, excavations, concrete and masonry, demolition, health hazards in construction, materials handling, storage and disposal, hand and power tools, motor vehicles, mechanized equipment, steel erection, and stairways and ladders or any others that are applicable to the work being performed.

4.3.2 No work will occur beyond those topics presented above. The Chapter 9 sub-plans and the hazard analysis process evaluate each of the Chapter 2 tasks and have determined the applicability of the training and proof-of-competency required. Training requirements are presented in Chapter 6 and proofs-of-competency are presented in **Attachment C**.

4.4 COMPETENT AND/OR QUALIFIED PERSONS

4.4.1 The following personnel are designated as Competent and/or Qualified Persons to complete the scope of services. Proof-of-competency is provided using resumes and certifications provided in **Attachment C** and required trainings and certifications are presented in Chapter 6. The designated competent/qualified persons are included in the AHAs provided in **Attachment A**. The SSHO will maintain copies of personnel certifications on the project site and supplement **Attachment C**. The personnel, roles, and their competencies are presented in **Table 4-2**.

4.4.2 Competent or Qualified Persons provided by subcontractors will be identified prior to the initiation of that task and will be presented in the AHAs. All personnel will need to satisfy the training, certification, and inspection requirements highlighted in Chapters 5, 6, and 7, respectively. Any additional competent or qualified persons identified prior to initiation of a task will be provided in subsequent addenda.

4.5 REQUIREMENTS FOR PRE-TASK SAFETY AND HEALTH ANALYSIS

4.5.1 The SHM has evaluated the activities associated with implementation of the site work and have determined potential hazards associated with the activities. The results of the hazard analysis and hazards are documented using AHAs (**Attachment A**). As part of the three-phase control process, AHAs will be submitted and accepted at or before the pre-mobilization preparatory meeting. In addition, site personnel will be required to review this APP and associated supplemental plans and will be given a pre-entry/pre-construction briefing on the contents of the APP and associated supplemental plans. The SSHO will provide the pre-entry/pre-construction briefing, which will include discussion of site description; site control measures; Emergency Response Plan and procedures; general and task-specific hazards and hazard controls including AHAs; task-specific personal protective equipment (PPE) requirements; task-specific environmental monitoring requirements and action levels; lines-of-authority and communication; stop-work authority in cases of safety non-compliance; Hazard Communication Program; location of hazardous materials; identification and recognition of hazardous materials; physical and health hazards of hazardous materials; and protective measures when working with hazardous materials.

4.6 REQUIREMENTS FOR INITIAL ACTIVITY HAZARD ANALYSIS SUBMISSION AND ACCEPTANCE

4.6.1 AHAs are not required to be submitted concurrently with the APP or associated required attachments; however, all AHAs will be submitted and accepted at or prior to the preparatory meetings. All AHAs will be resubmitted if the field methodology changes require an increase in the RAC score and/or if the increase in the RAC score results in a high-risk task or activity.

4.7 REQUIREMENT FOR WORK STOPPAGE WITHOUT COMPETENT PERSON

4.7.1 No work shall be performed by the contractor unless a designated competent person and/or SSHO is present on the jobsite. All site personnel have stop-work authority. Competent persons required to complete site work are listed in **Table 4-2**.

4.8 NON-COMPLIANCE WITH SAFETY REQUIREMENTS

4.8.1 The contractor requires that employees and its subcontractors shall adhere to this APP and associated supplemental plans.

4.8.2 Progressive disciplinary action is used to deal with non-compliance issues. For contractor employees, this includes the following:

- First offense will warrant a verbal warning, explanation of why the activity was non-compliant, and reference the section of the APP the activity lacking compliance was presented.

- A second offense, if it is of the same nature, will warrant a written warning and may lead to removal from the jobsite. If the second offense is not the same non-compliance issue as the first, additional explanation of why the activity was non-compliant will be discussed and the employee will be required to re-review the APP.

- A third offense will lead to removal from the jobsite.

- If additional offenses are perpetrated on other project sites, the employee may be suspended or terminated.

4.8.3 If subcontractors are non-compliant with safety requirements, they will be given verbal and written warnings for the first two offenses. If additional offenses occur, the subcontractor may be removed from the project site.

4.9 LINES-OF-AUTHORITY

4.9.1 The contractor maintains separate lines-of-reporting for technical task management and safety in order to limit conflicts of interest between the need to maintain safety and maintain project deliverables, budget, and schedule. Safety personnel have the authority to require and implement changes with regard to site safety and all site personnel maintain stop-work authority. The Corporate Quality Assurance (QA)/Quality Control (QC) Officer, in addition to the SSHO, can request changes to the APP. The Corporate QA/QC Officer will inform the Program Manager and PM of the required changes.

4.9.2 If there is disagreement between safety and management at the SSHO and Project Management level, the disagreement will be elevated to the Corporate QA/QC Officer, SHM, and the Program Manager for resolution. The Corporate QA/QC Officer, SHM, and the Program Manager have the ability to elevate safety issues to the contractor’s President/Chief Executive Officer, if required, for resolution. Work related to the identified safety issue or hazard will not resume until a safe resolution is agreed upon. The Contracting Officer’s Representative (COR) will be notified by the PM of safety issues that result in a work stoppage or required change to the APP. **Table 4-1** and **Figure 4-1** present project personnel, their involvement on the project, the organization these individuals represent, and contact information.

4.10 COMPANY PROCEDURES FOR MANAGER AND SUPERVISOR ACCOUNTABILITY FOR SAFETY

4.10.1 The contractor’s commitment to safety and health is documented, and requirements addressed, from the time an offer of employment is made to a job applicant. Managers and Supervisors, specifically the SEAD PM, SSHO, and Field Manager/Site Superintendent, are made responsible for enforcing safety and health as part of their job descriptions. They are ultimately responsible for protecting the health and welfare of the employees, as well as minimizing the potential liability associated with on the job or work-related accidents. All personnel are responsible for following the hazard controls within the APP and supporting documents and all managers and supervisors are evaluated annually for safety compliance.

4.10.2 A manager or supervisor has the authority to assign and direct personnel on project tasks. As such, the PM and SSHO will possess knowledge of the correct safe procedures for tasks that will be performed under their supervision. If there is question as to the appropriate safety measures from any person involved with the SEAD project that the SSHO or PM cannot answer, the SSHO or PM will seek assistance from the SHM. If any task cannot be accomplished safely, it will not be attempted.

4.10.3 In addition, at a minimum of once per year, each employee’s performance is formally evaluated in the following areas: personal commitment to safe work practices, adherence to established health and safety plans and programs, ability to recognize safety hazards, communication skills, acquisition and proper use of PPE and monitoring equipment, and proper budgeting for safety and health aspects in projects. The PM keeps the evaluations on file in the site-specific project folder.

4.10.4 Unsatisfactory performance in any of the above areas by SEAD supervisors or managers (SEAD PM, Deputy PM, SSHO, and Field Manager) is addressed through implementation of performance improvement plans, mandatory additional training, lower overall compensation, and, if appropriate, termination.

4.11 REQUIREMENTS FOR PRE-TASK SAFETY AND HEALTH ANALYSIS

4.11.1 The SHM has evaluated the activities associated with implementation of the site work and has determined potential hazards associated with the activities. The results of the hazard analysis and hazards are documented using AHAs (**Attachment A**). In addition, site personnel will be required to review this APP, review associated supplemental plans, and will be given a pre-entry/pre-construction briefing, or site indoctrination, on the contents of the APP and associated supplemental plans. The SSHO will provide the pre-entry/pre-construction briefing, which will include discussion of the following items:

- Site description
- Site control measures
- Emergency Response Plan and procedures
- General and task-specific hazards and hazard controls including AHAs
- Task-specific PPE requirements
- Task-specific environmental monitoring requirements and action levels
- Lines-of-authority and communication
- Stop-work authority in cases of safety non-compliance
- Hazard Communication Program
- Location of hazardous materials
- Identification and recognition of hazardous materials
- Physical and health hazards of hazardous materials
- Protective measures when working with hazardous materials

Table 4-1. Contact Information of Key Personnel

Project Personnel	Role	Primary Location/ Time Zone	Email Address	Phone Number
CEHNC/CENAN				
Todd Henderson	CEHNC, KO	Huntsville/CDT	Jeffrey.T.Henderson@usace.army.mil	256-895-3953
Hud Heaton, P.E.	CEHNC, COR/PM	Huntsville/CDT	Charles.H.Heaton@usace.army.mil	256-895-1657
Christy Tallant	CEHNC, Contract Specialist	Huntsville/CDT	Christy.N.Tallant@usace.army.mil	256-895-3953
Chris Gallo	CENAN, PM	Huntsville/CDT	Christopher.T.Gallo@usace.army.mil	917-790-8230
Barry Hodges	CEHNC, Technical Manager	Huntsville/CDT	Barry.A.Hodges@usace.army.mil	256-895-1894
Alexandria Chesnut	CEHNC, Chemist	Huntsville/CDT	Alexandria.R.Lambert@usace.army.mil	256-895-1392
Tony Isadore	CEHNC, OE Safety Specialist	Huntsville/CDT	Anthony.N.Isadore@usace.army.mil	256-895-8098
Chad Wood	CEHNC, Project Geophysicist	Huntsville/CDT	Chad.M.Wood@usace.army.mil	256-895-1399
Jim Moore	CENAN, Base Environmental Coordinator	Huntsville/CDT	James.T. Moore@usace.army.mil	347-271-0226
Regulators				
Bob Morse	EPA - Remedial Project Manager	New York/EDT	Morse.Bob@epa.gov	212-637-4331
Melissa Sweet	NYSDEC- Remedial Project Manager	Albany/EDT	Melissa.Sweet@dec.ny.gov	518-402-9614
EA				
Rick Hanoski	Program Manger	Hunt Valley/EDT	rhanoski@eaest.com	410-584-7000
Ivy Harvey	Deputy Program Manager	Hunt Valley/EDT	iharvey@eaest.com	410-527-2438
Frank Barranco	Corporate QA/QC Manager	Hunt Valley/EDT	fbarranco@eaest.com	410-329-5137
Robert Casey	Business Unit Director	Syracuse/EDT	rcasey@eaest.com	315-565-6550
Adrian Hughes	SHM	Hunt Valley/EDT	ahughes@eaest.com	410-527-2059
Tim Reese	PM	Abingdon/EDT	treese@eaest.com	410-329-5185
Brenda Nuding	Project Chemist	Portland/PDT	bnuding@eaest.com	808-589-1455
Don Conan	Project Senior Engineer	Syracuse/EDT	dconan@eaest.com	315-565-6551
Frank DeSantis	Technical Manager	Syracuse/EDT	fdesantis@eaest.com	315-656-6550
Mike Wright	SSHO	Syracuse/EDT	mwright@eaest.com	315-565-6572
Grant Reeder	Field QC Manager	Syracuse/EDT	greeder@eaest.com	315-565-6570
Amanda Kohn	Field Geologist	Syracuse/EDT	akohn@eaest.com	315-431-4610

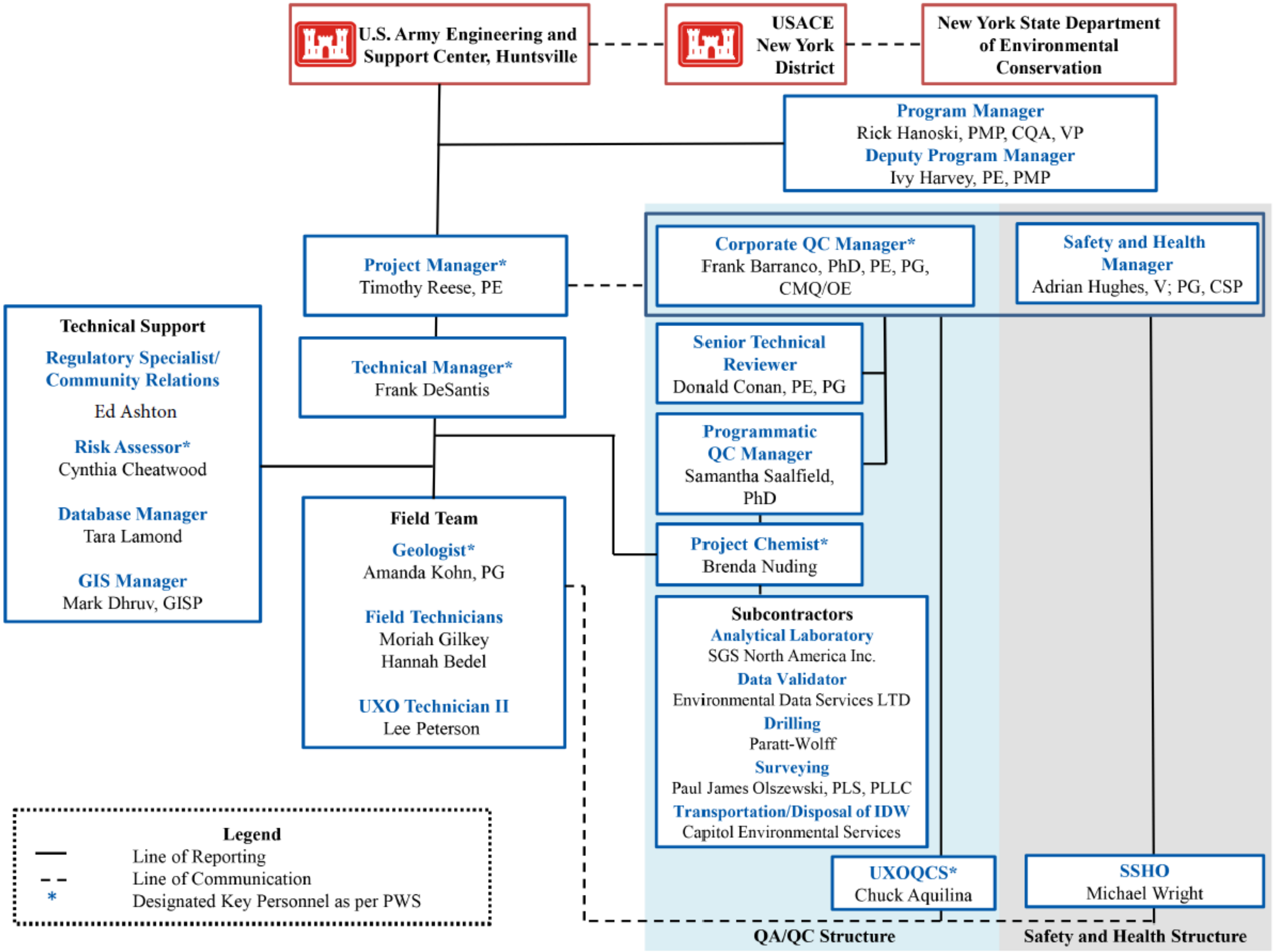
Notes:
CDT/CST = Central Daylight Time/Central Standard Time
CENAN = USACE-New York District
EDT/EST = Eastern Daylight Time/Eastern Standard Time
EPA = U.S. Environmental Protection Agency
PDT/PST = Pacific Daylight Time/Pacific Standard Time
KO = Contracting Officer
NYSDEC = New York State Department of Environmental Conservation

Table 4-2. Competent and/or Qualified Persons

Role	Name(s)	Activities
Safety and Health Manager	Adrian Hughes, PG, ASP, CSP	Program SHM. Review and approval of the APP and SSHP, hazard identification, resolution of unanticipated safety issues, and forwarding safety documents and/or resolutions to USACE for acceptance. Responsible for field audits and training.
Site Supervisor/Technical Manager	Frank DeSantis	Site management, execution of field tasks
SSHO	Mike Wright	Overall safety for contractor; site walk and survey; equipment usage; air and personal monitoring; PPE (selection, compliance, training); IDW management; site mobilization and restoration. The SSHO will also perform personal monitoring (air and temperature-related stress); equipment operation; PPE compliance; inspections; with support from the Designated Representative.
Field QC Manager	Grant Reeder	Overall QC officer for contractor personnel.
Unexploded Ordinance Quality Control Specialist	Chuck Aquilina	Documents explosives safety status of materials prior to final disposal. Develops and implements the project's QC plan for MEC-related activities, conducts and documents QC audits of MEC-related activities, and prepares QC reports. Identifies, documents, reports, and ensures completion of corrective actions, as needed, for MEC-related activities.
Designated Representative(s)	All Field Support Staff	Personal monitoring (air and temperature-related stress); support SSHO with documentation. Perform supplementary safety-related tasks at discretion of Safety and Health Manager and SSHO.
Geologist	Amanda Kohn	Competent person for ensuring field sampling, quality assurance, and project work occur in accordance with approved project plans.

Notes:
MEC = Munitions and explosives of concern
Competent persons are presented on AHAs (**Attachment A**).
Qualified persons, as described in EM 385-1-1 Chapter 18, are required to complete the operation of vehicles, machinery, and equipment.
Subcontractors and suppliers are presented in Chapter 5.

Figure 4-1. Lines-of-Authority for EA Corporate and Site Activities (Safety)



This page left intentionally blank

5. SUBCONTRACTORS AND SUPPLIERS

5.1 IDENTIFICATION OF SUBCONTRACTORS AND SUPPLIERS

5.1.1 Subcontractors currently identified to assist in implementation of the project include:

- Analytical Laboratory – SGS North America, Inc.
- Data Validator – Environmental Data Services
- Drilling – Paratt-Wolff
- Surveying – Paul James Olszewski, PLS, PLLC
- IDW Transportation and Disposal – Capitol Environmental Services

5.1.2 Drilling, surveying, and IDW transportation tasks performed on site are expected to involve subcontractors onsite. EA staff will accompany subcontractors while on site. The surveyor and drilling subcontractors will be on site to assist with soil boring services. Applicable SEAD sites, which will have soil boring activities are detailed in **Table 2-1**. IDW services will occur during soil boring and groundwater services, which have been identified for SEAD sites, located on **Table 2-1**. Off-site work conducted by subcontractors (e.g., equipment providers and analytical laboratories) is not covered by this APP.

5.2 SAFETY RESPONSIBILITIES OF SUBCONTRACTORS

5.2.1 The drilling, surveying, and IDW subcontractors will review the safety requirements applicable to their work detailed under this APP before mobilizing to the site to perform services. Additionally, all subcontractors, expecting to perform services will be required to sign an APP review record, provided in **Attachment D** of this APP during the tailgate safety meeting.

This page intentionally left blank

6. TRAINING

6.1 The contractor will ensure site personnel and supervisors have received the required training to complete the pertinent phases of work in a manner that is consistent with the Safety and Health Policy goals and objectives highlighted in Chapter 3, and state and federal standards. All employees and supervisors working on this project receive safety and occupational health training upon hire and annually thereafter.

6.2 The SSHO will ensure that all employees engaged in site operations are informed regarding the nature and degree of exposure to chemical, physical, and biological hazards likely to result from participation in site operations. The contractor will accomplish this by ensuring that all personnel entering the site have received the appropriate training required to safely complete site-specific work prior to participation in site activities. OSHA-required training will be conducted prior to site mobilization and is documented through the certificates presented in **Attachment C**.

6.3 The contractor will conduct daily safety briefings summarizing site-specific activities and the training required to complete the on-site work. Site workers will have received the required training prior to the start of involvement in site activities and are required to attend daily safety briefings. Documentation of training, update frequency of training, time of initial training, training types, and personnel receiving the training are presented in **Table 6-1**.

6.4 The SSHO will brief all visitors to the site on the site hazards and controls. All visitors will be required to sign a visitor log and will be always escorted by the SSHO or Site Superintendent when work is occurring, or hazards are present.

Table 6-1. Mandatory Training and Certifications

Personnel	Training	When	Update Frequency(1)	Documentation
No Chemical Hazards Exposure	Pre-Entry Site Briefing Site Indoctrination	Initially	As hazards increase	APP Indoctrination
Visitors and Authorized Entrants	Visitor Briefing (by SSHO) (Escort by SSHO or Site Supervisor)	Prior to observing on-site work	Once per visit	Visitor's Log
Workers Exposed to COCs	Safety and Occupational Health Training (29 CFR 1910.120 (e)-compliant 40-Hour HAZWOPER)	Upon hire	See 8-Hour Refresher	Corporate Files
40-Hour Trained Personnel	Annual Health and Safety Refresher (29 CFR 1910.120 (e)-compliant 8-Hour HAZWOPER Refresher training)	One year after initial training	Annually after 40-Hour HAZWOPER	Corporate Files
$\geq$2 Personnel	First aid/CPR (in person, not online)	Initially	Bi-annually	Corporate Files **Attachment D**
First aid/CPR Providers	OSHA 1910.1030-Compliant Bloodborne Pathogen Training	Initially	Annually	Corporate Files
SSHO	8^+ hours of annual/formal safety training over 4-year period	Rolling aggregate	4-Year Total	Corporate Files
	8-Hour Supervisor Training (includes 8-Hour HAZWOPER Supervisor Training)	Initially(2)	Does not expire	Corporate Files **Attachment D**
	OSHA 30-Hour Construction Safety Course or equivalent in addition to 40-Hour HAZWOPER	Initially	Does not expire	Corporate Files **Attachment D**
Designated Representative and/or SSHO	Personal air sampling/monitoring (Methods Presented in SSHP)	Initially	NA	Corporate Files
	Dust Monitoring (total dust)	Initially	NA	Corporate Files
	Operating photoionization detector	Initially	NA	Corporate Files
	OSHA Heat Stress Application or Wet-Bulb Globe/Physiological Monitoring	Initially	NA	Corporate Files
All On-site Personnel	Pre-Entry Site Briefing/Site Indoctrination ("General Training")	Initially	NA	APP Review Form
	3^+ days – on-the-job training	Initially	NA	Corporate Files
	Emergency Response Training (Requirements in Chapter 9.2)	Initially	Prior to on-site work	APP Review Form
	Use of fire extinguishers (Annual and Emergency Response)	Initially	Annually	Corporate Files
	PPE	Initially	Annually and if retraining required(4)	PPE Training Form
	Daily Tailgate Safety Meeting (*Topics Exceed Monthly/Weekly Meeting*)	Daily	NA	Daily Tailgate Safety Form
	Hot Environments Training	Initially	Annually	Corporate Files/ Daily Tailgate Safety Form
	COVID-19 Awareness	Initially	Annually	APP Review Form
Contractor and USACE	Safety Pre-Work Conference	Prior to on-site work	NA	Meeting Minutes

Table 6-1. Mandatory Training and Certifications

Personnel	Training	When	Update Frequency[1]	Documentation
Supervisors	Monthly Safety and Health Training and Planning Meeting[5]	Monthly	NA	Annotation on Daily Form
	8-Hour Supervisor Training	Initially	Annually	Corporate Files
Equipment Operators	Valid driver's license – operational experience	NA	Varies by Individual	Driver's License Corporate Files
	Equipment Inspection Protocols	Initially	Annually	Corporate Files/ Daily Tailgate Safety Form

Notes:

1. Currently, the contractor utilizes an automated system to notify the Director of Safety and Health/SHM and the employee when a training or certification is about to expire. Employees are required to communicate their plan to update the training/certification with the Director of Safety and Health and will be provided with resources to meet training/certification requirements. Subcontractor safety documentation will be reviewed prior to on-site work and periodically to ensure continued compliance.
2. "Initially" indicates either upon hire or prior to on-site work.
3. Site characterization shows no potential for concrete coring or replacement personnel to be exposed to site contaminants (present in groundwater only); therefore, in accordance with 1910.120, the activity may be carried out as a normal construction operation.
4. Retraining requirements are at the discretion of health and safety personnel based on accuracy and compliance.
5. In the event any field events last longer than 1 month.

COC = Contaminant of concern
CPR = Cardiopulmonary resuscitation
HAZWOPER = Hazardous Waste Operations and Emergency Response
NA = Not applicable

This page intentionally left blank

7. SAFETY AND HEALTH INSPECTIONS

7.1 Periodic safety and health-related inspections are required at the project site. **Table 7-1** summarizes inspectors, frequency of the inspection, and documentation. The qualifications of the inspectors stated below are presented in **Attachment C**. If a deficiency is found during the inspection process, the SSHO will note the date the deficiency was identified, a description, name of the person responsible for correcting the deficiency, the projected date of correction, and once corrected, the date the deficiency is actually resolved. This information will also be recorded in chronological order on a deficiency log posted in the site work area. The SSHO will perform a follow-up inspection and note the corrective measures taken and the date the correction was completed. The deficiency, follow-up actions, and statuses will be noted on the Daily Safety Inspection Checklist and the deficiency will be discussed during subsequent Daily Tailgate Safety Meetings. No external inspections or certifications are required to complete the work in this PWS.

7.2 A summary of inspections is presented in **Table 7-1**, and the forms to document the inspections are presented in **Attachment D**.

Table 7-1. General Safety and Health Inspection Requirements

Personnel(1)	**Inspection**	**Timing**	**Documentation(3)**
SSHO (Assisted by Designated Representative)	General Site Conditions (e.g., vehicles, documents, etc.)	Initial and Daily	Initial and Daily Safety and Health Inspection Checklist Health and Safety Activity Report
	PPE	Initial and Daily	Initial and Daily Safety and Health Health and Safety Activity Report Dispose of PPE, if faulty
	Emergency Equipment: • Fire extinguisher • First aid kit • Portable eyewash containers	Initial and Monthly	Initial Safety and Health Inspection Monthly Safety and Health Inspection
	Exposure hours	Daily (Monthly)	Site Entry and Exit Log (Logged daily and reported monthly)
	Physiological monitoring (heat stress prevention) (Employees in Level D)	**Tables 9-5 and 9-6**	Daily Environmental Monitoring Record
	Physiological monitoring (heat stress prevention) (Employees in Level C)	**Tables 9-5 and 9-6**	Daily Environmental Monitoring Record
	Air temperature, wind speed, inclement weather risk	≥2x Daily	Daily Environmental Monitoring Record
	Personal Sampling Pumps	≥2x Daily	Daily Environmental Monitoring Record
	Respirators and cartridges	Daily	Respirator Logs and Cartridge Logs
	Deficiency tracking and associated Inspection(s)	Daily	Deficiency Tracking Log Deficiency Tracking Safety Inspection
	Excavations	Daily/ Changes	Daily Safety and Health Inspection
	General safety and health	Daily	Daily Safety and Health Inspection
All Employees	PPE	Before use	None; dispose of PPE, if faulty
	Hand tools and equipment	Before use	None; dispose of faulty equipment/supplies.
Project QC Manager	QC Officer review of safety	Daily	Daily Safety and Health QC Form
SHM	Fire Prevention Plan Survey	Annual	Fire Prevention Plan Audit
	Safety and Health Audits	Random	Contractor Corporate Audit Forms
	Fire prevention	Annual	Contractor Corporate Audit Forms
Equipment Operators	Mobile equipment and attachments (**Attachment D**)	Daily	Daily Equipment Inspection Form(s) Note: Model-Specific

Notes:

1. Personnel associated with titles are presented in Chapter 4.
2. Monitoring frequency is weather-dependent and presented in the SSHP (**Attachment E**). Only applies during outdoor work or when work is occurring by employees in Level C.
3. Any deficiencies and related information will also be recorded in chronological order on a deficiency log posted in the site work area in accordance with Chapter 7.
4. Due to the current COVID-19 pandemic, the contractor is performing audits at a more frequent level and virtually. This will be denoted on the audit forms if this occurs.

8. MISHAP REPORTING AND INVESTIGATION

8.1 The contractor will track exposure hours, mishap notifications and reporting, and accident investigations at the Former Seneca Army Depot site. The contractor will monitor employee exposure hours using the Site Entry and Exit Log (**Attachment D**). Site personnel are required to sign-in and sign-out each time they enter and exit the site. These hours will be compiled monthly by the SSHO and will be provided to the contractor Program Manager on the first workday of the month. The contractor Program Manager will provide these data to the USACE PM by the 10th day of the subsequent month.

8.2 FIELD EXPOSURE DATA REPORTING

8.2.1 The contractor will report contractor field exposure hours (total hours on-site including unpaid hours and individual subcontractor hours) monthly to USACE. Reporting will be completed by the contractor PM or their designee.

8.3 MISHAP REPORTING AND INVESTIGATION

8.3.1 A mishap is defined as any unplanned, undesired event that occurs during the course of work being performed. Mishaps include accidents, incidents, and near misses. Employees will immediately report all mishaps to the SSHO who will report the accident to the PM, Supervisors, Program Manager, Director of Safety and Health/SHM, Corporate QA/QC Officer, and Human Resources. The SSHO will complete the Accident/Loss Report (**Attachment D**) and submit it immediately to the Director of Safety and Health and the PM. The PM will report to the USACE PM/COR. All recordable mishaps must be communicated to the USACE PM/COR as soon as possible and within 24 hours of the accident with the exception of the following events, which must be reported immediately: fatality, permanent partial or total disability, hospitalization of one or more people from a single incident, or property damage of $500,000 or more.

8.3.2 The contractor is also responsible for reporting property damage (exceeding $5,000 is recordable), days away injuries, days away illnesses, and restricted/transfer injuries to USACE. In addition, the contractor is responsible for reporting any fatality to the State Occupational Health and Safety Bureau within 8 hours and any inpatient hospitalization, amputation, or eye loss within 24 hours.

8.3.3 Any mishap occurring in any of the following high hazard areas will be immediately reported to the USACE PM/COR:

- Electrical (e.g., arc flash, electrical shock, etc.)
- Uncontrolled release of hazardous energy (electrical and non-electrical)
- Load handing equipment or rigging
- Eye injury

- Hand injury
- Fall-from-height (any level than the same surface)

8.3.4 The above mishaps will be investigated in depth to identify all causes and to recommend hazard control measures.

8.3.5 An accident investigation will be conducted for all mishaps. Reportable accidents will be investigated by the SHM including occupational injuries and illnesses; accidents resulting in significant loss or damage to property; accidents involving vehicles whether or not they result in damage to property or personnel; and accidents in which there may have been no injury or property damage, but which have a high probability of recurring with at least a moderate risk to personnel or property (near miss). Minor accidents will be investigated by the SSHO. An accident investigation will be used to determine and implement corrective actions, identify the causal factors contributing to the accident, identify deficiencies to the APP, provide information to identify trends or problem areas, and follow requirements for Workers' Compensation and/or OSHA recordkeeping and reporting. Results of the accident investigation along with the appropriate corrective actions will be sent to the USACE PM as soon as possible and within 5 working days using the USACE Accident Investigation Report.[1]

8.3.6 The SSHO will provide the Director of Safety and Health, SHM, Corporate QA/QC Officer, and the PM with an update once the corrective action has been implemented. The contractor PM will notify the COR of the status of the corrective action. Contact information for individuals involved in accident reporting procedures is presented in **Table 4-1** and in Chapter 9.2 under Emergency Response Procedures.

---

[1] http://www.swg.usace.army.mil/Portals/26/docs/Safety/ENGForm3394AccidentInvestigationForm.pdf.

9. SUPPLEMENTAL PLANS

9.1 FATIGUE MANAGEMENT PLAN

9.1.1 A Fatigue Management Plan has been completed for the Former Seneca Army Depot site because it is anticipated that during the life of the project, the following triggers for a Fatigue Management Plan will be met:

- Exceed 10 hours a day for more than 4 consecutive days
- Exceed 50 hours in a 7-day work week
- Exceed 12 hours a day for more than 3 consecutive days
- Exceed 58 hours a week for sedentary (to include office) work

9.1.2 Fatigue can be defined as a state of impairment that can include physical and/or mental elements. This is associated with lower alertness and ultimately reduced performance. Fatigue is the result of insufficient rest and sleep between activities and symptoms are not easily recognized. Rest is defined as a period of time during which the person concerned is off duty; is not performing work, including administrative tasks; and is afforded the opportunity for uninterrupted sleep. This does not include time for breaks, meals, or travel time to/from work.

9.1.3 Scope

9.1.3.1 All work tasks have been noted that would require fatigue management control.

9.1.4 Application

9.1.4.1 All employees are subject to fatigue; however, equipment operators and motor vehicle operators are the primary focus because of the use of equipment or vehicles that can put others in harm’s way. A minimum of 8 consecutive hours of rest between shifts in a 24-hour period is required for equipment and motor vehicle operators.

9.1.4.2 Equipment operators are defined as operators of equipment, including but not limited to the following that may be found on-site hoisting equipment and draglines, mobile construction equipment, electrical power systems, and hydraulically operated equipment. These operators are not permitted to exceed 12 hours of duty time in any 24-hour period, including time worked at another occupation.

9.1.4.3 Motor vehicle operators are defined as operators of motor vehicles, while on duty. These operators shall not operate vehicles for a continuous period of more than 10 hours in any 24-hour period; no employee, while on duty, may operate a motor vehicle after being in a duty status for more than 12 hours during any 24-hour period.

9.1.5 Evaluation of Risk

9.1.5.1 Generally, activities will not consistently exceed the hours above; therefore, the level of risk is determined to be low. If site hours or site conditions change, then the risk evaluation will be updated and submitted as an addendum.

9.1.6 Controls

9.1.6.1 Controls for fatigue may include work scheduling (limit number of consecutive night shifts), rotating jobs to prevent repetitive work, breaks at critical times in the work cycle, control of environmental factors (heat, cold, and use of PPE), buddy check-in for individuals working alone, and alternate transportation for long commutes. Extensive commute times are prevalent between primary offices and the work site.

9.1.6.2 Two types of fatigue controls can be used: administrative controls and workplace controls.

9.1.6.3 Administrative Controls:

- Alternate work tasks
- Allow for more frequent or longer breaks
- Alternative commutes
- Healthy food (lower sugar)
- Administrative employees take a walk
- Alternating, limit, or eliminating night shifts
- Schedule high risk tasks when most alert.

9.1.6.4 Workplace Controls:

- New fatigue mats
- Adequate lighting
- Lifting devices
- Work assistance in lifting and holding
- Good ventilation, either cool or heat depending
- Ability to move around every hour or so

- Use of PPE
- Alarms or monitors.

9.1.7 Training

9.1.7.1 Training shall include symptoms of fatigue, habits, and actions the worker may take to avoid fatigue, actions workers should take if they observe fatigue in a co-worker, and controls in place to prevent fatigue. This training will be integrated into the safety kickoff and periodically throughout the life of the project in Daily Tailgate Safety Meetings.

9.1.8 Procedures

9.1.8.1 The following procedures will be utilized for work tasks identified as having a risk of fatigue:

- Work tasks will be planned to eliminate or minimize fatigue, including utilizing the controls discussed in Chapter 9.1.4.
- Workers will be provided with adequate breaks.
- Workers will be encouraged to arrive to work in a rested state (ideally 8 hours of sleep, at least 5 hours of interrupted sleep).
- Symptoms of fatigue and work hours for equipment and vehicle operators will be monitored by employees and the SSHO. Symptoms include excessive yawning, reduced alertness, and reduced reaction time.

9.1.8.2 If a fatigued employee is identified, their task will be re-assigned to a non-fatigued employee. The fatigued employee will be safely transported (vehicle operated by other) to an area for rest.

9.2 EMERGENCY PLANS

9.2.1 An emergency is defined as a situation that requires calling outside help onto a job site. Depending on the phase of work, field personnel will immediately stop work and report to the Site Supervisor/SSHO under the following situations: medical emergency, fire emergency, spill emergency, discovery of unanticipated hazards (e.g., drums, heavily contaminated materials), heavy equipment accident, overexposure of personnel to on-site contaminants requiring Emergency Medical Services, or heat/cold-related injury or stress requiring Emergency Medical Services support. **Figure 9-2** contains the site evacuation route.

9.2.2 Personnel are prohibited from working alone and will always abide by the buddy system and continue work within similar zones of work. No Civil Disaster Emergency Operations will occur as part of this Scope of Work (SOW).

9.2.3 Procedures and Tests

9.2.3.1 Prior to work startup, personnel will be familiar with this Emergency Response Plan. A test of cellular phone coverage will be made across the entire work area and will be conducted prior to mobilization to ensure that emergency services can be alerted in the event of an emergency.

9.2.3.2 Prior to the start of work at the site, field personnel will conduct a drill to mobilize to the rally point as determined by the SSHO prior to the start of work. Alternate rally point locations will be communicated to field personnel. Additionally, the SSHO will review the provisions of this plan during the Pre-Entry Site Briefing. The Site Supervisor/SSHO will make this plan available for review and photocopying. Emergency contact numbers are provided in **Table 9-1**. Directions to the nearest hospitals (**Figure 9-1**) will be posted in the work area and maintained in work vehicles.

9.2.3.3 In the event of an emergency, the information available at that time will be properly evaluated and the appropriate steps taken to implement the Emergency Response Procedures. The SSHO will assume command of the situation and will call the appropriate emergency services and evacuate personnel to the rally point (as indicated by SSHO) where attendance will be taken. On-site emergencies will ultimately be handled by off-site emergency support personnel (i.e., the local fire department, ambulance squad, or police, depending on the nature of the emergency) who will have authority once they arrive. Information garnered on-site will not be released to parties other than those listed in this section and emergency responders. Once emergency response agencies have been notified, the PM will then be notified immediately.

9.2.3.4 The site layout will ensure that sufficient room to maneuver site vehicles within the Support Zone is present. All vehicles will conduct back-in parking to both reduce the probability and severity of a mishap and to ensure quick egress in the event of an emergency.

9.2.3.5 Site personnel will retreat to the Support Zone rally point (where the Daily Tailgate Safety Meeting occurs daily) or evacuate at the discretion of the SSHO.

9.2.3.6 No rescue activities will occur beyond traditional first aid/CPR procedures at this site. Contact personnel for emergencies is discussed above and in Chapter 9.2.4.

9.2.4 Posting of Emergency Telephone Numbers

9.2.4.1 Emergency telephone numbers will be posted in the support zone at the jobsite and kept in support vehicles. Additional copies will be distributed to site personnel by the SSHO. The SSHO will have the phone numbers readily available on his/her person or in their vehicle. Emergency contact information is presented in **Table 9-1**.

Table 9-1. Emergency Contact Numbers

Contacts	Name	Office/Work	Mobile
Emergency Services	Ambulance, Fire, Police	911	NA
Emergency Services	Seneca County Sheriff Department	911 or 607-582-6555	NA
Emergency Services	Romulus Fire Department	911 or 607-869-5282	NA
Hospitals (24-Hour Emergency Rooms)	Geneva General Hospital	315-787-4000	NA
Program Manager	Rick Hanoski	410-584-7000	443-632-4887
Corporate Safety and Health Director	Rob Marcase	410-329-5192	717-586-9878
Safety and Health Manager	Adrian Hughes	410-527-2059	NA
PM	Tim Reese	410-329-5185	410-935-3887
Field QC Manager	Grant Reeder	315-565-6570	603-856-6124
Technical Manager	Frank DeSantis	315-656-6550	315-395-7689
SSHO	Mike Wright	315-565-6572	NA
CEHNC COR/PM	Hud Hudson	256-895-1657	NA
CEHAN, PM	Chris Gallo	917-790-8230	NA
CENNC Technical Manager	Barry Hodges	256-895-1894	NA
Poison Control	NA	800-222-1222	NA
EPA National Response Center	NA	800-424-8802	NA
AllOne Medical Services (Physician – On Call)	All One Health Resources	800-350-4511	NA
CHEMTREC	NA	800-424-9300	NA
Federal OSHA Hotline	NA	800-321-6742	NA

Figure 9-1. Hospital Map and Directions from Former Seneca Army Depot to Geneva General Hospital (24-Hour Emergency Room)

Head west on Seneca Army Depot toward North-South Baseline Road
(0.8 miles)

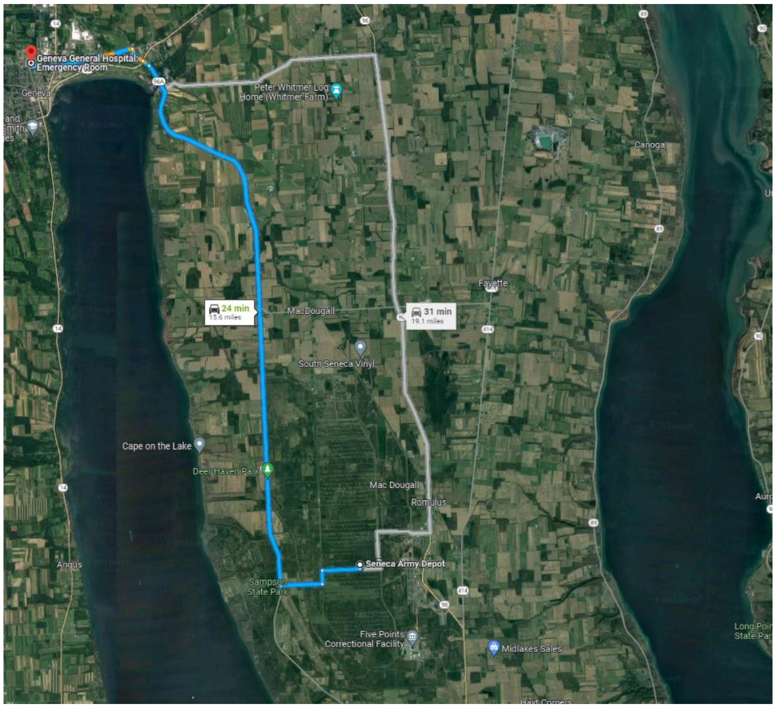
Turn left onto North-South Baseline Road (0.3 miles)

Turn right onto Smith Farm Road/Smith Vineyard Road
(0.8 miles)

Turn right onto NY-96A North
(11.2 miles)

Keep left to stay on NY-96A North
(0.2 miles)

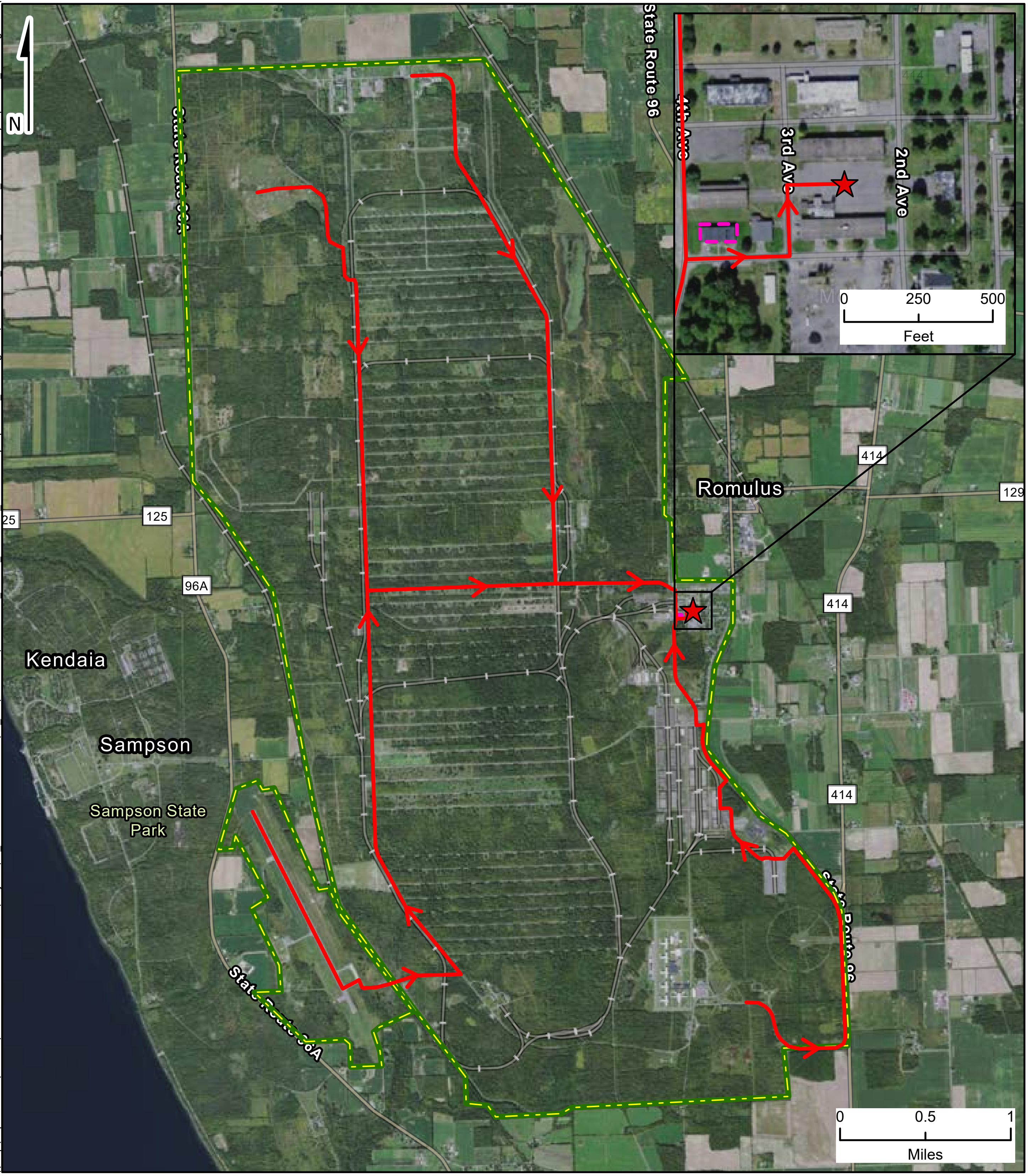
Take Border City Road and E North Street to your destination in Geneva
(6.0 miles)

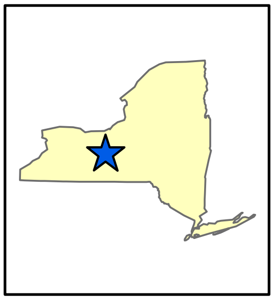


Record of Communication with Hospital:

Person Calling Hospital	Date	Result of Call
Patrick Gannon	20221018@ 1051 EST	1. Hospital will accept personnel from the site. 2. Personnel did not state desire to visit location. 3. Personnel reiterated COVID-19 may affect availability of beds within the Intensive Care Unit.

\\eafp\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01_Seneca O&M and LUCs\05_GIS\PROJECTS\637490374_USACE_Huntsville_SenecaArmyDepotLTM_PlanningDocs\637490374_USACE_Huntsville_SenecaArmyDepotLTM_PlanningDocs.aprx





Legend

- 🟩 SEAD Boundary
- ▭ Office Footprint
- — Evacuation Route
- ★ Evacuation Rally Point
- ★ Site Location

Figure 9-2
Site Layout Plan and Evacuation Route
Seneca Army Depot (SEAD)
Romulus, Seneca County, New York

Map Date:12/21/2022 10:06 AM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

This page intentionally left blank

9.2.5 Spill Emergency Response Plan

9.2.5.1 Based on a review of the proposed phases of work by the SHM, emergency response for spills will be conducted by outside emergency responders. No emergency response for spills will be handled by site personnel and emergency response for spills is not part of this PWS. Spills of materials within drums and incidental spills are discussed in **Attachment E**.

9.2.5.2 Small incidental spills of non-hazardous materials less than reportable quantities (e.g., fuel in equipment) that do not cause injury to personnel or the environment are possible and will be cleaned up as quickly as possible. Waste will be containerized and disposed of properly and labeled accordingly. Spill kits will be present on-site in the event of spillage of fluids from site vehicles or during refueling of site vehicles during daily operations. Safety data sheets (SDSs) (**Attachment F**) will be reviewed prior to addressing the spill. This written plan applies to all employees. No testing of the recovered materials will be required based on the lack of a hazard. No escape routes or procedures will be required, nor will critically plant operations (and the related emergency evacuation) be required. No rescue or medical duties are required beyond the first aid/CPR training (and associated bloodborne pathogen training) required on-site for other tasks.

9.2.5.3 Based on the materials contained within the drums used for IDW as dictated by previous groundwater sampling results, a spill of the contents of the drums will not be considered an emergency. Procedures, hazards, and controls for managing a broken, leaking, or spilled drum are discussed in Chapter 2 and the SSHP (**Attachment E**).

9.2.6 Firefighting Plan/Fire Emergency Response Plan

9.2.6.1 Site personnel will not attempt to handle a fire/explosion emergency. The SSHO will take measures to reduce injury and illness, primarily by evacuating personnel as quickly as possible. The SSHO will then notify the PM. Site personnel will evacuate the area and gather/meet at the rally point (as indicated by the SSHO). The SSHO will be responsible for identifying if any site personnel did not gather at the rally point.

9.2.6.2 The Firefighting Plan will be presented by SSHO and reviewed by site workers as part of the Pre-Entry Site Briefing (Chapter 6). In addition, the Director of Safety and Health, the contractor’s designated authority for fire prevention and emergency response, prepares the fire hazard evaluation program, which is reviewed by contractor employees during annual employee safety and occupational health training.

9.2.6.3 As part of this plan, the SHM has evaluated the operations and type(s) of equipment/materials to determine potential fire or explosion hazards and will convey this information to site personnel through the SSHO. Training requirements are listed in **Table 6-1**. A fire and/or explosion will be immediately recognized as an emergency. Emergency services (fire, police, and ambulance) will immediately be notified by the SSHO (emergency numbers are provided in **Table 9-1**). A copy of the emergency numbers will be included in the site support vehicle.

9.2.6.4 Cleanup after such events may require specialized services and are not covered by this APP/SSHP. The PM will establish proper cleanup actions through coordination with emergency services personnel, with input from the USACE PM. Emergency contact information is presented in **Table 9-1**.

9.2.7 Posting of Emergency Telephone Numbers

9.2.7.1 Emergency telephone numbers will be posted in the support zone at the jobsite and additional copies will be kept in site support vehicles. Emergency contact information is presented in **Table 9-1**.

9.2.8 Plan for Prevention of Alcohol and Drug Abuse

9.2.8.1 Employees are strictly prohibited from any activity related to using, possessing, manufacturing, selling, transporting, distributing, storing, concealing, and/or dispensing any controlled or illegal substances, as defined by federal or state law, on the premises of the contractor's property, while conducting contractor business (including travel), during contractor-sponsored activities, or in off-the-job activities. This includes places of public accommodation or recreation, restaurants, and common carriers. Violation of this policy will result in immediate removal from the site and appropriate disciplinary action, up to and including termination of employment. If the employee is observed by another employee as not "fit-for-work" for any reason, contact the employee's immediate Supervisor or Corporate Human Resources as the situation will be managed as any other performance problem. The contractor may drug test/screen employees at any time. Drug testing procedures are part of corporate policy and are not covered within this plan. Additionally, contractor employees are to have no expectation of privacy with respect to any property brought onto site premises or carried during travel, including air travel. Specific information can be obtained from Corporate Human Resources. No part of this plan grants employees contract rights or changes their status as "at-will" employees.

9.3 SITE SANITATION/HOUSEKEEPING PLAN

9.3.1 ***Housekeeping*****—**The work area will be kept as clean as possible including frequent trash removal and efforts to keep pathways clear of materials and debris. Efforts will be made to move all equipment and supplies daily and to prevent equipment and personnel from traversing the site form contacting materials and/or debris.

9.3.2 ***Drinking Water*****—**Adequate bottle drinking water will be provided to all site workers and will be stored in coolers within dedicated site vehicles and in the support zone of each work area. Sufficient quantities will be provided to ensure a minimum of 4 ounces per worker per work hour on-site. Drinking water will be supplemented with electrolyte beverages.

9.3.3 ***Non-Potable Water*****—**No non-potable water will be utilized for dust suppression activities and will not be consumed by site personnel.

9.3.4 ***Toilets*****—**Restrooms are anticipated to be within 10 minutes of the site at all times by vehicle; however, if/when these conditions are not maintained, portable restrooms (via trailer) will be provided to ensure sanitary conditions are met. COVID-19 controls will include abundant handwashing and hand sanitation facilities using site control vehicles.

9.3.5 ***Washing Facilities*****—** Each vehicle and the support zone will also be furnished with a bottle of hand sanitizer and eyewash container in addition to the hand washing facilities.

9.3.6 ***Showers and Food Service*****—**No showers or food service area is necessary for the completion of site activities.

9.3.7 ***Waste Disposal*****—**All municipal wastes (trash, dunnage, etc.) will be removed from the site in a timely manner from adequately located waste receptacles to prevent a health hazard.

9.4 MEDICAL SUPPORT AGREEMENT

9.4.1 Less than 100 personnel will be required on-site to complete this job; therefore, on-site medical support is not required for this project. At least two people currently trained in first aid/CPR will be present on-site. Training requirements are presented in Chapter 6. Off-site medical support will be provided by professional medical services presented in **Table 9-1** and **Figure 9-1**. Medical facilities identified in **Table 9-1** have been contacted to confirm that injured employees will be able to receive prompt treatment. No work tasks with a high or extremely high RAC on the AHAs have been identified; therefore, arrangements do not need to be confirmed in writing.

9.5 BLOOD-BORNE PATHOGEN PROGRAM AND EXPOSURE CONTROL PLAN

9.5.1 This site-specific plan will be applied in conjunction with the Contractor’s Corporate Bloodborne Pathogen Exposure Control Plan and OSHA 29 CFR 1910.1030, which will be available for consultation by site employees. This plan applies to personnel who will potentially be providing first aid/CPR as the completion of the work required in the PWS will not expose site personnel to bloodborne pathogens. OSHA definitions relating to bloodborne pathogens are covered during training.

9.5.2 Based on a review of the work required, only site personnel providing first aid/CPR will potentially be exposed to bloodborne pathogens. Universal precautions and PPE will be used by providers of first aid/CPR to prevent contact with blood or other potentially infectious materials when working with employees who have an injury or in areas where the injury may have contaminated surfaces. PPE required for the program is presented in Chapter 5 of the SSHP (**Attachment E**). No decontamination of PPE will occur; all PPE will be disposed. Work areas will be kept clean and sanitary and will be decontaminated after contact with blood/potentially infectious materials with a dilute bleach solution. Information pertaining to the Hepatitis B vaccination series; post-exposure reporting, evaluation, and follow-up procedures; and recordkeeping practices. Training requirements are presented in Chapter 6.

9.6 EXPOSURE CONTROL PLAN

9.6.1 Based on a review of the work required in the PWS for the Former Seneca Army Depot site, only site personnel providing first aid/CPR will potentially be exposed to bloodborne pathogens. Universal precautions and PPE will be used by providers of first aid/CPR to prevent contact with blood or other potentially infectious materials when working with employees who have an injury or in areas where the injury may have contaminated surfaces. PPE required for the program is presented in Chapter 5 of the SSHP (**Attachment E**). No decontamination of PPE will occur; all PPE will be disposed. Work areas will be kept clean and sanitary and will be decontaminated after contact with blood/potentially infectious materials with a dilute bleach solution. Information pertaining to the Hepatitis B vaccination series; post-exposure reporting, evaluation, and follow-up procedures.

9.6.2 COVID-19 is addressed in Chapter 2.3.9 of the SSHP (**Attachment E**). Training requirements are presented in Chapter 6.

9.7 AUTOMATIC EXTERNAL DEFIBRILLATOR PROGRAM

9.7.1 No automatic external defibrillators will be located on-site.

9.8 SITE LAYOUT PLANS

9.8.1 No site layout plans are formally required for completion of this PWS. Operations will be conducted using site support vehicles and personnel will utilize the vehicle to access sanitation facilities.[2] No temporary construction buildings or fencing will be required due to the nature of the work area location being within public areas. No ramps, trestles, scaffolds, or platforms will be used to complete this PWS. If temporary facilities are installed, an AHA will be generated in the field, an addendum created for document tracking. The general site location was previously presented as **Figures 2-1 and 2-2**.

9.8.2 Temporary Power Distribution Approval

9.8.2.1 No temporary power distribution is needed for the completion of the PWS.

9.8.3 Temporary Ramp, Trestle, Scaffold, and Platform Approval

9.8.3.1 No ramps, trestles, scaffolds, or platforms will be used to complete the PWS.

9.9 ACCESS AND HAUL ROAD PLAN

9.9.1 An access or haul road plan will not be required to complete the investigation.

---

[2] Restrooms are anticipated to be within 10 minutes of the site at all times by vehicle; however, if/when these conditions are not maintained, portable restrooms (Chapter 9.3.4) will be provided to ensure sanitary conditions are met. COVID-19 controls will include abundant handwashing and hand sanitation capabilities using site control vehicles.

9.10 HEARING CONSERVATION PROGRAM

9.10.1 The contractor has evaluated the workplace and SOW for noise hazards and will initially and regularly evaluate potential noise hazards during the course of work. The hearing conservation program applies to all employees who are exposed to hazardous noise or ototoxic chemicals during Chapter 2 tasks. None of the following ototoxic chemicals (including arsenic, carbon disulfide, carbon monoxide, cyanide, lead and derivatives, manganese, mercury and derivatives, n-hexane, Stoddard solvent, trichloroethylene, toluene, and xylenes) will be encountered during work tasks. Total lead, polycyclic aromatic hydrocarbons, and fuel-related volatile organic compounds (VOCs) have been included as COCs (**Attachment E**) within groundwater. Based on an evaluation of maximum COC concentrations and associated time-weighted averages listed in Table 2-1 of the SSHP, the required use of PPE listed in Chapter 5 of the SSHP, and the presence of COCs limited to aqueous media, no ototoxic risk was identified at the site.

9.10.2 Workers will be made aware of potential noise hazards prior to the start of tasks with noise hazards. Medical surveillance (Chapter 6 of the SSHP [**Attachment E**]) includes pre-employment and end-of-employment testing for all employees.

9.10.3 Noise Hazard Identification

9.10.3.1 Noise measurements shall be made whenever there is difficulty in communicating at distances greater than 2 feet (ft) (0.6 meters), upon worker complaint of excessive noise, or whenever hazardous noise levels are suspected. Noise assessments and/or measurements shall be performed and documented when any new facility or new equipment is placed in service and when areas that in the past were not noise hazards become noise hazardous for any reason.

9.10.3.2 Completion of the Chapter 2 tasks are anticipated to expose employees to instantaneous noise levels greater than the National Institute for Occupational Safety and Health (NIOSH) recommend exposure limit; however, noise concentrations are not anticipated to be continuous. The SHM has screened the on-site equipment versus the Federal Highway Administration Construction Noise Handbook.[3] Based on this screening, personnel outside of 50 ft of the following equipment will experience: a pickup truck (55 decibels on the A-weighted scale [dBA]), a concrete mixer truck (85 dBA), a mini excavator (85 dBA), a skid-steer front end loader (80 dBA), a dump truck (84 dBA), and a drill rig (85 dBA). Conversely, operators[4] will be exposed to noise concentrations that frequently exceed the NIOSH Recommended Exposure Limit though often not the OSHA Probable Effects Level. Based on these data and the exposures observed historically, hearing protection (subsequently discussed) will be sufficient to protect workers during the initial exposure assessment.

9.10.4 Assessment of Noise Hazards

9.10.4.1 Workplaces known or suspected to include hazardous noise will be surveyed initially, annually, and whenever site conditions change impacting noise generation. The following will be followed for the assessment of noise hazards:

---

[3] https://www.fhwa.dot.gov/Environment/noise/construction_noise/handbook/handbook09.cfm.

[4] https://www.cdc.gov/Niosh/mining/UserFiles/works/pdfs/hcensu.pdf.

- For continuous (steady state) noise and impact (impulse) noise, the instrument settings shall be in accordance with **Table 9-2**.

- Dosimeters shall measure the employee's full work shift to be considered full-shift sampling.

- Calibration of noise measuring equipment shall be in accordance with manufacturer's instructions (USACE refer to Engineer Regulation 385-1-89).

- The anticipated unit for use will be a Lutron Personal Noise Dosimeter (DS-92005). If this unit is unavailable near the time of mobilization, the updated unit(s) chosen will be submitted to the USACE for acceptance.

Table 9-2. Settings for Noise Measuring Equipment

Feature	Dosimeter (ACGIH)	Dosimeter (Department of Defense and USACE)*	Type 2 (or better) Sound Level Meter for Continuous Noise (USACE)*	Type 1 Sound Level Meter for Impulse Noise (USACE)*
Criterion Time	8 hours	8 hours	8 hours	8 hours
Criterion Level	85 dBA	85 dBA	85 dBA	85 dBA
Weighting	A	A	A	Unweighted, linear, or Z
Peak Weighting	Unweighted	Unweighted, linear, or Z	Unweighted, linear, or Z	Unweighted, linear, or Z
Threshold Level	80 dBA	80 dBA	80 dBA	140 dBA
Upper bound on integration	130 dBA	None	None	None
Time Weighting	Slow	Slow	Slow	Impulse
Exchange Rate	5 dBA	3 dBA	3 dBA	3 dBA

Notes:
* When used for the purposes of delineating noise hazardous areas or evaluating noise exposures to personnel.
ACGIH = American Conference of Governmental Industrial Hygienists

9.10.5 Exposure Standards

9.10.5.1 Work using heavy equipment often creates excessive noise. Noise can cause workers to be startled, annoyed, or distracted; it can cause physical damage to the ear, pain, and temporary and/or permanent hearing loss; and it can interfere with communication. For impact (impulse) noise, personnel exposures may not exceed 140 dBA (unweighted) without effective hearing protection devices.

9.10.5.2 No impact or impulse noise is anticipated to be encountered based on the SOW.

9.10.5.3 If workers are subjected to noise exceeding an 8-hour time-weighted average sound level of 85 dBA, hearing protection will be provided with an appropriate noise reduction rating to comply with 29 CFR 1910.95 and reduce noise levels to or below 85 dBA. Workers involved near heavy machinery operation activities are likely to be subjected to noise exceeding sound levels of 85 dBA peak sound pressure. At this level, hearing protection will be selected by the SSHO with

---

[5] https://inspectusa.com/lutron/database/pdf/ds-9200.pdf

an appropriate noise reduction ratio (NRR) to reduce noise levels to or below these values (**Table 9-3**).

Table 9-3. Non-Department of Defense Continuous Noise Exposures (OSHA Standard)

Duration per day (hours)	Permissible Sound Pressure Level (dBA)
8	85
4	88
2	91
1	94
0.5 = 30 minutes	97
0.25 = 15 minutes	100

9.10.5.4 When the daily noise exposure is composed of two or more periods of noise exposure of different levels, the combined effects must be considered. Exposure to different levels for various periods of time shall be computed according to the following formula:

$$Cn = T1 / L1 + T2 / L2 + . . . + Tx / Lx$$

where

Cn = Combined noise exposure factor.
T = Total time of exposure at a specified sound-pressure level (in hours).
L = Total time of exposure permitted at that level (in hours), from **Tables 9-3 or 9-4**, as appropriate. If the sum exceeds 1, the mixture of exposure periods exceeds the threshold limit value.

9.10.6 Noise Controls

9.10.6.1 Hearing protection will be worn when working within 50 ft of heavy equipment (e.g., skid steer) that is in operation. Adequacy of the hearing protection will be verified by utilizing a sound-level meter application with a 5 dBA safety factor to take noise level measurements. The action level will be 85 dBA for all site work, as stated above.

9.10.6.2 Elimination of noise through engineering controls is not viable on-site. Administrative controls are viable; however, they will not be used as the noise hazard may be adequately controlled using PPE and the greater physical hazard is an incident pertaining to equipment operator change outs.

9.10.6.3 The necessary controls will include hearing protection comprised of formable earplugs with a 32 dBA or greater noise reduction rating or muffs with a 30 dBA or greater noise reduction rating. Based on the NIOSH-recommended effective reduction factors, this will provide combined protection of 16 dBA and 23 dBA, respectively.

9.11 RESPIRATORY PROTECTION PLAN

9.11.1 No contractor personnel are anticipated to be donning respirators; however, the contractor SSHO will ensure training and compliance requirements have been met prior to allowing personnel to don respiratory protection. The SHM is the Respiratory Program Administrator for the contractor and will support an addendum if contractor personnel will don respiratory protection. Voluntary use of respirators will be managed under the OSHA Appendix.

9.11.2 The contractor will monitor potential respiratory hazards, will implement feasible engineering, and work practice controls to reduce the hazard, and will evaluate action levels for upgrading or downgrading respiratory protection, and personnel authorized to perform each task requiring respiratory protection. If it determined that a Respiratory Protection Plan is required for contractor personnel as work progresses a site-specific respiratory protection program, in accordance with the contractor's corporate respiratory protection program will be developed as an addendum to this APP and submitted to the Government for review.

9.11.3 Improper use of respirators can be hazardous to the employee's safety and health. Selection of the wrong equipment may result in the employee being unknowingly exposed to the hazard; and thus, inhaling harmful concentrations. Respirators that are not properly maintained, inspected, and cleaned can reduce the protection afforded, as well as cause skin irritation and place a greater strain on the respiratory system. An improper respiratory protection program may give the employee a false sense of security that could lead to harmful exposures. The purpose of this plan is to ensure that employees who must wear respirators are adequately protected, and that respirator usage complies with the requirements of the OSHA Respiratory Protection Standard (29 CFR 1910.134). **Note**: Fit testing on the exact respirator that meets respiratory protection requirements is required prior to donning respiratory protection. Site personnel have not been finalized at the time of publication of this APP; therefore, prior to site work requiring a respirator, the full resume and certification package, and fit testing completion will be submitted to USACE. No work will occur with respirators as PPE without fit testing using respirators that meet or exceed the minimum respiratory protections. Also note that no respiratory protection is anticipated if no spillage of the caustic materials occurs.

9.12 HEALTH HAZARD CONTROL PROGRAM

9.12.1 The purpose of this Hazard Communication Program is to ensure that important information regarding hazardous chemicals used, handled, or stored during the conduct of business is transmitted to employees and other affected persons as appropriate. A hazardous chemical as defined by OSHA means any chemical that is either a physical hazard or health hazard and includes hazardous chemicals generated during work operations. Chemical hazard information will be made available to employees and other affected persons, as appropriate, through the implementation of this comprehensive program, which includes container labeling and other forms of warning, collection, and compilation of SDSs, and training. A summary of the hazard communication program, as it pertains to this PWS, is presented below.

9.13 HAZARD COMMUNICATION PROGRAM

9.13.1 The purpose of this Hazard Communication Program is to ensure that important information regarding hazardous chemicals used, handled, or stored during the conduct of business is transmitted to employees and other affected persons as appropriate. A hazardous chemical as defined by OSHA means any chemical that is either a physical hazard or health hazard and includes hazardous chemicals generated during work operations. Chemical hazard information will be made available to employees and other affected persons, as appropriate, through the implementation of this comprehensive program, which includes container labeling and other forms of warning, collection, and compilation of SDSs, and training. A summary of the hazard communication program, as it pertains to this PWS, is presented below.

9.13.2 Chemicals Included in the Hazard Communication Program

9.13.2.1 The program applies to hazardous chemicals that are known to be present in the workplace and used or stored in such a manner that employees may be exposed under normal conditions of use or in a foreseeable emergency. It is the responsibility of the SHM with support of the SSHO to ensure that chemical materials meet the provisions of this Hazard Communication Program. If there are any questions regarding the applicability of these program requirements to a particular material or situation, the SHM will be consulted.

9.13.3 Lists of Hazardous Chemicals

9.13.3.1 No hazardous chemicals will be used, brought on-site, or manufactured. Non-hazardous chemicals brought on-site are presented by the SDSs in **Attachment F** and includes the name of each chemical, type of compound (e.g., flammable, corrosive, poison), date of the inventory, and location of the compound. The SSHO will maintain the list for the duration of the project, update the list appropriately, notify site personnel and the SHM of the addition of new compounds, and inform the site personnel of the associated hazards of those compounds. Small amounts of chemicals will be required for sample preservation (hydrochloric acid, sulfuric acid, and nitric acid). SDSs for all on-site chemicals, even non-hazardous chemicals, will be updated in a manner consistent with the above paragraph as new chemicals are brought on-site.

9.13.4 Labels and Other Forms of Warning

9.13.4.1 Site personnel will rely upon the original product labels to the extent practical. When labels must be applied to a temporary container, they will be printed in English and contain the following information:

- Identity of the hazardous chemical(s)

- Appropriate hazard warnings (i.e., any words, pictures, symbols, or combination thereof), which provide employees with specific information regarding the physical or health hazard(s) including primary target organ effect(s)

- Name of the chemical manufacturer, importer, or other responsible party, if appropriate.

9.13.4.2 Labels and other forms of warning will be legible, in English, and prominently displayed on the container, or readily available in the work area throughout each work shift. If existing labels already contain the required information, new labels are not required.

9.13.5 Alternatives to Labeling, Tagging, or Marking Requirements

9.13.5.1 Alternatives to the above-referenced labeling, tagging, or marking requirements are described below:

- Signs, placards, process sheets, batch tickets, operating procedures, or other such written materials may be used in lieu of affixing labels to individual stationary process containers, as long as the alternative method identifies the containers to which it is applicable and conveys the marking information required above. The written materials will be readily accessible to employees in their work area throughout each work shift. If this alternative system is utilized, it will be done only with approval of the SHM or the SSHO.

- Portable containers into which hazardous chemicals are transferred from labeled containers, and which are intended only for the immediate use of the employee who performs the transfer, are not required to be labeled (e.g., fueling vehicles with gasoline).

9.13.6 Shipping Hazardous Chemicals

9.13.6.1 No shipping of hazardous chemicals is required for completion of this PWS. Decontamination methods (presented in the SSHP [**Attachment E**)] will not generate hazardous chemicals.

9.13.7 Safety Data Sheets

9.13.7.1 The SSHO will maintain a copy of the SDS for each new chemical brought on-site and will ensure that they are readily accessible during each work shift to employees when they are in their work area(s). While conducting site-specific field operations, the list of chemicals and the SDSs must be readily available on-site. SDSs are presented in **Attachment F** and will be kept on-site.

9.13.8 Employee Information and Training

9.13.8.1 At a minimum, training will be conducted at the Pre-Entry Briefing and whenever a new physical or health hazard (e.g., new material brought on-site) the employees have not previously been trained in is introduced into their work scope.

9.14 PROCESS SAFETY MANAGEMENT PLAN

9.14.1 A Process Safety Management Plan is not required to complete Chapter 2 tasks because it does not include the use or storage of any highly hazardous chemicals.

9.15 LEAD COMPLIANCE PLAN

9.15.1 A Lead Compliance Plan is not required to complete Chapter 2 tasks because they do not include lead hazard control activities.

9.16 ASBESTOS ABATEMENT PLAN

9.16.1 An Asbestos Abatement Plan is not required to complete Chapter 2 tasks because they do not include asbestos hazard control activities.

9.17 RADIATION SAFETY PLAN/RADIATION PROTECTION PLAN

9.17.1 A Radiation Safety Plan/Radiation Protection Plan is not required to complete Chapter 2 tasks because it does not include the handling of radioactive material or the use of radiation generating devices.

9.18 ABRASIVE BLASTING PROCEDURES

9.18.1 An Abrasive Blasting Plan is not required to complete Chapter 2 tasks because it does not include abrasive blasting.

9.19 HEAT STRESS MONITORING PLAN

9.19.1 It is the responsibility of the SSHO, with support from the Technical Manager, and each employee to ensure that temperature stress controls are adequate for the site conditions and tasks. All employees are empowered and expected to stop or modify work and take any precautionary measures to prevent temperature-related illnesses.

9.19.2 Heat stress hazards can occur even in temperatures not commonly considered “hot” due to the level of physical activity, the level of PPE the worker is wearing, or the physical condition of the worker. Site training will include symptoms of heat-related illnesses and prevention techniques. Personnel will be familiar with the signs and symptoms of heat stress, including the following:

- ***Heat Cramps***—Muscle spasms in the abdomen or limbs. Frequent rest periods and fluid intake are appropriate measures to prevent or reduce heat cramps.

- ***Heat Exhaustion***—Severe dehydration; pale, clammy skin; profuse sweating; dizziness, light-headedness; slurred speech; rapid pulse; confusion; fainting; fatigue; cool skin; nausea. Affected personnel will be escorted from the site, set in a cool, shaded area, and given fluids slowly.

- ***Heat Stroke***—Life-threatening condition occurring when the body’s temperature-regulating system improperly functions. Hot dry skin; rapid, deep breathing; lack of perspiration; delirium; high fever (often 106 degrees Fahrenheit [°F] or more), nausea; unconsciousness. Brain damage and/or death may occur if body temperature is not reduced. Provide fluids, use cooling devices (hose-down or shower), call emergency medical services or transport to hospital immediately.

9.19.3 Heat stress prevention techniques include:

- Resting frequently in a shaded or air-conditioned area (site support vehicles)
- Allowing workers who are not acclimatized to take additional breaks. **Note** that all presumed workers are local personnel
- Drink at least 8 ounces of water or diluted Gatorade every 15–20 minutes
- Monitoring workers on a periodic basis as described below.

9.19.4 Heat stress monitoring will be conducted in a manner that anticipates and prevents the onset of heat stress symptoms (i.e., work-rest regimens). The radial pulse of each worker will be counted by the SSHO or Field Technicians during a 30-second period as early as possible during the rest period immediately following work activities. If the heart rate exceeds 110 beats per minute at the beginning of the rest period, the next work cycle will be shortened by one-third and the rest period will be maintained. If the heart rate still exceeds 110 beats per minute at the next rest period, the following work cycle will be shortened by another one-third. When ambient temperatures are expected to exceed 75°F, the resting heart rate of each worker will be measured by the workers and reported to the SSHO prior to the start of on-site activities.

9.19.5 All work will occur in Level D or Modified Level D PPE unless a spill of liquid occurs on-site. Physiological monitoring and work-rest regimens will be halved for work conducted during spill operations that will include Level C PPE. The PPE suites are presented in the SSHP (Chapter 5) and reinforced in the AHAs (**Attachment A**).

9.19.6 The buddy system will be applied to assist in compliance with radial pulse measurement and to ensure that observations of site personnel are maintained continually within each work-rest cycle. This system will also be in place to ensure a compliant rate of fluid consumption. A Wet-Globe Bulb will be used to calculate the adjusted temperature. The frequency for physiological monitoring is provided in **Table 9-4**.

Table 9-4. Frequency of Physiological Monitoring for Fit and Acclimatized Workers

Adjusted Temperature (°F)		**Monitoring Interval (Minutes of Work)**
90	Above 90	45
87.5	90	60
82.5	87.5	90
77.5	82.5	120
72.5	77.5	150

Assumes work levels of 250 kilocalories/hour (e.g., a moderate work level). Consider increasing the frequency for heavier work rates.

Adjusted Air Temperature: Calculate the adjusted air temperature by using this equation: *AdjustedTemperature*(°F) = *AirTemperature*(°F) + ([*13*] × [*%*
‘[7 sunshine]).Measure the air temperature with a standard thermometer, with the bulb shielded from radiant heat. Estimate the percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow.

100 percent sunshine = no cloud cover and a sharp, distinct shadow.

0 percent sunshine = cloud cover and no shadows.

For the purpose of this chart, a normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants.

Work completed in impermeable clothing (Level C) will cut these intervals in half.

Table 9-4. Frequency of Physiological Monitoring for Fit and Acclimatized Workers

Adapted from: NIOSH/OSHA/U.S. Coast Guard/ U.S. Environmental Protection Agency Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, Chapter 8 (1985).

Only local personnel will be used to perform the work to ensure full acclimatization.

9.19.7 The suggested and work-rest regimen is provided in **Table 9-5**.

Table 9-5. Suggested Work-Rest Regimen

Ambient Temperature (°F)	Work Period (Hours)	Rest Period (Minutes)
70	3.0	15
75	2.5	15
80	2.0	15
85	1.5	15
90	1.0	15
95	0.5	15

Clothing adjustment factors (CAF) for Level C with Tyvek will be a CAF of 1.
$WBGT_{eff} = WBGT_{out} + CAF$ (use Celsius)

9.19.8 Other factors, such as a worker's level of acclimation, level of physical fitness, and age, may increase or decrease his/her susceptibility to heat stress. Before assigning a task to an individual worker, these factors will be taken into account to ensure that the task will not endanger the worker's health. Sunscreen lotions will be provided and used per manufacturer's recommendations.

9.19.9 If a heat-related illness is suspected or observed, the affected person will be moved to a cool or shaded area and given plenty of liquids to consume. If symptoms of a heat stroke are observed, the victim will be cooled, and site personnel will immediately call 911.

9.20 COLD STRESS MONITORING PLAN

9.20.1 Cold stress hazards are most likely to occur at low temperatures or low wind chill factors, with wet, windy conditions contributing to risk. As temperatures could fluctuate during these events, workers will be trained in signs and symptoms of cold stress and controls. If unexpected cold weather occurs, workers will be trained in signs and symptoms of cold stress and controls. Workers will be familiar with the signs and symptoms of cold stress, which include:

- ***Hypothermia***—Cold-induced decreasing of the core body temperature that produces shivering, numbness, drowsiness, and muscular weakness. If severe enough, it can lead to unconsciousness and death.

- ***Frostbite***—Constriction of blood vessels in the extremities, decreasing the supply of warming blood may result in formation of ice crystals in the tissues, causing tissue damage. Condition may range from frostnip, which is a numbing of extremities, to deep-freezing tissue beneath the skin. Symptoms include white or grayish skin, blisters, numbness, mental confusion, failing eyesight, fainting, shock, and cessation of breathing. Death may occur from heart failure.

9.20.2 Pain in the extremities may be the first warning of cold stress and precautions will be taken to reduce exposure. Maximum severe shivering will be taken as a sign of immediate danger to the worker and exposure to cold will be immediately terminated. Personnel exhibiting signs and symptoms of cold stress will be removed from the site and given appropriate first aid. Emergency medical services will be contacted if symptoms are severe (e.g., more than numbness of the extremities or shivering). Employees will not be immersed in water.

9.20.3 As a precautionary measure, employees will wear layers of loose-fitting clothing including insulated coveralls, head cover, gloves, and boots when temperatures fall below 40°F. Protection of the hands, feet, and head is particularly important because these are likely to be injured first by cold. However, actual injury to hands, feet, and head is not likely to occur without prior development of early signs of hypothermia such as numbing and shivering. Bare skin-contact with cold surfaces (below 32°F) will be avoided. No continuous exposure to cold is permitted when the air speed and temperature results in an equivalent chill temperature of 26ºF or less. The equivalent chill temperature will be determined by the using the wind chill temperature shown in **Table 9-6**. Warm rest areas (support vehicles) will be provided. Air temperature and wind speed will be monitored at least every 4 hours at air temperatures below 45ºF.

Table 9-6. Wind Chill Temperature

		Wind Speed (miles per hour)										
		0	5	10	15	20	25	30	35	40	45	50
Air Temperature (°F)	40	40	36	34	32	30	29	28	28	27	26	26
	35	35	31	27	25	24	23	22	21	20	19	19
	30	30	25	21	19	17	16	15	14	13	12	12
	25	25	19	15	13	11	9	8	7	6	5	4
	20	20	13	9	6	4	3	1	0	-1	-2	-3
	15	15	7	3	0	-2	-4	-5	-7	-8	-9	-10
	10	10	1	-4	-7	-9	-11	-12	-14	-15	-16	-17
	5	5	-5	-10	-13	-15	-17	-19	-21	-22	-23	-24
	0	0	-11	-16	-19	-22	-24	-26	-27	-29	-30	-31
	-5	-5	-16	-22	-26	-29	-31	-33	-34	-36	-37	-38
	-10	-10	-22	-28	-32	-35	-37	-39	-41	-43	-44	-45
	-15	-15	-28	-35	-39	-42	-44	-46	-48	-50	-51	-52
	-20	-20	-34	-41	-45	-48	-51	-53	-55	-57	-58	-60
	-25	-25	-40	-47	-51	-55	-58	-60	-62	-64	-65	-67
	-30	-30	-46	-53	-58	-61	-64	-67	-69	-71	-72	-74
	-35	-35	-52	-59	-64	-68	-71	-73	-76	-78	-79	-81
	-40	-40	-57	-66	-71	-74	-78	-80	-82	-84	-86	-88
	-45	-45	-63	-72	-77	-81	-84	-87	-89	-91	-93	-95

Green:	**LITTLE DANGER** (frostbite occurs in >2 hours in dry, exposed skin)
Yellow:	**INCREASED DANGER** (frostbite could occur in 45 minutes or less in dry, exposed skin)
Red:	**GREAT DANGER** (frostbite could occur in 5 minutes or less in dry, exposed skin)

Adapted from: Sustaining Health and Performance in Cold Weather Operations: U.S. Army Research Institute of Environmental Medicine. October 2001.

9.21 INDOOR AIR QUALITY MANAGEMENT PLAN

9.21.1 All work will be conducted outdoors; however, employee health will be protected. Employees will be protected from involuntary exposure to environmental tobacco smoke in working areas. Smoking, including smokeless (vape), will be prohibited inside vehicles and work zones. Designated smoking areas that are not commonly used or accessed by nonsmokers will be a minimum of 25 ft from work zones.

9.22 MOLD REMEDIATION PLAN

9.22.1 A Mold Remediation Plan is not required to complete Chapter 2 tasks because it does not include the remediation of mold.

9.23 CHROMIUM (VI) EXPOSURE EVALUATION

9.23.1 A Chromium (VI) Evaluation is not required to complete Chapter 2 tasks because it does not include the cutting or breaking up of cement surfaces made from Portland cement with a high chromium content, painting or paint removal operations, welding using rods or wire with a chromium coating, heading or welding on stainless steel, and handing or applying anti-corrosive substances or coatings.

9.24 CRYSTALLINE SILICA MONITORING PLAN AND ASSESSMENT

9.24.1 A Crystalline Silica Monitoring Plan is not required under the current scopes of work because no sites include the handling of crystalline silica.

9.25 LIGHTING PLAN FOR NIGHT OPERATIONS

9.25.1 A Night Operations Plan is not required to complete Chapter 2 tasks because all work will be scheduled during daylight hours. Work is prohibited when lighting conditions are insufficient.

9.26 TRAFFIC CONTROL PLAN

9.26.1 A Traffic Control Plan is not required to complete Chapter 2 tasks as no roads will be closed.

9.27 FIRE PREVENTION AND PROTECTION PLAN AND PROGRAM

9.27.1 Introduction and Applicability

9.27.1.1 This plan focuses on the prevention and control of incidental incipient-stage fires caused from site vehicles and potential violation of smoking protocol and assesses the safeguarding of demolition operations (National Fire Protection Association [NFPA] 2019). The effectiveness will be documented through surveys and inspections (Chapter 7) to identify potential compliance issues and evaluate effectiveness. Based on a review of the Chapter 2 tasks to federal, USACE, and New York standards, a site-specific fire prevention and protection plan will be required; however, several elements are inapplicable at this time.

9.27.1.2 A critical heat flux evaluation has occurred for the potential on-site ignition sources and the results are presented below. No temporary offices or sheds, hot work, temporary heating equipment, temporary wiring, explosive materials, cooking, temporary lighting, fuel gas and/or associated piping, underground work, marine operations, or similar Standard elements are present for the investigation.[6]

9.27.1.3 Similarly, no unusual fire hazards, hot work, required fire or open flames, risk of underground fire, gas cylinders, facility-related vegetation management (separate from general vegetation clearance), paint-soiled clothing or paint-soiled drop cloths, combustible waste disposal, burning operations, installation of low-density fiberboard/insulation/vapor barrier, temporary enclosure usage or installation, temporary buildings, fire lane control, fire hydrant access control, hazardous locations, heating unit siting, torch use (cut/sweat pipe), formwork or scaffolding protections, construction of buildings or structures, or existing water supply are either present and/or required for the investigation.[7]

9.27.1.4 Only one audit will be required per year and at least two are likely. If hot work of any kind is deemed necessary, an addendum and commensurate AHA will be provided. Inspection/audit frequency are provided in **Table 7-1**.

9.27.2 Site-Specific Assessment of General Hazards and Controls

9.27.2.1 Based on the anticipated Chapter 2 tasks, the primary on-site fire hazards include the ignition of dried vegetation, poorly-managed general refuse, and ignition of poorly-managed diesel refueling operations. Ignition sources are limited but include poorly-managed smoking-related materials (e.g., lighters, matches, cigarettes, pipes, cigars, and vaping), hot surfaces from running engines, and a statistically-remote lightning strike.

9.27.2.2 The on-site personnel are not responsible for firefighting activities as a primary job duty. Personnel may voluntarily fight an incipient-stage fire using the properly-rated fire extinguishers, utilize the on-site water truck, and/or notify personnel on-site of an incipient-stage fire. No alarms or other warning system is required as the site size is sufficiently small for verbal communications. The SSHO and Technical Manager will be the points-of-contact for notification procedures if the fire is not immediately contained. All personnel on-site are responsible for following the controls presented below.

9.27.3 Site-Specific Controls and Procedures

9.27.3.1 Smoking is prohibited in all areas other than designated smoking areas. This process is to manage smoking as both an ignition source and health-related issue (Indoor Air Quality; Chapter 9.2.1). Combustible waste materials will be removed from the work area at least daily to ensure that these materials do not contact the ignition sources presented above. The purposeful ignition of materials on-site is prohibited. Fire extinguishers will be placed around the site in accordance

---

[6] Checklist presented in NFPA 241.

[7] Checklist presented in Chapter 9 of EM 385-1-1 (2014).

with **Table 9-4** once site measurements may be fully completed by the SSHO or Designated Representative.

9.27.4 Flammable and Combustible Liquids and Flammable Gasses

9.27.4.1 No flammable liquids or gases are present on-site except for gasoline-powered vehicles.

9.27.5 First Response Fire Protection

9.27.5.1 First response, as stated above, will be for incipient-stage fires that may be handled with properly-rated fire extinguishers or the water truck. They will be inspected monthly, and records will be maintained in writing. Only those fire extinguishers that are approved by a listed company, properly-marked, contain approved (e.g., no CCl4 or other) agents, and are properly-constructed are suitable for use on-site.

9.27.5.2 The SSHO and Technical Manager will ensure that the inventory of fire extinguishers are inspected prior to beginning each definable feature of work and that personnel have received fire extinguisher training. Currently, each support vehicle will have a minimum 2A:5B:C-rated extinguisher, each piece of equipment will have a minimum 2A:10B:C-rated extinguisher, and a minimum 4A:40 B:C-rated extinguisher will be located within 100 ft of the pickup-mounted transfer tank. Finally, a water truck will be on-site to supplement the incipient-stage fires that may be present for simple fires with combustible fuels.

9.27.5.3 No explosives will be brought on-site nor are they present on-site, and no fixed fire suppression system is present on-site, no on-site firefighting organizations will be staffed on-site, and no fire watches are present on-site as no hot work is required at this time.

9.28 WILD LAND FIRE MANAGEMENT PLAN

9.28.1 A Wild Land Fire Management Plan in accordance with USACE Engineer Pamphlet 1130-2-540 is not required to complete Chapter 2 tasks; however, general fire prevention measures are discussed in the Fire Prevention and Protection Plan.

9.29 ARC FLASH HAZARD ANALYSIS

9.29.1 An Arc Flash Hazard Analysis is not required as no work will occur on energized equipment. Additionally, workers are prohibited from working on energized equipment.

9.30 ASSURED EQUIPMENT GROUNDING CONTROL PROGRAM

9.30.1 No Assured Equipment Grounding Control Program is required for the Chapter 2 tasks at this time. The following information is to provide the SSHO with information that may trigger the needs of the program. Ground fault current interrupter (GFCI) protection shall be provided on all circuits serving portable electric hand tools, semi-portable electric power tools, sampling pumps, or equipment charging stations.

9.30.2 As part of the Assured Equipment Grounding Control Program, the following will be considered in all stages and implementation of tasks that involve the use of electrical receptacle outlets. All receptacle outlets (125-volt, 15-, 20-, 30-amperage and greater) that provide temporary electrical power during construction, remodeling, maintenance, repair, or demolition shall have GFCI protection for personnel. GFCI protection shall be provided on all circuits serving portable electric hand tools or semi-portable electric power tools (such as block/brick saws, table saws, air compressors, welding machines, and drill presses). The GFCI device shall be calibrated to trip within the threshold values of 5 milliamperes +/-1 milliamperes as specified in UL Standard 943. GFCI devices shall be tested before initial use and before use after modification. Receptacle outlets that are not part of the permanent wiring of the building or structure shall be GFCI protected by one of the following means: a receptacle outlet with integral GFCI protection; a standard receptacle outlet connected downstream of a receptacle outlet with integral GFCI protection; and/or receptacles protected by a GFCI-type circuit breaker.

9.30.3 Receptacle outlets that are part of the permanent wiring of the building or structure and are used for temporary electric power, (including portable generators) shall use a portable GFCI if the receptacle outlets are not already GFCI protected. The portable GFCI shall be as near as practicable to the receptacle outlet.

9.31 HAZARDOUS ENERGY CONTROL PLAN (LOCK-OUT/TAG-OUT)

9.31.1 A Hazardous Energy Control Plan is not required to complete Chapter 2 tasks; however, permit control measures (e.g., Utility One Call) will occur to ensure striking of underground utilities. For on-site equipment, no equipment maintenance is allowed on energized equipment by any personnel. Equipment will be towed off-site for repair by qualified personnel outside of the scope of this APP.

9.32 STANDARD PRE-LIFT PLAN

9.32.1 A Standard Pre-Lift Plan is not required to complete Chapter 2 tasks, because there are no tasks that include lifts or rigging.

9.33 CRITICAL LIFT PLAN

9.33.1 A Critical Lift Plan is not required to complete Chapter 2 tasks, as no critical lifts are anticipated to complete the PWS.

9.34 NAVAL ARCHITECTURAL ANALYSIS

9.34.1 A Naval Architectural Analysis is not required to complete Chapter 2 tasks, as no marine activities will be conducted.

9.35 FLOATING PLANT INSPECTION AND CERTIFICATION

9.35.1 A Floating Plant Inspection and Certification Program is not required to complete Chapter 2 tasks, as no marine activities will be conducted.

9.36 SEVERE WEATHER FOR MARINE ACTIVITIES

9.36.1 A Severe Weather Plan for Marine Activities is not required to complete Chapter 2 tasks, as no marine activities will be conducted.

9.37 EMERGENCY PLAN FOR MARINE ACTIVITIES

9.37.1 An Emergency Plan for Marine Activities is not required to complete Chapter 2 tasks, as no marine activities will be conducted.

9.38 MAN OVERBOARD/ABANDON SHIP ACTIVITIES

9.38.1 A Man Overboard/Abandon Ship Activities Plan is not required to complete Chapter 2 tasks, as no marine activities will be conducted.

9.39 FLOAT PLAN FOR LAUNCHES, MOTORBOATS, AND SKIFFS

9.39.1 A Float Plan is not required to complete Chapter 2 tasks, as no marine activities will be conducted.

9.40 SEVERE WEATHER CONTINGENCY PLAN

9.40.1 The SSHO will monitor local weather conditions and advise the PM when severe weather is forecasted. Based on the SOW associated with this contract, it is likely that work tasks can be postponed until the severe weather passes. In the event of severe weather occurring while personnel are on-site, the following procedures will be followed:

- All personnel shall shut down field operations and take shelter.
- If lightning is occurring, stop outdoor work and move indoors, or stay inside a moving vehicle (do not continue to linger outdoors). Shut down and move away from heavy equipment.
- In case of tornado conditions, seek out low ground (i.e., ditch or basement), shield yourself from falling objects, and stay away from windows.
- The SSHO will take a head count.
- Any visitors should remain with the group, if feasible.
- All personnel will stay assembled until further instructions are received. However, it is important to note that in some emergencies, employees must deviate from these instructions. Use common sense. For example, if smoke is present, employees need to begin evacuating even if the alarm has not been sounded. If smoke is present, stay below smoke while evacuating.

9.40.2 Note that not all emergencies are the same. In some cases, employees will have to follow a procedure that is different from the facility evacuation plan. Be certain to train and drill employees in this need to exercise common sense above all in emergency situations.

9.40.3 To safely mitigate the hazards from severe weather (i.e., heavy rains, electrical storms, or extreme winds), site personnel (including the SSHO) will look for indications of impending severe weather (e.g., changes in wind direction, cloud formation, or humidity) and monitor weather conditions online using a weather station that is part of the National Oceanic and Atmospheric Administration (NOAA) weather radio network. If severe weather is likely, based on weather review, site personnel will retreat to their support vehicle. If site personnel observe lightning within 6 miles of the project site, as based on a lightning detector, NOAA radio application, and/or a lightning strike map monitored by the SSHO, all site activity will be halted immediately. The SSHO will monitor weather conditions, and activity will not resume for 30 minutes following cessation of severe weather. The SSHO is responsible for providing site personnel notification that work may resume. Hazards associated with heat stress are described in Chapter 9.19 of this APP.

9.41 SITE-SPECIFIC FALL PROTECTION AND PREVENTION PLAN

9.41.1 A site-specific Fall Protection and Prevention Plan is not required to complete Chapter 2 tasks, because no elevated work will be conducted.

9.41.2 Personnel are prohibited from working at elevations greater than 4 ft.

9.42 DEMOLITION/RENOVATION PLAN

9.42.1 A Demolition/Renovation Plan is not required to complete Chapter 2 tasks, as no demolition or renovation activities are planned.

9.43 ROPE ACCESS WORK PLAN

9.43.1 A Rope Access Work Plan is not required to complete Chapter 2 tasks, as no climbing activities will occur.

9.44 EXCAVATION AND TRENCHING PLAN

9.44.1 An Excavation and Trenching Plan is not required to complete Chapter 2 tasks. Fire Prevention and Protection Plan for Underground Construction. A Fire Prevention Plan and Protection Plan for Underground Construction is not required to complete Chapter 2 tasks, as no underground construction activities will occur.

9.45 FIRE PREVENTION AND PROTECTION PLAN FOR UNDERGROUND CONSTRUCTION

9.45.1 A Fire Prevention Plan and Protection Plan for Underground Construction is not required to complete Chapter 2 tasks, as no underground construction activities will occur.

9.46 COMPRESSED AIR WORK PLAN FOR UNDERGROUND CONSTRUCTION

9.46.1 A Compressed Air Work Plan and Protection Plan for Underground Construction is not required to complete Chapter 2 tasks, as no underground construction activities will occur.

9.47 EMERGENCY RESCUE (TUNNELING) PLAN

9.47.1 An Emergency Rescue (Tunneling) Plan is not required to complete Chapter 2 tasks, as no underground construction activities will occur.

9.48 ERECTION AND REMOVAL PLAN FOR FORMWORK AND SHORING

9.48.1 An Erection and Removal Plan for Formwork and Shoring is not required to complete Chapter 2 tasks, as no forms or shoring will be constructed.

9.49 PRECAST CONCRETE PLAN

9.49.1 A Precast Concrete Plan is not required to complete Chapter 2 tasks, as no such operations will occur.

9.50 LIFT SLAB PLAN

9.50.1 A Lift Slab Plan is not required to complete Chapter 2 tasks, as no slab lifting activities will occur.

9.51 MASONRY BRACING PLAN

9.51.1 A Masonry Bracing Plan is not required to complete Chapter 2 tasks, as no masonry activities will occur.

9.52 STEEL ERECTION PLAN

9.52.1 A Steel Erection Plan is not required to complete Chapter 2 tasks, as no erection activities will occur.

9.53 EXPLOSIVE SAFETY SITE PLAN

9.53.1 An Explosives Safety Site Plan is not required as no munitions and explosives of concern avoidance or construction support is required for portions of the Chapter 2 tasks.

9.54 BLASTING PLAN

9.54.1 A Blasting Plan is not required to complete Chapter 2 tasks, as no blasting activities will occur.

9.55 DIVING OPERATIONS PLAN

9.55.1 A Diving Operations Plan is not required to complete Chapter 2 tasks, as no diving activities will occur.

9.56 SAFE PRACTICES MANUAL FOR DIVING ACTIVITIES

9.56.1 A Safe Practices Manual for Diving Activities is not required to complete Chapter 2 tasks, as no diving activities will occur.

9.57 EMERGENCY MANAGEMENT FOR DIVING

9.57.1 An Emergency Management for Diving Plan is not required to complete Chapter 2 tasks, as no diving activities will occur.

9.58 TREE FELLING/MAINTENANCE PROGRAM

9.58.1 A Tree Felling/Maintenance Program is not required; no tree felling will occur.

9.59 AIRCRAFT/AIRFIELD CONSTRUCTION SAFETY AND PHASING PLAN

9.59.1 An Aircraft/Airfield Construction Safety and Phasing Plan is not required to complete Chapter 2 tasks, as no aircraft/or airfield construction is being completed.

9.60 AIRCRAFT/AIRFIELD SAFETY PLAN COMPLIANCE DOCUMENT

9.60.1 An Aircraft/Airfield Safety Compliance Document is not required to complete Chapter 2 tasks, as no work is being conducted in proximity to aircraft or an airfield.

9.61 SITE SAFETY AND HEALTH PLAN

9.61.1 An SSHP is presented in **Attachment E**.

9.62 CONFINED SPACE ENTRY PROCEDURES

9.62.1 Confined space entry procedures are not required as no confined spaces will be entered nor exist.

9.63 CONFINED SPACE PROGRAM

9.63.1 The Confined Space Program is not required as no confined spaces will be encountered.

9.64 PERSONAL HYGIENE AND PERSONNEL DECONTAMINATION PLAN

9.64.1 Fieldwork will be conducted in Level D for general operations. Fieldwork will be conducted in Level D or Modified Level D when handling groundwater, surface water, sediment, and/or soil directly. Site personnel will wash their hands, face, and exposed skin surfaces prior to ingestion of food, liquids or any other hand-to-mouth activities and when leaving the area designated as the Exclusion Zone. Hand washing with potable water, soap, and paper towels will be available at the portable restroom facilities. The site vehicle will also be furnished with hand sanitizer.

9.64.1 Additional details are presented within **Appendix E**.

9.65 EQUIPMENT DECONTAMINATION PLAN

9.65.1 Dedicated environmental sampling supplies will be dedicated whenever possible. Decontamination of non-dedicated sampling equipment (i.e., submersible pumps and stainless-steel hand augers) will occur in Modified Level D PPE. Decontamination fluids include non-phosphate soap (i.e., Liquinox®) and deionized water. Decontamination fluids will be purged to the ground surface as they will be de minimis quantities. All equipment decontamination will occur in Modified Level D PPE.

9.66 EXPOSURE MONITORING AND/OR AIR MONITORING PLAN

9.66.1 Air monitoring and related discussions are presented in the SSHP (**Attachment E**).

This page intentionally left blank

10. RISK MANAGEMENT PROCESSES

10.1 An assessment of the hazards, training, and equipment required to perform the tasks were completed as part of a risk analysis by corporate health and safety management with input from personnel who have previously performed the tasks. As stated in EM 385-1-1 01.A.13, major activities and phases of work to be performed will be covered in an AHA. AHAs will be reviewed with all personnel involved in a task prior to each work activity or phase presenting hazards not experienced in previous project operations.

10.2 Upon commencement and throughout the activity, the AHA will be used to verify compliance with the prescribed hazard controls and to note any potential changes in process. The AHAs provide detailed project-specific hazards and controls for each major phase/activity of work. The primary activities and phases of work required to complete the PWS for the Former Seneca Army Depot site are presented in Chapter 2. AHAs are provided in **Attachment A.**

This page intentionally left blank

11. PERSONAL PROTECTIVE EQUIPMENT

11.1 Information pertaining to PPE is presented in the SSHP (**Attachment E**).

This page intentionally left blank

12. REFERENCES

National Fire Protection Association (NFPA). 2018. *NFPA 30: Flammable and Combustible Liquids Code*. 17 August 2017.

———**.** 2019. *NFPA 241: Standard for Safeguarding Construction, Alternation, and Demolition Operations*. September 2018.

U.S. Army Corps of Engineers (USACE)**.** 2014. *Engineer Manual 385-1-1 Safety and Health Requirements Manual*. 30 November.

This page intentionally left blank

Attachment A

Activity Hazard Analyses

This page intentionally left blank

Overall Risk Assessment Code (RAC) (highest code from subtasks): **M**

Activity/Activities: **General** Phases: **All Phases**

Project Location: Former Seneca Army Depot

Project Number: 637490374

Date Prepared: 7 December 2022

Prepared By: P. Gannon

Reviewed By: A. Hughes, PG, ASP, CSP

Competent and/or Qualified Person(s): Table 4-2 Mike Wright

RAC Matrix

	Probability				
Severity	1 Frequent	2 Likely	3 Occasional	4 Seldom	5 Unlikely
1 Catastrophic	E	E	H	H	M
2 Critical	E	H	H	M	L
3 Marginal	H	M	M	L	L
4 Negligible	M	L	L	L	L

Step 1: Review each "hazard" and determine RAC.
Probability = The likelihood to cause an incident, near miss, or accident. Identified as frequent, likely, occasional, seldom, or unlikely.
Severity = The outcome/degree if an incident, near miss, or accident did occur. Identified as catastrophic, critical, marginal, or negligible.
Step 2: Identify the RAC as E, H, M, or L for each hazard on AHA. Select the highest RAC and note at the top of the form.

RAC Chart
E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

TASK BREAKDOWN, HAZARDS AND CONTROLS

Work Task Steps	Hazards	Controls	S/P-RAC
All Work Task Steps	Minimal potential for chemical hazard exposure,	• Inspect work areas when arriving to identify presence and absence of hazard(s). • Don Level D personal protective equipment (PPE) or above and minimize or eliminate contact with chemical hazards.	4/1/M
All Work Task Steps	Hand Tools	• Use proper tool for the job, inspect the tool prior to use, do not use damaged tools, make sure area is adequately clear.	4/1/M
All Work Task Steps	Biological Hazards: Bites and Stings from Insects, Spiders, Snakes	• Inspect work areas when arriving to identify presence and absence of hazard(s). • Review site-specific Biological Hazards and associated controls within Accident Prevention Plan (APP) and Site Safety and Health Plan (SSHP). • Use insect repellant if desired. Insect repellant containing DEET may be used on exposed skin and/or clothing insect repellant containing Permethrin. • Stay alert and safe distance away from biological hazards. • Flagging or extermination of nests (hired professional). • Utilize barrier cream and PPE (See Equipment).	3/3/M
All Work Task Steps	Biological Hazards: Contact with Poisonous Plants	• Review biological hazard fact sheets. • DO NOT consume any wild plant or berries. • Maintain proper hygiene procedures and avoid saps and sharp plant areas. • Don Level D PPE or above and minimize or eliminate contact with poisonous plants.	1/5/M
All Work Task Steps	Biological Hazards: Interaction with Hazardous Animals	• Review the biological hazard fact sheets • If area is not cleared, make noise to alert the presence to avoid startling wild animals (e.g., boars, coconut crabs, etc.). • Review first aid procedures for bites from each of the animals and insects noted.	3/3/M
All Work Task Steps	Biological Hazards: Infection or disease from microorganisms	• Follow hygiene procedures including handwashing and use of hand sanitizers; disinfection of commonly contacted surfaces; consumption of potable water only; no sharing of equipment and supplies; and review of hygiene practices within APP. • Review Coronavirus Disease 2019 (COVID-19) Exposure Control Plan Activity Hazard Analysis (AHA) controls presented	1/5/M
All Work Task Steps	Physical Hazard: Exposure to Solar Radiation	• Follow heat stress protective controls. • Don sunscreen with sun protection factor of 45 or greater, reapply every 1-3 hours. • Utilize site support vehicles to reduce sun exposure.	1/5/M

Work Task Steps	Hazards	Controls	S/P-RAC
All Work Task Steps	Physical Hazard: Slips, Trips, and Falls (Same Level)	• When working throughout the site, keep work area free of excess material and debris. • Remove all trip hazards by keeping materials/objects organized and out of walkways. • Keep non-essential personnel away from equipment and tools. • Work at an appropriate pace and do not run. • Be aware of uneven surfaces while walking. • Working from height is prohibited without revisions to planning documents. • Conduct a site walk to assess presence of sharp corals, algae-covered surfaces, and hidden holes/caves. Manage these as per Occupational Safety and Health Administration (OSHA_ requirements for “Holes” on a construction site (i.e., size, demarcation, etc.).	3/4/L
All Work Task Steps	Physical Hazard: Noise-induced hearing loss	• Review hearing protection plan and program • Review maximum decibel levels emitted by equipment as stated in manuals and ensure non-essential personnel remain at least 50 feet (ft) from operating equipment. • Hearing protection shall be worn by personnel when working around (within 50 ft) of on-site operating heavy equipment (equipment list presented on subsequent AHAs).	1/5/M
All Work Task Steps	Physical Hazard: Struck-By/ Collision	• Use headlights at all times visibility is decreased with focus on inclement weather. • Note the potential presence of algae on coral-constructed roads. • Passengers are prohibited from riding in the rear of trucks. • Beware of drivers stopping to execute turns in all directions.	1/5/M
All Work Task Steps	Exposure to Fire	• Review Fire Prevention and Protection Plan. • Proper housekeeping procedures will be followed to prevent buildup of flammable materials. • Fire extinguishers commensurate with Table 9-1 (EM 385-1-1) will be deployed. • Vegetation will be managed to prevent the possibility of a fire though disposal or wetting (climate may prevent drying out during the sufficiently short Scope of Work [SOW]). • The area will be surveyed by the Site Safety and Health Officer (SSHO) and Designated Representative (DR) to identify new fire hazards, daily. • Personnel will notify the SSHO of any newly identified potential fire hazards. • Hot work is currently prohibited from occurring on-site.	1/5/M
All Work Task Steps	Physical Hazard: Musculoskeletal Sprains and Strains from Overexertion	• Determine the mass of the item(s) to be lifted and/or moved. • Personnel are prohibited from lifting items greater than 50 pounds without additional support or mechanical assistance. • Follow proper lifting techniques for all materials. • Do not twist, use feet to rotate. • Use mechanical devices to move loads when possible (i.e., a skid steer to move equipment or debris versus carrying items manually). • Work gloves must be worn when personnel are handling materials.	3/3/M

Work Task Steps	Hazards	Controls	S/P-RAC
All Work Task Steps	Physical Hazard: Heat Stress	• SSHO and DR will monitor weather and conduct physiological monitoring as per SSHP. • Buddy system will be in place to assist SSHO and DR in observations and warning signs of illness • Take breaks as per SSHP AND take breaks as needed if more frequent. • Breaks should be taken in shade or climate-controlled support vehicle • Be aware of weather conditions and dress appropriately (Level D PPE). • Consume adequate food/beverages (Drink 4-8 ounces of water/diluted electrolyte per hour). • Determine appropriate work schedule; take regular breaks. If possible, adjust work schedule to avoid heat stresses (see Table 9-5 and Table 9-6). • If conditions change during general activities, stop work and evaluate conditions.	3/2/M
All Work Task Steps	Physical Hazard: Striking an object or person while driving support vehicle	• Obey all traffic laws, including no cell phone usage while driving. • Maintain eye contact with site personnel/vehicle operators when personnel are working near site support vehicles. • Use spotters when backing up within work areas. • Personnel will don Level D PPE (see Equipment) • Back into parking places and ensure site vehicle faces direction of evacuation route. • Clear obstacles or use spotters. • Be aware of the blind spots of other vehicles and do not park where blind spots hide personnel or obstacles. Do not put body parts into pinch points (e.g., tailgate or doors) of vehicle. Prior to using hinges, doors, or tailgates, ensure personnel are clear of areas. • Drivers will drive appropriately for the conditions (e.g., slower in rain or on unpaved roads). • Do not put body parts into pinch points (e.g., tailgate or doors) of vehicle. Prior to using hinges, doors, or tailgates, ensure personnel are clear of areas.	3/3/M
All Work Task Steps	Physical Hazard: Weather/Extreme Weather	• Monitor weather conditions online or on the radio using a weather station that is part of the National Oceanic and Atmospheric Administration (NOAA) weather radio network or similar notification system. • If unfavorable weather conditions are anticipated and/or arise, the SSHO will evaluate the safety hazards and activities will be halted; work will discontinue during thunderstorms (10-mile rule) and severe weather events; 30 minutes after last occurrence to resume work. • SSHO will provide “all-clear” notification when outside work may commence.	2/4/M
All Work Task Steps	Dermal Contact with Virus-Contaminated Surface	• Wash hands often with soap and water for at least 20 seconds especially if in a public place, or after blowing your nose, coughing, or sneezing. • If soap and water are not readily available, use a hand sanitizer that contains at least 60% alcohol. Cover all surfaces of hands and rub them together until they feel dry. • Avoid touching your eyes, nose, and mouth with unwashed hands.	2/4/M

Work Task Steps	Hazards	Controls	S/P-RAC
All Work Task Steps	Inhalation of virus from infected individual (symptomatic or asymptomatic) by other individuals	• Remain more than 6 ft from each other, unless necessary to perform job function. • Daily safety tailgates meetings will continue to be held outside when possible and will be limited to no more than 10 people at a time (breaking up groups and staggering meeting times accordingly). • Maintain social spacing of 6 ft for meetings, with preference for telemeetings during preliminary phases. • Stay outside of individual offices (at doorways) when talking. • Use phones to communicate. • Maintain diligent use of PPE including safety glasses to limit contact with eyes and nitrile gloves. Face shields may be worn for work that cannot be completed without maintaining a distance of 6 ft between individuals. • Staff are discouraged from taking breaks and eating lunch in communal settings where it is difficult to maintain a distance of 6 ft from co-workers. Breaks and lunches should be taken in offices, cubicles or personal vehicles. • Staff are encouraged to practice social distancing when not on the jobsite. • Staff are required to comply with all Federal, State, and local requirements and recommendations.	2/4/M
All Work Task Steps	Dermal Contact - Contamination on Surfaces	• Clean AND disinfect frequently touched surfaces daily. This includes field equipment, personal mobile phones, vehicle surfaces (steering wheel, door handles, shift stick), tables, doorknobs, light switches, countertops, handles, desks, phones, keyboards, toilets, faucets, and sinks. • If surfaces are dirty, clean them: use detergent or soap and water prior to disinfection. • Use disinfectant capable of killing the virus on surfaces including: – Bleach mix (1/3 cup bleach per gallon of water or 4 teaspoons bleach per quart of water. – Alcohol (isopropanol) solutions with at least 70% alcohol. – Other approved disinfectants listed at https://www.epa.gov/pesticide-registration/list-n-disinfectants-use-against-sars-cov-2. • The communal areas will be cleaned twice weekly, with a focus on sanitizing/disinfecting all commonly touched surfaces such as doors, doorknobs and hardware, handrails, tabletops, windowsills, light switches, toilets, sinks, etc.	2/4/M
All Work Task Steps	Infected individual(s) personnel at work	• Personnel will be required to answer the questionnaire presented within the exposure control plan.	2/4/M

REQUIRED EQUIPMENT, INSPECTION AND TRAINING:

Equipment	Inspection Requirements	Training Requirements (including Competent Person and Qualified Personnel, if applicable)
• Level D (steel/composite toed boots, safety glasses, work pants) – Add Class II (or greater) Vest when within 50 ft of operating equipment – Add work gloves if laceration hazard – Add nitrile gloves for cleanliness – Add hard hat if overhead hazard found – Add snake chaps if snake hazard found – Hearing protection (descriptions on supporting AHAs). General requirements include: ▪ Formable plugs (Noise Reduction Ratio [NRR] $\geq$32) or ▪ Muffs (NRR >30) • Insect repellant and/or barrier cream (only when desired by employee and insects/ spiders are observed within work area) • Emergency equipment including first aid kit, fire extinguisher(s), and portable eyewash kit • Support vehicles • OSHA-supported radio or NOAA application for tracking hazardous weather • Hand soap/water and hand sanitizer • Dosimeter (Noise) • EPA-accepted disinfectant	• Inspect PPE daily and prior to each use • Inspect emergency equipment/ supplies monthly • Inspect insect repellant or creams prior to use • Inspect support vehicle daily • Inspect personnel for heat stress • Inspect monitoring equipment, screening equipment, and personal sampling equipment	• SSHO (Competent Person Overall Safety) – Aggregate formal training (24 hours/36 months) – OSHA 40-Hour Hazardous Waste Operations and Emergency Response (HAZWOPER) and refresher – OSHA 8-Hour Supervisor – OSHA 30-Hour (or Commensurate) • First aid/Cardiopulmonary resuscitation (CPR) providers – First aid/CPR – Bloodborne Pathogens • All Personnel (Table 7-1) – Initial Safety and Occupational Health (SOH) training – Site Indoctrination/Pre-Entry Briefing – 8-Hour annual SOH training – Use/limitations of PPE – Valid driver's license (if driving) – APP and AHA review – Emergency Response Training – Fire extinguisher use • Users of Handheld Equipment – Review of the General AHA – Review of manufacturer instructions and specifications – Prior use of tool under supervisor's observation – Review results of negative exposure assessment to confirm PPE Suite.

Activity/Activities: **Groundwater Sampling, Sediment Sampling, Soil Sampling, Water Level Gauging, Soil Vapor Intrusion Sampling Activities**

Overall RAC (Highest code from subtasks): **M**

Project Location: Former Seneca Army Depot

Project Number: 637490374

Date Prepared: 7 December 2022

Prepared By: P. Gannon

Reviewed By: A. Hughes, PG, ASP, CSP

Competent and/or Qualified Person(s): Table 4-2 List of Competent Persons

RAC Matrix

Severity	Probability				
	1 Frequent	2 Likely	3 Occasional	4 Seldom	5 Unlikely
1 Catastrophic	E	E	H	H	M
2 Critical	E	H	H	M	L
3 Marginal	H	M	M	L	L
4 Negligible	M	L	L	L	L

Step 1: Review each "hazard" and determine RAC.

Probability = The likelihood to cause an incident, near miss, or accident. Identified as frequent, likely, occasional, seldom, or unlikely.

Severity = The outcome/degree if an incident, near miss, or accident did occur. Identified as catastrophic, critical, marginal, or negligible.

Step 2: Identify the RAC as E, H, M, or L for each hazard on AHA. Select the highest RAC and note at the top of the form.

RAC Chart
E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

TASK BREAKDOWN, HAZARDS AND CONTROLS:

Steps	Hazards	Controls	RAC
All	General Hazards	Review General AHA and follow associated controls.	M
Setup at Well	Exposure to Residential Traffic	Notify community association prior to start of work Park support vehicle to the roadside of well Prevent setup where vehicle collision with support vehicle will impact workers Setup seating to face direction of oncoming traffic Place road signs and cones to warn oncoming traffic of workers.	1/5/M
Open Well	Lacerations	Don Level D PPE Inspect hand tools prior to use. Only use tools for their intended purpose (e.g., do not pry with a screwdriver)	5/5/L
Collect Depth to Water	Lacerations	Inspect depth to water meter prior to use for burrs, sharp edges, or other defects.	4/5/L
Place Pump or PDB	Overexertion	Work at an appropriate pace. Team lift if needed; individuals cannot lift item greater than 50 pounds.	3/5/L
Pump Water/ Pull Passive Diffusion Bag (PDB)	Exposure to Trace volatile organic compounds (VOCs) (dermal/ingest)	Work at an appropriate pace to reduce contact with groundwater. Don modified Level D PPE (add nitrile gloves) Eating, smoking, or other hand-to-mouth contact is prohibited within exclusion zone. Follow proper hygiene procedures.	4/5/L
Pump Water/ Pull PDB	Exposure to Trace VOCs (Inhalation)	Following setup, work from an upwind position unless this opposes traffic safety controls. Inspect monitoring equipment prior to use. Calibrate monitoring equipment prior to use. Identify action limits for monitoring activities. Perform environmental monitoring as required in SSHP Utilize engineering controls (fan) to dilute and disperse potential VOC-containing vapors.	2/4/M
Collect Sample	Exposure to Trace VOCs (dermal) or Preservative	Don Modified Level D PPE Pump water at an appropriate pace, do not splash. Ensure sample jars remain upright Do not expose jars to direct sunlight or high temperatures to volatilize preservative	2/4/M
Filter investigation-derived waste (IDW)	Exposure to Trace VOCs (dermal/ingest)	Inspect granular activated carbon (GAC) bucket prior to use. Tighten all loose seals and maintain spill kit. Filter at an appropriate pace to prevent spillage.	4/5/L
Decontaminate Equipment	Exposure to Trace VOCs (dermal/ingest)	Work at an appropriate pace to reduce contact with groundwater. Don modified Level D PPE (add nitrile gloves) Eating, smoking, or other hand-to-mouth contact is prohibited within exclusion zone. Follow proper hygiene procedures.	3/4/L

Steps	Hazards	Controls	RAC
Connect Air Sampling Equipment	Overexertion	Work at an appropriate pace. Team lift if needed; individuals cannot lift item greater than 50 pounds.	3/5/L
Sample Air Media	Exposure to Trace VOCs (dermal/ingest)	Work at an appropriate pace to reduce contact with groundwater. Don modified Level D PPE (add nitrile gloves) Eating, smoking, or other hand-to-mouth contact is prohibited within exclusion zone. Follow proper hygiene procedures.	4/5/L
Sample Air Media	Exposure to Trace VOCs (Inhalation)	Following setup, work from an upwind position unless this opposes traffic safety controls. Inspect monitoring equipment prior to use. Calibrate monitoring equipment prior to use. Identify action limits for monitoring activities. Perform environmental monitoring as required in SSHP Utilize engineering controls (fan) to dilute and disperse potential VOC-containing vapors.	2/4/M
Collect Sample	Exposure to Trace VOCs (dermal) or Preservative	Don Modified Level D PPE Pump water at an appropriate pace, do not splash. Ensure sample jars remain upright Do not expose jars to direct sunlight or high temperatures to volatilize preservative	2/4/M
Surface Water and Sediment Sampling	Drowning Hazard	Personnel will not enter water greater than 24 inches deep	1/5/M
		Personnel will don a USCG-Rated Class II PFD (or greater)	
		A life ring will be present within 90’ of any person in the water	
		Personnel will stop work and leave the water if conditions change	
Filter IDW	Exposure to Trace VOCs (dermal/ingest)	Inspect GAC bucket prior to use. Tighten all loose seals and maintain spill kit. Filter at an appropriate pace to prevent spillage.	4/5/L
Decontaminate Equipment	Exposure to Trace VOCs (dermal/ingest)	Work at an appropriate pace to reduce contact with groundwater. Don modified Level D PPE (add nitrile gloves) Eating, smoking, or other hand-to-mouth contact is prohibited within exclusion zone. Follow proper hygiene procedures.	3/4/L

REQUIRED EQUIPMENT, INSPECTION AND TRAINING:

Equipment	Inspection Requirements	Training Requirements (including Competent Person and Qualified Personnel, if applicable)
• Level D (steel/composite toed boots, safety glasses, work pants) − Add Class II (or greater) Vest when sampling on private roadway − Add work gloves if laceration hazard − Add nitrile gloves when handling groundwater − Add nitrile gloves for general hygiene − Add hearing protection (see General AHA) • Support vehicle • Traffic cones and signage • Depth-to-water meter • Submersible Pump and Tubing or PDBs, String, Weights − Add a suitcase (small, 78 dBA) compressor for bladder pump system • Box Fan and Fused Vehicle DC-AC Inverter w/GFCI • Air pumps if needed, air sampling equipment. • Monitoring equipment (e.g., photoionization detector [PID]) • Buckets and/or Containers/containerization material (drums, polyethylene liner) • Non-Phosphate Detergent • GAC Filter System • Emergency equipment − First Aid/5A:10B:C Fire Extinguisher/Eyewash − Drinking water and electrolyte beverages • USCG Type II Personal Floatation Device • USCG Rated Life Ring	• Inspect PPE prior to each use • Inspect support vehicle daily • Inspect groundwater sampling equipment (depth-to-water meter, pump, air compressor if present) • Calibrate environmental monitoring equipment daily prior to use. • Inspect emergency equipment/supplies daily (document extinguisher monthly) • Inspect GAC Filter System daily	• APP and AHA review • Use and limitations of PPE • Valid driver's license • Low-flow and no-purge groundwater sampling techniques • Compressor Safety • Proper Lifting Techniques • Use of monitoring equipment • Decontamination Procedures • GAC Filter System Usage • First aid/CPR (2+ On-site Persons) • BBP for FA/CPR Providers • Fire Extinguisher Use • Buddy System • 40-Hour HAZWOPER plus Refreshers and Medical Surveillance • SSHO Requirements in Chapter 6

Activity/Work Task: **Well Installation, Soil Sampling, Borehole Drilling, and Well Development**

Overall RAC (use highest code from all subtasks): **M**

Project Location: Former Seneca Army Depot

Project Number: 637490374

Date Prepared: 7 December 2022

Prepared By: P. Gannon

Reviewed By: A. Hughes, PG, ASP, CSP

Competent Person: Licensed Driller

RAC Matrix					
	Probability (P)				
Severity (S)	1 Frequent	2 Likely	3 Occasional	4 Seldom	5 Unlikely
1 Catastrophic	E	E	H	H	M
2 Critical	E	H	H	M	L
3 Marginal	H	M	M	L	L
4 Negligible	M	L	L	L	L

Step 1: Review each “hazard” and determine RAC.
Probability = the likelihood to cause an incident, near miss, or accident. Identified as frequent, likely, occasional, seldom, or unlikely.
Severity = the outcome/degree if an incident, near miss, or accident did occur. Identified as catastrophic, critical, marginal, or negligible.
Step 2: Identify the RAC as E, H, M, or L for each hazard on AHA. Select the highest RAC and note at the top of the form.

RAC Chart

E = Extremely High Risk

H = High Risk
M = Moderate Risk
L = Low Risk

TASK BREAKDOWN, HAZARDS, AND CONTROLS: WELL INSTALLATION

Work Task Steps	Hazards	Controls	RAC/Severity/ Probability RAC
Drilling	Physical Hazard: Injury from heavy equipment (drill rig and support vehicles)	• Be aware of the location of equipment, where high visibility safety colors establish eye contact with operator. • Be aware of pinch points, swinging chains, drill rods, etc. • PPE (hard hat) when working within radius of elevated equipment or materials.	2/4/M
	Physical Hazard: Physical Injury from Failure of Equipment	• Qualified driller must inspect drill rig prior to use, if faulty or inappropriate, do not proceed until repaired or replaced. • Inspection will be documented using inspection form.	2/4/M
	Physical Hazard: Faulty or Inappropriate Equipment	• Inspect all hand tools prior to use, if faulty or inappropriate, do not proceed until repaired or replaced. Also follow manufacturers' recommendations regarding hearing and eye protection during operation of all hand tools. Evaluate each operation to determine if safety glasses are adequate for the work being performed and have face shields available, as necessary.	2/4/M
	Physical Hazard: Moving Equipment/Direct-push and Sonic Drilling	• Clear area of obstructions; notify personnel work is commencing. • Do not exceed manufacturers' recommended speed, force, torque, etc. and penetrate the ground slowly with hands on the controls for at least the first foot of soil to minimize chance of kick-out. • Stay clear of rotating drill rods and compressed air lines/equipment. • Use long-handled shovel to clear away cuttings when drilling has stopped. • Secure loose clothing. • Do not walk under suspended loads. • When possible, remove overhead hazards promptly. • Wear appropriate PPE including hard hat and steel-toed boots.	3/4/L

Work Task Steps	Hazards	Controls	RAC/Severity/ Probability RAC
Drilling	Physical Hazard: Noise-Induced Hearing loss	• Wear hearing protection when working in proximity to drill rig. • PPE will meet/exceed requirements presented in Hearing Conservation Program.	3/4/L
	Physical Hazard: Musculoskeletal Sprains/ Strains from Material Handling, Moving, Lifting	• Observe proper lifting techniques. • Use two or more persons for heavy bulk lifting. • Use mechanical lifting equipment (hand carts, trucks, etc.) to move large awkward loads. • Obey sensible lifting limits (50-pound maximum per person manual lifting).	3/4/L
	Physical Hazard: Fire/Explosion	• Ensure type ABC, fully charged fire extinguisher on-site. • Perform utility clearance (New York One Call) to avoid possible utilities. • Stop work if hazardous conditions are identified.	1/5/M
	Physical Hazard: Electrical	• Inspect work areas for spark sources, maintain safe distances, properly illuminate work areas, and provide barriers to prevent inadvertent contact. • Maintain minimum clearance distances for overhead energized electrical lines. Use a spotter to confirm clearance of overhead lines and other obstructions. • Perform utility clearance (One Call) to avoid possible buried electrical lines. Interview property owners on location of possible private utilities.	1/5/M
	Chemical/Physical Hazard: Exposure to Elevated Organic Vapors and/or Combustible Gases	• Conduct Ambient Air Monitoring. • Approach and stay upwind of potential sources of vapors. • Ensure personnel using have been trained on instrument use and site specific action levels/upgrades. • Calibrate instrument daily and document calibration.	3/3/M
Equipment Relocation	Physical Hazard: Damage and/or Injury due to Rig Roll Over	• Do not move rig with mast raised. • Cross all hills and obstructions head on. • Set riggers prior to raising mast.	2/5/L
	Physical Hazard: Collision with property or personnel	• Utilize backup alarm and/or spotters when backing heavy equipment. • Use spotters when moving in/out of nominal clearance areas.	2/5/L
Borehole Abandonment	Physical Hazard: Injury from heavy equipment (grouter and support vehicles)	• Be aware of the location of equipment, wear high visibility safety colors, establish eye contact with operator. Wear appropriate PPE (hard hat) when working in proximity to overhead hazards.	2/5/L

Work Task Steps	Hazards	Controls	RAC/Severity/ Probability RAC
		• Be aware of pinch points, swinging chains, etc.	
	Physical Hazard: Material Handling, Moving, Lifting	• Observe proper lifting techniques. Use two or more persons for heavy bulk lifting. Obey sensible lifting limits (60 pound maximum per person manual lifting. • Use mechanical lifting equipment (hand carts, trucks, etc.) to move large, awkward loads.	3/4/L
	Chemical Hazard: Inhalation of Concrete	• Wear modified Level D PPE (including nitrile gloves), dust mask, and goggles or safety glasses (with foam seal) when mixing concrete and dust is visible.	3/3/M

REQUIRED EQUIPMENT, INSPECTION AND TRAINING

Equipment	Inspection Requirements	Training Requirements (including Competent Person and Qualified Personnel, if applicable)
• Support vehicle • Monitoring equipment per Table 4-2 of the APP. • Level D PPE (safety-toed boots, safety glasses, hard hat, work pants, high-visibility clothing and/or reflective safety vests) • Modified Level D PPE (above plus nitrile gloves; goggles or foam-lined safety glasses if visible dust) • Heavy equipment (drill rig, skid steer) • Power tools/hand tools • Emergency equipment including first aid kit, eye wash, fire extinguishers	• Inspect PPE prior to each use • Inspect drill rig daily • Inspect skid steer daily • Inspect and calibrate monitoring equipment daily • Inspect worksite for overhead or underground hazards daily • Inspect emergency equipment/supplies daily (first aid kit, eye wash, fire extinguisher)	All Personnel: • Site indoctrination (full site indoctrination as described in the Accident Prevention Plan (APP) • Lifting • APP and General AHA review • 40-Hour HAZWOPER training, annual updates for any intrusive activities Operators: • Valid driver's license • Use of monitoring equipment • Licensed to operate drill rig

Activity/Activities: **Munitions and Explosives of Concern Avoidance**

Overall RAC (highest code from subtasks): **M**

Project Location: Former Seneca Army Depot

Project Number: 637490374

Date Prepared: 7 December 2022

Prepared By: P. Gannon

Reviewed By: A. Hughes, PG, ASP, CSP

Competent and/or Qualified Person(s): Unexploded Ordnance Technician II (UXOTII) (Or Greater) See Table 4-2 in APP

RAC Matrix

	Probability				
Severity	1 Frequent	2 Likely	3 Occasional	4 Seldom	5 Unlikely
1 Catastrophic	E	E	H	H	M
2 Critical	E	H	H	M	L
3 Marginal	H	M	M	L	L
4 Negligible	M	L	L	L	L

Step 1: Review each "hazard" and determine RAC. Probability = The likelihood to cause an incident, near miss, or accident. Identified as frequent, likely, occasional, seldom, or unlikely.

Severity = The outcome/degree if an incident, near miss, or accident did occur. Identified as catastrophic, critical, marginal, or negligible.

Step 2: Identify the RAC as E, H, M, or L for each hazard on AHA. Select the highest RAC and note at the top of the form.

RAC Chart
E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

TASK BREAKDOWN, HAZARDS, AND CONTROLS

Work Task Steps	Hazards	Controls	RAC
All Work Task Steps	General Hazards	• Review of General AHA for general site hazards (e.g., physical, chemical, biological, etc.). • Separate AHA for munitions and explosives of concern (MEC) construction support (if needed).	Various
Driving to Site	General Hazards	• Review of General AHA for driving hazards. • Obey all traffic laws and adjust driving to match weather and site conditions.	2/4/M
Walking On-site	Exposure to MEC Explosion	• UXOTII or above required to perform MEC Avoidance Duties (see training requirements). • Non-unexploded ordnance (UXO) qualified personnel will receive site-specific (includes MEC Recognition) • All non-UXO personnel to receive MEC Awareness training prior to entering site • Identify areas known or suspected of containing UXO. • UXO-qualified personnel will escort all non-UXO qualified staff. • UXO-trained technicians will clear footpaths 4-ft wide; Mark centerline with white pin flags/pink survey tape. • Identified subsurface anomalies will be marked with yellow survey markers and avoided. • If suspect MEC is observed, evacuate area to a minimum of 200 ft from potential MEC and notify Site Manager, SSHO and UXO Safety Program Manager.	2/4/M

Work Task Steps	Hazards	Controls	RAC
Driving On-site	Exposure to MEC Explosion	• Inspect Magnetometer Prior to Use • UXOTII+ shall clear 25-ft wide access routes and include turnaround areas. • Identified surface anomalies will be flagged, made known to the field team, and avoided. • Do not use cell phones or radios within 50 ft of potential MEC, • Do not disturb the ground in potential MEC areas without consulting UXO-qualified staff, • Do not move UXO or MEC (avoidance only) • UXO-trained technicians will clear pathways with white pin flags and/or pink survey tape. • Identified subsurface anomalies will be marked with yellow survey markers and avoided. • If suspect MEC is observed, evacuate area to a minimum of 200 ft from potential MEC and notify Site Manager, SSHO and UXO Safety Program Manager.	2/4/M
Intrusive Boring	Exposure to MEC Explosion	• UXOTII or above required to perform MEC Avoidance Duties (see training requirements). • UXO Personnel shall be trained in accordance with the Department of Defense Explosive Safety Board Technical Paper-18 or above. • Non-UXO qualified personnel will receive site-specific training involving recognition of all types of MEC expected to be found on site. • All non-UXO personnel to receive MEC Awareness training prior to entering site • Identify areas known or suspected of containing UXO. • Clear a radius of 50 ft around drill rigs. • Perform borehole magnetometer searches for each 2-ft increment during drilling operations to a depth of 10 ft. • Abandon boreholes if anomaly detected • Identified subsurface anomalies will be marked with yellow survey markers and avoided. • If suspect MEC is observed, evacuate area to a minimum of 200 ft from potential MEC and notify Site Manager, SSHO and UXO Safety Program Manager.	2/4/M

REQUIRED EQUIPMENT, INSPECTION AND TRAINING

Equipment	Inspection Requirements	Training Requirements (including Competent Person and Qualified Personnel, if applicable)
• Support Vehicle (Contains General Emergency Supplies in General AHA) • Level D PPE (See General AHA) • Handheld Magnetometer • Downhole Magnetometer • Pin Flags, Flagging Tape and/or Spray Paint	• Inspect PPE Prior To Each Use • Inspect Magnetometer Daily (Test Strip) And Prior To Use (Field Inspection). • Review Chapter 7 Of APP	• All Site Personnel – MEC Avoidance and Awareness – General AHA And APP/SSHP Review • UXOTII Or Above – DDESP TP18 Commensurate Training/Experience (Updated Recently) • Review Chapter 6 Of APP

This page intentionally left blank

Attachment B

Occupational Safety and Health Administration 300 Form and Subcontractor Proofs of Competency

This page intentionally left blank

OSHA's Form 300 **(Rev. 01/2004)**

Log of Work-Related Injuries and Illnesses

Attention: This form contains information relating to employee health and must be used in a manner that protects the confidentiality of employees to the extent possible while the information is being used for occupational safety and health purposes.

Year 2021

U.S. Department of Labor

Occupational Safety and Health Administration

You must record information about every work-related injury or illness that involves loss of consciousness, restricted work activity or job transfer, days away from work, or medical treatment beyond first aid. You must also record significant work-related injuries and illnesses that are diagnosed by a physician or licensed health care professional. You must also record work-related injuries and illnesses that meet any of the specific recording criteria listed in 29 CFR 1904.8 through 1904.12. Feel free to use two lines for a single case if you need to. You must complete an injury and illness incident report (OSHA Form 301) or equivalent form for each injury or illness recorded on this form. If you're not sure whether a case is recordable, call your local OSHA office for help.

Form approved OMB no. 1218-0176

Establishment name EA Engineering, Science, and Technology, Inc., PBC

City Hunt Valley State MD

Identify the person		Describe the case				Classify the case												
						CHECK ONLY ONE box for each case based on the most serious outcome for that case:				Enter the number of days the injured or ill worker was:		Check the "injury" column or choose one type of illness:						
(A) Case No.	(B) Employee's Name	(C) Job Title (e.g., Welder)	(D) Date of injury or onset of illness (mo./day)	(E) Where the event occurred (e.g. Loading dock north end)	(F) Describe injury or illness, parts of body affected, and object/substance that directly injured or made person ill (e.g. Second degree burns on right forearm from acetylene torch)	Death (G)	Days away from work (H)	Remained at work: Job transfer or restriction (I)	Remained at work: Other record-able cases (J)	Away From Work (days) (K)	On job transfer or restriction (days) (L)	(M) Injury (1)	Skin Disorder (2)	Respiratory Condition (3)	Poisoning (4)	Hearing Loss (5)	All other illnesses (6)
1		Environmental Scientist II	05/18/2021	River bank of Mississippi at Jefferson Barracks base	Slipped on wet riprap and fell on elbow causing a laceration requiring stitches.				X			X					
2		Hydrogeologist	6/3/2021	Stibnite Mine, Idaho	Found a tick imbedded in back of scalp				X			X					
3		Scientist I	8/4/2021	Former Papermill Napanoch, NY	Poison Oak on stomach, back and arms.				X				X				
4		Geologist	9/28/2021	Aberdeen Proving Ground	Suspected chigger bites with some infection on ankles requiring perscription tratment cream.				X				X				
5		Geologist	10/25/2021	EA Warwick, RI office parking lot	Lost balance while changing out of wet weather gear and fell against the vehicle bruising the sternum/body core area. Modified duty to light lifting.			X		0	13	X					
					Page totals	**0**	**0**	**1**	**4**	**0**	**13**	**3**	**2**	**0**	**0**	**0**	**0**
												Injury (1)	Skin Disorder (2)	Respiratory Condition (3)	Poisoning (4)	Hearing Loss (5)	All other illnesses (6)

Be sure to transfer these totals to the Summary page (Form 300A) before you post it.

Public reporting burden for this collection of information is estimated to average 14 minutes per response, including time to review the instruction, search and gather the data needed, and complete and review the collection of information. Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number. If you have any comments about these estimates or any aspects of this data collection, contact: US Department of Labor, OSHA Office of Statistics, Room N-3644, 200 Constitution Ave, NW, Washington, DC 20210. Do not send the completed forms to this office.

OSHA's Form 300A (Rev. 01/2004)
Summary of Work-Related Injuries and Illnesses

Year 2021

U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no. 1218-0176

All establishments covered by Part 1904 must complete this Summary page, even if no injuries or illnesses occurred during the year. Remember to review the Log to verify that the entries are complete and accurate

Using the Log, count the individual entries you made for each category. Then write the totals below, making sure you've added the entries from every page of the log. If you had no cases write "0."

Employees former employees, and their representatives have the right to review the OSHA Form 300 in its entirety. They also have limited access to the OSHA Form 301 or its equivalent. See 29 CFR 1904.35, in OSHA's Recordkeeping rule, for further details on the access provisions for these forms.

Number of Cases

Total number of deaths	Total number of cases with days away from work	Total number of cases with job transfer or restriction	Total number of other recordable cases
0	0	1	4
(G)	(H)	(I)	(J)

Number of Days

Total number of days away from work	Total number of days of job transfer or restriction
0	13
(K)	(L)

Injury and Illness Types

Total number of…
(M)

(1) Injury	3	(4) Poisoning	0
(2) Skin Disorder	2	(5) Hearing Loss	0
(3) Respiratory Condition	0	(6) All Other Illnesses	0

Post this Summary page from February 1 to April 30 of the year following the year covered by the form

Public reporting burden for this collection of information is estimated to average 58 minutes per response, including time to review the instruction, search and gather the data needed, and complete and review the collection of information. Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number. If you have any comments about these estimates or any aspects of this data collection, contact: US Department of Labor, OSHA Office of Statistics, Room N-3644, 200 Constitution Ave, NW, Washington, DC 20210. Do not send the completed forms to this office.

Establishment information

Your establishment name EA Engineering, Science, and Technology, Inc., PBC

Street 225 Schilling Circle, Suite 400

City Hunt Valley State Maryland Zip 21031

Industry description (e.g., Manufacture of motor truck trailers)
Environmental Remediation and Consulting

Standard Industrial Classification (SIC), if known (e.g., SIC 3715)

OR North American Industrial Classification (NAICS), if known (e.g., 336212)
5 6 2 9 1 0

Employment information

Annual average number of employees 592

Total hours worked by all employees last year 1,231,888

Sign here

Knowingly falsifying this document may result in a fine.

I certify that I have examined this document and that to the best of my knowledge the entries are true, accurate, and complete.

Ian D. MacFarlane
Company executive

Pres., CEO & Chair
Title

410-584-7000
Phone

19 January 2022
Date

Attachment C

Resumes and Certifications of Key Personnel

(Any certification that is set to expire prior to, or during, field activities will be renewed before said expiration date. On-site files will be amended with current certifications as appropriate.)

This page intentionally left blank

Robert Marcase, CIH, CSP, CHMM
Corporate Director of Safety and Health

This page intentionally left blank

Robert O. Marcase, CIH, CSP, CHMM

Corporate Director of Health and Safety; Deputy Technical Chief, Environmental, Health, Safety, and Sustainability Compliance with Emphasis on Health and Safety

Education
B.S./Environmental Science (Minor in Geology)/1995 (Slippery Rock University)

Registrations/Certifications
Certified Industrial Hygienist—2007 (No. 9283CP)
Certified Safety Professional—2010 (No. 21609)
Certified Hazardous Materials Manager (CHMM)–2012 (No. 15935)

Specialized Training
OSHA 40-Hour Hazardous Waste Operations and Emergency Response Training;
OSHA 8-Hour Hazardous Waste Operations and Emergency Response Refresher Training;
OSHA 30-Hour Construction Safety Training;
NIOSH 582 Certification, Collecting and Analyzing Asbestos Air Samples; 1998
Asbestos Building Inspector Certification, Maryland and Pennsylvania; 1999

Professional Affiliations/Appointments
American Industrial Hygiene Association; Full Member

Experience
Years with EA: 10 Total Years: 26

Mr. Marcase is a Certified Industrial Hygienist (CIH), Certified Safety Professional (CSP), and Certified Hazardous Materials Manager (CHMM) with 26 years of experience in a wide range of environmental, safety and health, and industrial hygiene projects. His experience includes regulatory compliance strategy, industrial hygiene investigation and process analysis, occupational exposure assessment, facility-wide health and safety auditing, and air quality permitting and compliance. His experience also includes environmental assessments, building inspections, industrial air pollution testing, and water quality analysis.

Professional Experience

Director of Corporate Health and Safety—As Director of EA's Corporate Health and Safety Program, manages health and safety compliance for more than $200 million of environmental services annually. Under his supervision, EA has maintained an OSHA recordable incident rate of 0.81 for 2021, well below the Fiscal Year 2021 Bureau of Labor Statistics industry averages of 1.5 for EA's primary NAICS code 562910. Under EA's 40+ current Federal contracts, reviewed/served as signing CIH and managed the implementation for more than 200 Accident Prevention Plans/Site Safety and Health Plans for U.S. Army Corps of Engineers, Air Force, Navy, U.S. Environmental Protection Agency (EPA), and other federal agencies. Managed the health and safety requirements, guidance, and protocols in accordance with Engineer Manual 385-1-1.

Industrial Hygiene Program Management—Managed health and safety programs for the Architect of the Capitol in Washington, D.C. The Architect of the Capitol manages and operates the Capitol Complex on behalf of the U.S. Congress, the Library of Congress, and the U.S. Supreme Court. The Capitol Complex encompasses more than 450 acres and more than 18.4 million square ft of space, all national historical sites and critical continuity of government facilities. Worked in the Architect of the Capitol Safety, Fire, and Environmental Programs office developing and managing diverse Complex-wide health and safety policies including hazardous building materials, respiratory protection, occupational exposure control, Indoor Air Quality Assessment, mold/water intrusion evaluation and control, and hazardous communications. Provided health and safety project management and oversight support on mega-projects such as the U.S. Capitol Dome Restoration project ($70 million), Cannon House Office Building Renovation ($800 million), and Capitol Power Plant Cogeneration project ($300 million) as well as all other construction activities at the Architect of the Capitol. Managed more than $500,000 in contract support and an inventory of scientific equipment worth more than $100,000.

Industrial Hygiene Project Management—Managed industrial hygiene projects for an industrial hygiene and toxicology consulting firm located in Baltimore. Responsibilities included scheduling company projects, writing proposals, establishing and meeting budgets, and supervising industrial hygienists; supervising asbestos, chemical, hazardous waste, and industrial hygiene surveys; monitoring, inspecting, and writing specifications for asbestos and hazardous waste projects; conducting environmental audits; and reviewing and approving industrial hygiene reports. Also performed onsite inspections for compliance with safety and health standards.

***Permitting and Compliance Services*—**Provided permitting and compliance services to industrial and commercial clients, ranging from hospitals and universities to specialty chemical manufacturers. Experience includes preparation and revision of Resource Conservation and Recovery Act Part B permits, development and negotiation of Memoranda of Agreement, Title V applicability, and permitting; state and local air permit applicability and permit negotiation; Reasonably Available Control Technology applicability and specification; specification of emission control equipment; risk and catastrophic release modeling; and compliance assessment, planning, and monitoring. Has broad compliance auditing experience and identifying permitting needs and procedures for a variety of clients.

***Environmental Management Systems*—**Providing technical assistance in the development and implementation of a compliance-focused environmental management system for a state transportation agency, including development and communication of policy; structuring and scoping of the environmental organization for the agency and associated responsibilities; completion of multimedia compliance audits of all facilities over a 5- to 7-year period; development of corrective actions; development of a web-based, password protected, system-wide compliance data management system; development of standard operating procedures for compliance functions; moderation of a steering committee; and development and presentation of training to agency employees. Lead third party auditor for implementation of an environmental management system by a county government laboratory. Leading compliance assessment and program development for a county government department of public works and transportation.

Indoor Air Quality/Mold—Performed numerous indoor air quality/mold inspections. Provided comprehensive mold assessment services for federal, state, municipal, and private clients. Services provided included microbiological bulk/air/wipe sampling, water intrusion and moisture inspections, air quality monitoring, employee training, preventative maintenance, remediation design and controls, and remediation oversight and clearance. Performed these services for numerous clients including the Maryland State Highway Administration, Maryland Aviation Administration, and multiple private sector clients. Developed mold abatement specifications for the Maryland State Highway Administration and major realty development companies.

EA Project Experience

Environmental Remediation Multiple Award I and Jr.; Environmental Command; Corporate Health and Safety Manager. Directs the Health and Safety Program over the past 2 years that covered remedial investigation/feasibility study, risk assessment, remedial design/remedial action, military munitions response, remedial oversight, operation and maintenance, long-term monitoring, and operational range assessments. Ensures compliance with Engineer Manual 385-1-1 and serves as the reviewer and concurrence signatory for project Accident Prevention Plans. Key projects include:

- **Per- and Polyfluoroalkyl Substances (PFAS) Remedial Investigation/Feasibility Study at Fort Leavenworth, Kansas**—Reviewed and overseeing implementation of the Site Safety and Health Plan/Accident Prevention Plan for the PFAS remedial investigation at this 234-acre active army installation. Developed Activity Hazard Analysis for novel coronavirus 2019 hazard mitigation to safely perform field work during the pandemic. health and safety concerns included: reviewed and approved boat safety for overwater core and water sampling, review and coordinate daily safety briefs, directed the Site Safety and Health Officer in development of safe work practices for heat and cold stress during field activities, reviewed and approved near miss incidents while overseeing incident investigation for drilling subcontractor heat stress. Manages and maintains medical monitoring and fitness for duty determinations, exposure assessments for hazardous chemicals, reviews and develops risk assessment and hazard rankings, and assists/directs field staff in determination and use of proper personal protective equipment for specific work activities.

- **RAO, Twin City Army Ammunition Plant, Minnesota**—Former US Armey ammunitions plant in Minnesota contaminated with metals, polycyclic aromatic hydrocarbons, polychlorinated biphenyls, volatile organic compound, cyanide, and explosives. Reviewed and approved Site Safety and Health Plan/Accident Prevention Plan for subsurface investigation including drilling/well installation, well abandonment, soil, groundwater, and surface water sampling. Developed exposure monitoring program and assisted Site Safety and Health Officer and Project Manager in determining occupational exposure to site specific hazardous chemicals. Manages and directs medical monitoring, safety and health training, drug screening, certificate maintenance, and safety orientation for site specific work activities.

2012 MAES (Project 7) and 2019 MAES Contracts U.S. Army Corps of Engineers–Baltimore; Corporate Health and Safety Manager—Maintains EA's written Safety and Health Program, including munitions and explosives of concern and radiation safety, and provides health and safety oversight for U.S. Army Corps of Engineers–Baltimore task orders to ensure compliance with Engineer Manual 385-1-1. Manages and conducts Hazardous Waste Operations and Emergency Response and non-Hazardous Waste Operations and Emergency Response Health and Safety training, medical surveillance, and respiratory protection programs; ensures preparation of Accident Prevention Plans by a Qualified Person; reviews Activity Hazard Analyses and associated Remedial Action Contracts and authorizes finalization and implementation; develops and maintains safety audit program and ensures audits are conducted by a Competent Person; Reviewer and concurrence signatory for project Accident Prevention Plans. Key projects include the following:

- **PFAS Site Investigation at 80 Army National Guard Facilities, Nationwide**—EA is conducting site investigations for PFAS to develop conceptual models of contamination. Site investigation activities include soil, surface water, and ground water sampling. Review and approve Site Safety and Health Plans as site specific scopes are identified. Ensure compliance with safety requirements for site access, drilling, reviewing subcontractor safety, development and implementation of medical programs, exposure and hazard assessments, site safety audits and Site Safety and Health Officer support, and identification and delivery of safety training requirements.

- **Integrated Natural Resources Management Plan at 24 Air National Guard Facilities, Nationwide**—Reviewed and approved the Abbreviated Accident Prevention Plan for site visits at Air National Guard facilities nationwide. Field teams from across EA were deployed to conduct multi-species flora/fauna surveys, erosion surveys, and Integrated Natural Resources Management Plan surveys. Site hazards ranged from dangerous fauna (bears, including development of bear protection plans, training, and subcontracted bear guards), poisonous flora, as well as hazardous walking surfaces. Managed medical monitoring and fitness for duty programs, drug and alcohol abuse policies, training requirement identification and safety training implementation.

- **Building Demolition, Walter Reed Medical Center**—Managed and reviewed the development of an Accident Prevention Plan/Site Safety and Health Plan for demolition of 12 buildings on the campus of the Walter Reed Medical Center in Washington, D.C. Reviewed and directed development of hazardous and toxic materials investigations for engineering design of remediation plans to safely remove asbestos, lead, and other toxic/hazardous materials in preparation for demolition. Hazards controlled for the project included electrical safety, fall protection plan development, structural engineering surveys, site layout for security, and tree and brush clearing activities. Reviewed and approved Activity Hazard Analyses for task specific activities and provide senior technical review of subcontractor remediation plans. 2012 MAES: $1,3459,804; 2019 MAES: $13,933,030 (awarded to date)

- **Performance-Based Remediation for Expansion of the Dissolved Ethylene Dibromide Plume Groundwater Treatment System, Kirtland Air Force Base, New Mexico; U.S. Army Corps of Engineers–Albuquerque District; Health and Safety Manager—**Project requires implementation of a Resource Conservation and Recovery Act Interim Measure for expanding the groundwater treatment system at Solid Waste Management Units ST-106/SS-111 at Kirtland Air Force Base, New Mexico for containment of the dissolved-phase ethylene dibromide off-base plume associated with the Bulk Fuels Facility and historical releases of jet propellant-4, jet propellant-8, and aviation gas.

Drum Disposal, Lonfit Planning Project; U.S. Army Corps of Engineers–Huntsville; Health and Safety Senior Technical Reviewer—Provided senior technical review for project which includes disposal of up to 63 drums located within a dilapidated Quonset hut in Asan, Guam. Authored Project Management Plan and Uniform Federal Policy-Quality Assurance Project Plan as well as responsible for supporting the Project Manager in organizing and scheduling project activities.
Project Date: June 2019 – Present

Installation Restoration Program at Joint Base Lewis-McChord; Pierce County, Washington; U.S. Army Corps of Engineers; Health and Safety Manager—EA is providing Environmental Remediation Program Services for Joint-Base Lewis-McChord and Yakima Training Center. Work under this contract includes remediation systems operation, maintenance, monitoring, and optimization. Contribution to this effort includes task managing multiple field efforts to collect representative groundwater samples utilizing low-flow sampling techniques with submersible, bladder, and peristaltic pumps from approximately 30 groundwater wells and collecting groundwater samples from passive diffusion bag samplers from over 100 monitoring wells. Chemicals of concern at the sites are volatile organic compounds including trichloroethene and tetrachloroethene, diesel and gasoline range organics, and metals.
Project Date: January 2018 – Present

Cleanup of the Former York Naval Ordnance Plant York, Pennsylvania—Health and safety support during cleanup of Military Munitions Response Program hazards at the former York Naval Ordnance Plant Formerly Used Defense Sites. Responsible for preparing a site-specific conceptual site model for the Formerly Used Defense Sites based on the historical operational information and the previous investigations for the Military Munitions Response Program. Project includes surface clearance for munitions and explosives of concern and munitions debris, analog and digital geophysics, intrusive anomaly investigations, and munitions constituents sampling. Site follows Pennsylvania Department of Environmental Protection Act 2 and U.S. Environmental Protection Agency (EPA) Resource Conservation and Recovery Act cleanup using Act 2 guidance and cleanup criteria. Responsible for preparation and review of planning documents, oversite of unexploded ordnance investigations (surface clearance, geophysics, and intrusive investigations) and munitions constituents sampling and analysis, and review of investigation results. Prepared a Remedial Investigation report which was approved by Pennsylvania Department of Environmental Protection And EPA. Prepared a Remedial Alternatives Analysis with a recommended alternative to address Risk at the Former New York Naval Ordnance Plant. Remedial action was approved by stakeholders Pennsylvania Department of Environmental Protection and EPA. Prepared a cleanup plan to address residual munitions and explosives of concern and munitions constituents contamination which include removal of former firing range buildings. Provided Munitions Response/Construction Support to support during Harley-Davidson building expansion program. Prepared a design, sediment and erosion control plan, and specifications to support subcontractor selection process for cleanup. Conducted hazmat surveys and identified residual asbestos-containing material, which needed to be address thru abatement (friable asbestos-containing on steam lines, roofing material and asbestos-containing sprayed on walls). Remedial action will address residual asbestos-containing, Resource Conservation and Recovery Act hazardous waste (lead dust and sand in the backstop) as well as munitions and explosives of concern, munitions constituents and building debris. Prepared planning documents (Health and safety plan, sampling and analysis plan, quality control plan) to support cleanup activities. Cleanup activities commenced in Spring 2021.
Project Date: December 2014 – Present

Remedial Investigation/Feasibility Study Oversight, Valley Pike Volatile Organic Compounds Superfund Site, Riverside, Ohio; EPA Region 5; Health and Safety Manager—Health and Safety Manager for completion of Remedial Investigation and Feasibility Study Potentially Responsible Party oversight at the Valley Pike volatile organic compounds Superfund Site located in Riverside, Ohio under the EPA Remedial Acquisition Framework Environmental Services and Operations Contract. The site is located southwest of the Mullins Rubber Products Incorporated facility in a mixed industrial and residential area that includes approximately 500 residential properties. Groundwater contaminated with tetrachloroethene and trichloroethene was discovered in 2013 and the residential area has been impacted by vapor intrusion issues from the groundwater plume. Activities completed to date (December 2020) include development of planning documents (Health and Safety Plan, Uniform Federal Policy–Quality Assurance Project Plan, and Project Management Plan). Activities to be completed include oversight of Potentially Responsible Party led remedial investigation field activities including sample collection and treatability study and technical review of Potentially Responsible Party submittals including technical memorandum (site characterization, current and future land uses); Screening Level Ecological Risk Assessment Report; Baseline Risk Assessment Report; and Remedial Investigation Report.
Project Date: August 2020 – Present

Oklahoma–Arkansas Group Optimized Remediation Contract; Air Force Plant 3, Altus Air Force Base, Tinker Air Force Base, and Vance Air Force Base, Oklahoma, and Little Rock Air Force Base, Arkansas; U.S. Army Corps of Engineers–Tulsa District (contracting agency for Air Force Civil Engineer Center)— Health and Safety Manager for 10-year, performance-based contract to achieve high resolutions site characterizations, decision documents, Remedy-in-Place, Response Complete, Site Closeout, Remedial Action-Operation, Long-Term Monitoring, and/or Five-Year Reviews at 66 sites across five installation.

Marion Pressure Treating Company Superfund Site, Marion, Louisiana; EPA; Remedial Design; Health and Safety Manager—Providing health and safety oversight and technical support during the remedial design associated with a former pressure-treated wood product company located in Marion, Louisiana. Creosote was reported to be the only wood preservative used during the wood treatment process. The Marion Pressure Treating Company site was proposed for the National Priorities List in 1999 and added to the list in 2000. A remedial investigation and feasibility study were completed at the site in 2001, and the Record of Decision was completed in 2002. A remedial design was developed in September 2003, and an independent technical review of the design was performed by U.S. Army Corps of Engineers in 2006. However, due to issues with the selected technology, the remedial action was never performed. EA conducted a supplemental field investigation employing the use of a cone penetrometer testing rig in conjunction with the Tar-specific Green Optical Technology® to delineate the extent of creosote at the site. EPA issued a Record of Decision Amendment in 2016 thereby establishing the remedy to be implemented at the site. The remedial design is based on the remedy of *in situ* solidification/stabilization of the dense non-aqueous phase liquid area, removal soil and sediment from the Big Creek and the waste piles on the south side of the site into the Consolidation Cap Area, and extension of the Resource Conservation and Recovery Act cap.
Project Date: 2010 – Present

Environmental and Engineering Assessments for Department of Defense Fuel Systems Worldwide; Air Force Civil Engineer Center; Health and Safety Manager—Health and Safety Manager to provide senior technical review of health and safety plans for tasks providing Leak Detection Testing and Monitoring for the Defense Logistics Agency-Energy Leak Detection Centrally Managed Program formerly known as the Defense Energy Support Center who is responsible for the environmental compliance of capitalized petroleum, oil, and lubricants storage and distributions systems at Department of Defense facilities throughout both the continental United States and outside the United States worldwide.
Project Date: June 2018 – Present

Highways Division Safety Consulting Services (Hawaii, Maui, and Kauai Districts); Hawaii Department of Transportation; Health and Safety Senior Technical Reviewer—Provide senior technical review for various safety consulting services at the Hawaii District baseyards (Hilo, Honokaa, Waimea, North Kona, South Kona and Kau), Maui District baseyards (Kahului, Keanae, Molokai, and Lanai), and Kauai District baseyard (Puhi). The goal of the project was to provide safety consulting services for the various baseyards including training, inspections, plan updates, recordkeeping, reporting, and other miscellaneous tasks in accordance with applicable regulatory requirements for each baseyard.
Project Date: October 2020 – Present

Water Treatment Plant Upgrades, Naval Security Group Activity, Northwest Annex, Chesapeake, Virginia; Naval Facilities Engineering Systems Command Washington; Health and Safety Manager—Provide health and safety management and support during project management and technical execution of furnishing and installing six 2,000-pound granular activated carbon contactors in two trains of lead-lag-polishing series. Redevelopment and sampling of existing monitoring wells associated with the former Navy Exchange fueling station (source area) is also included. Responsible for the preparation/submittal of the Remedial Action Work Plan and associated documents (Quality Assurance Project Plan, Accident Prevention Plan Construction Quality Control Plan,

Environmental Protection Plan, Stormwater Pollution Prevention Plan, Traffic Plan, etc.), management of subcontractors and field staff, as well as report preparation.
Project Date: March 2020 – Present

Spirit Lake Estuary Remedial Design; Duluth, Minnesota; EPA Region 5/Region 9; Health and Safety Senior Technical Reviewer and Health and Safety Manager—Senior Technical Reviewer and Health and Safety Manager for a remedial design consisting of multiple remedy elements to address over 700,000 cubic yards of polycyclic aromatic hydrocarbons and metal contaminated sediment at the Spirit Lake site; remedy elements include sediment removal, capping, enhanced monitored natural recovery, monitored natural recovery, and onsite disposal in three project-constructed confined disposal facilities. Supporting as a lead reviewer for a design team of over 30 people to design confined disposal facilities; stream and river diversion structures; dredge prisms and methods; staging, access, dewatering, and disposal. Provided significant support in the contractor procurement, negotiation, and construction planning support for first $30 million of environmental remediation activities. Provides leadership and support for construction activities and field staff coordination as Construction Quality Manager.
Project Date: 2017 – Present

Performance-Based Remediation, Kirtland Air Force Base, New Mexico; U.S. Army Corps of Engineers–Albuquerque District, Health and Safety Manager—Project requires implementation of a Resource Conservation and Recovery Act Interim Measure for expanding the groundwater treatment system and groundwater extraction/conveyance system at Solid Waste Management Unit ST-106/SS-111 at Kirtland Air Force Base, New Mexico for containment of the dissolved-phase ethylene dibromide off-base plume associated with the Bulk Fuel Facility and historical releases of jet propellant-4, jet propellant-8, and aviation gas. The groundwater treatment system expansion included the construction of a second 400 gallons per minute granular activated carbon filter treatment system and the design of sand filters for both treatment trains with total capacity of 800 gallons per minute. Provided health and safety management support and quality assurance for the successful expansion of the groundwater treatment system as well as the groundwater extraction/conveyance system. Provides direction and support on safety matters as Accident Prevention Plan Reviewer as well as development of project-wide risk management planning document and procedures.
Project Date: 2015–2019

Site Management Program; Architect of the Capitol, Washington, D.C.; Program Manager—EA has supported the Architect of the Capitol since 2007 under various contracts, providing a wide range of mission support, including industrial hygiene services. The Office of the Architect of the Capitol is responsible to the U.S Congress for the maintenance, operation, development, and preservation of the 18.4 million square feet of buildings and more than 450 acres of land throughout the Capitol Complex. The Architect of the Capitol Power Plant provides steam and chilled water service through a network of underground piping and utility tunnels to 21 buildings and facilities on Capitol Hill. The tunnels total approximately 2.5 miles in length and vary in cross-section and age, with most tunnels exceeding 50 years of age. The Congressional Office of Compliance became aware of deteriorating and potentially dangerous conditions within these tunnels and issued a formal complaint against Architect of the Capitol that resulted in a Settlement Agreement between the Architect of the Capitol and Office of Compliance. This Settlement Agreement required the correction of nearly 2,000 discrete health and safety findings. Under this Contract, EA has provided consulting services, design services, safety training services, facilitation services, support products, and program and project management for Architect of the Capitol, as described below. Within all consulting services, EA provides expert services from Certified Industrial Hygienists, Certified Safety Professionals, Professional Engineers, LEED Accredited Professionals, Certified Energy Managers, and Project Management Professionals.

Occupational Health and Safety Program Support (Consulting Services)—EA has provided a wide range of consulting services to Architect of the Capitol to support the $200 million Utility Tunnel Modernization Program. EA provides onsite and offsite support to the Architect of the Capitol program staff in program and project planning, audits, evaluations, analysis of program elements, development and testing of scenarios, and Information Technology system solution development, rollout, support, and professional consultation. EA was contracted to support the development and implementation of a Program (supported by a Site Management Team comprised of an Architect of the Capitol management team with contractor support) with an initial focus of developing processes and procedures for tracking the health and safety finding life cycle as a matter of regulatory record. The Site Management Team focused initially on the correction of physical hazards such as overhead hazards (falling concrete), confined space and communication issues, excessive heat, and potential asbestos exposure and was primarily construction activity driven. As the Program progressed, EA's role expanded to include the audit and enhancement of the health and safety program elements necessary to safely operate the utility tunnel system. EA provided Certified Industrial Hygienists and Certified Safety Professionals to review and enhance these programs.

- ***Permit-Required Confined Space***—EA worked closely with Architect of the Capitol safety personnel and management to enhance and implement the Permit-Required Confined Space program by updating program documentation, performing field inspections of confined space entrant activities, performing atmospheric monitoring, and ensuring personal protective equipment was appropriate for hazards encountered during the entry.

- ***Occupational Exposure Assessment*—**EA performed occupational exposure assessments and negative exposure assessments for airborne contaminants such as hydrogen sulfide, carbon monoxide, asbestos, and silica. In addition, EA developed new record keeping and documentation procedures and tools to ensure the exposure assessments provided regulatory compliant information.

- ***Heat Stress Prevention*—**The more than 4 miles of tunnels that supply steam and chilled water service throughout the Capitol Complex can often create significantly elevated temperatures; consequently, EA worked closely to partner with Architect of the Capitol staff and management to implement and update a heat stress prevention policy. EA developed exposure criteria for the unique operational activities and environment found in the tunnels, including confined space issues, entrants often wearing impermeable coveralls and respirators, long distances to rest areas, etc. Wet Bulb Globe Temperature measurements and employee health monitoring were implemented to ensure work rest cycles and acclimatization were occurring appropriately.

- ***Emergency Action and Response Plan and Other Consulting Services*—**Over time, EA's role has also expanded to develop and implement key operational systems within Architect of the Capitol's framework. Specifically, EA created, launched, and trained Architect of the Capitol personnel in an Emergency Action and Response Plan, requiring extensive coordination with the D.C. Department of Fire and Rescue, U.S. Capitol Police, and Congress. EA continues to provide support to the Architect of the Capitol in the annual emergency preparedness drill cycle, documentation of issues/enhancements, updates to the Emergency Action and Response Plan, and training.

- ***Asbestos and Survey Services*—**EA developed and administered two gap analyses of the Architect of the Capitol's existing Asbestos Operations and Management System and its Utility Distribution System Standard Operation Procedures. EA's evaluation of conditions involved review of historical documentation, a survey of field personnel, and review of procedures. EA then performed qualitative and quantitative analyses to determine the veracity of compliance with appropriate regulations and guidelines, identified targets for improvement, proposed solutions, facilitated work teams to generate consensus, and helped guide the implementation of improvements. Finally, EA developed site-specific training materials for Asbestos Operations and Maintenance Plan requirements. To ensure full implementation, EA provided training to more than 55 individuals over multiple training sessions.

Emergency Egress and Safety Signage Improvements (Design Services)—EA provided a team of health, safety, and engineering professionals to evaluate emergency egress signage requirements (exit signs) and Occupational Safety and Health Administration-required signage and safety markings for physical hazards within the tunnel system. EA's in-house team of Certified Industrial Hygienists, Certified Safety Professionals, and Professional Engineers assessed the tunnel system for hazards and egress route requirements per Occupational Safety and Health Administration and National Fire Protection Agency Life Safety Code requirements. EA's developed plan sets and bid contract documents and specifications for the correction of the more than 200 deficiencies noted within the tunnels. EA's team continues to provide Construction Administration support by developing responses to requests for information, coordinating pre-construction facility reviews with contractors and Architect of the Capitol, performing "punch list" inspections of completed installations, and developing final as-built facility plans based on contractor red-line drawings.

Training Programs and Other Facilitation Services—In 2008, EA staff facilitated a one-day planning summit with over 20 Architect of the Capitol stakeholders, including senior administration from the Architect of the Capitol, U.S. Army Corps of Engineers, and EPA. The summit was held at the Dirksen Senate Office Building in Washington, D.C. and was well attended with over 75 individuals. The focus of the summit was to develop a strategic plan for the Utility Tunnel Modernization Program that defined key drivers, critical success factors, and reporting requirements. EA presented a beta version of the Utility Tunnel Information System web-based program that was developed by EA as a management solution. Stakeholder input was received through an EA facilitation specialist. EA prepared the agenda, handouts, briefing packages, presentations, and coordinated post-summit communication. EA has also provided training for more than 100 employees and contractors for Permit-Required Confined Space, facility specific asbestos awareness, health and safety hazard reporting, and health and safety requirements to safely enter the tunnels.

On a day-to-day basis, EA provides collaborative management and reporting with Architect of the Capitol and contract staff on a biweekly basis and at other project-focused meetings. Specifically, EA was responsible for preparing the Monthly Senior Leadership Team reports for multiple programs used by the Acting Architect of the Capitol and key staff in managing decisions, and the monthly Architect's Brief for programs that is used to brief staff members of the Architect of the Capitol on progress, performance, and forecasts. EA's team also provides support for all health and safety issues related to the program.

Health and Safety Support Products—EA developed a web-based program management tool (Utility Tunnel Information System) to manage health and safety issues associated with the utility tunnels around the Capitol. The task included the development of an internet mapping system for analysis and map production along with the ability to create sophisticated reports from the system. EA currently hosts and manages Utility Tunnel Information System.

- ***Application Development*—**Supporting the Architect of the Capitol in the development of Utility Tunnel Information System to manage health and safety issues associated with the utility tunnels, supporting the Congressional Campus in Washington, D.C. The password-protected web application, currently being maintained by EA, gives users access to a number of information management functions that include an online file repository, a list of tunnel safety findings and associated corrective measures, construction schedules, and an internet mapping (Geographic Information System) application. The mapping tool was developed with user-friendly point-and-click functionality, where no previous Geographic Information System knowledge is required by the user to create customized maps or access the associated data. The system serves as the primary program management tool for Architect of the Capitol's Utility Tunnel Safety Program, allowing Safety Program team members, regulators, various contractors, and Architect of the Capitol staff to coordinate efforts through a central information repository. Specific elements of the online application include:
    - ***Finding and Corrective Measure Tracking*—**Provides the ability to add, edit, view, search, and track all health and safety issues and their associated corrective measures within the utility tunnel network. Users can track changes over time and manage assigned corrective actions for all identified issues.
    - ***Construction Schedule*—**Provides the ability to plan, schedule, and track construction activities associated with health and safety corrective measures. Users can view all completed, in-progress, and future construction activities for a given section of tunnel and print detailed Gantt chart style schedules.
    - ***Financial Analysis*—**Provides the ability to track budgets and costs in multiple tiers and in varying methods to appropriately address and respond to Congressional inquiries, Also provides the ability to measure and manage financial performance at the project and program levels.

Project Date: 2007–2014; 2019 – Present

Phase I/II Environmental Site Assessments – Food and Drug Administration Pharmaceutical Laboratory, St. Louis, Missouri; Food and Drug Administration/U.S. Army Corps of Engineers and TerranearPMC.; Lead

Industrial Hygienist—Lead Industrial Hygienist for the decommissioning evaluation of a former Food and Drug Administration pharmaceutical research laboratory. Followed the ANSI Z9.11 Laboratory Decommissioning Standard to investigate and evaluate multiple chemical, biological, and radiological hazards. Supervised on-site activities for health and safety. Developed sampling methodologies and strategies to evaluate boundaries of contaminants compared to multiple end-use clean-up criteria.
Project Date: February–March 2014

Mold and Building Envelope Investigation, Internal Revenue Service Processing Center; General Services Administration; Project Manager—Assessment of extent of mold impacts and potential sources of water intrusion in main IRS processing center in Kearneysville, West Virginia. Scope included detailed visual inspection of building envelope, visual inspection of mold in wall cavities, and development of recommendations for intrusive investigation.
Project Date: August 2011 – January 2012

Mold and Building Envelope Investigation, Internal Revenue Service Processing Center; General Services Administration; Project Manager—Structural assessment of building envelope for detailed evaluation of sources of water intrusion in main Internal Revenue Service processing center in Kearneysville, West Virginia. Airborne mold monitoring during and after investigation activities. Development of corrective action plan for building defects and mold remediation plan.
Project Date: June 2012 – 2014; 2019 – Present

Environmental and Engineering Assessments for Department of Defense Fuel Systems Worldwide; Air Force Civil Engineer Center; Technical Review of Health and Safety Plans—Providing technical review and support for health and safety plan development for field effort program wide for activities including Leak Detection Testing and Monitoring for the Defense Logistics Agency Energy Leak Detection Centrally Managed Program formerly known as the Defense Energy Support Center who is responsible for the environmental compliance of capitalized petroleum, oil, and lubricants storage and distributions systems at Department of Defense facilities throughout both the continental United States and outside the United States worldwide. Work activities reviewed include: engineering tests and evaluations at Defense Logistics Agency-Energy fuel systems as well as Department of Defense and Defense Logistics Agency who sponsors fuel projects for Defense Fuel Support Points and provides integrity and leak detection testing of bulk storage tanks, hydrant fueling systems, off-loading facilities, fuel terminals, and ground fuel pipelines.
Project Date: December 2009 – 2014; 2019 – Present

Environmental Programs, Baltimore, Maryland; Loyola University Maryland; Lead Safety Auditor—The compliance program consists of conducting a campus wide environmental audit and the completion of a new Spill Prevention Control and Countermeasure Plan to ensure compliance relative to federal, state, and local regulations and conformance with best management practices.
Project Date: February 2011 – 2014; 2019 – Present

Lead, Asbestos, and Indoor Air Quality Services for Baltimore City Public Housing; Baltimore, Maryland; Housing Authority of Baltimore City; Health and Safety Technical Review—Review documentation and procedures in support of the implementation and operation of Baltimore City agency lead poisoning prevention program, asbestos monitoring program, indoor air quality program, and programs for other environmental service areas.
Project Date: 2010–2014; 2019 – Present

Massachusetts Port Authority; Logan Airport Air Monitoring – Equipment Inspection and Services; Boston, Massachusetts—Quality assurance/quality control support for all aspects of air monitoring program to determine impacts of construction of new taxiway at Logan International Airport. Reviewed updated Quality Assurance Project Plan, Work Plan, and Standard Operating Procedure documents for Year 2 of air monitoring program. Reviewed data collection and management as well as audited field activities for all analyses including TO-11a (carbonyls and formaldehydes), TO-13a (polycyclic aromatic hydrocarbons), TO-15 SIM (volatile organic compounds), and gravimetric analysis ($PM_{2.5}$ analysis).
Project Date: May 2010 – April 2012

Indoor Air Quality Surveys; General Services Administration—Project for indoor air quality surveys at the J. Caleb Boggs Federal Building in Wilmington, Delaware; the Mitchell H. Cohen Courthouse and Cohen Annex in Camden, New Jersey; the Clarkson S. Fisher Federal Building and Fisher Annex in Trenton, New Jersey, and the Social Security Administration Trust Fund Building in Bridgeton, New Jersey. Project included indoor air sampling and measurements and visual inspection of heating, ventilation, and air conditioning systems.
Project Date: July 2010 – November 2011

Indoor Air Quality Surveys; General Services Administration—Project Manager for indoor air quality surveys at five facilities in Philadelphia (Robert Nix Federal Building and U.S. Post Office, U.S. Custom House, William J. Green, Jr. Federal Building, James A. Byrne U.S. Courthouse, and the Veterans Administration Center), four facilities in Baltimore (U.S. Custom House, Appraisers Store, G.H. Fallon Federal Building, and Edward A. Garmatz U.S. Court House), and the Maude R. Toulson Federal Building in Salisbury, Maryland. Project included indoor air sampling and measurements and visual inspection of heating, ventilation, and air conditioning systems.
Project Date: August 2009 – 2014; 2019 – Present
Project Value – $63,219; Contract Type – Firm Fixed Price; EA Project Nos. – 6202840; EA Project Manager – R. Marcase

Environmental Compliance Program Support; Maryland Aviation Administration, Maryland; Task Manager—Currently providing technical support of a compliance-focused environmental management system for Maryland Aviation Administration facilities including Baltimore/Washington International Thurgood Marshall Airport and Martin State Airport. Instrumental in creating facility-wide environmental compliance documentation for the Maryland Aviation Administration. Activities include site audits for document preparation, planning, and design meetings for a web based tracking system, and client interview and data gathering. Providing support in identification of regulatory requirements and assessment of compliance with requirements, with particular emphasis in underground storage tanks and bulk fuel management. Managed efforts to provide documentation and recommendations for both underground and aboveground storage tanks pertaining to environmental regulation compliance inspections. Efforts include performing a detailed evaluation and inventory of existing underground and aboveground storage tank systems to determine compliance with applicable regulations.
Project Date: 2006–2014; 2019 – Present

Compliance-Focused Environmental Management System; Maryland State Highway Administration, State-Wide, Maryland; Task Manager—Team Leader for development of compliance-focused environmental management system for State Highway Administration's facilities under voluntary agreement with EPA. Reviewed State Highway Administration operations and Maryland regulations, and identified compliance requirements in support of development of environmental compliance inventory/assessment program for 28 primary vehicle maintenance shops. Lead auditor for implementation of this program. The effort is part of a multi-phase approach to assess, design, and implement compliance-focused environmental management system at over 125 State Highway Administration facilities over the next 5 years.
Project Date: May 2006 – 2014; 2019 – Present

Spill Prevention Control and Countermeasure Plan Preparation; Maryland Environmental Service in support of the Maryland Port Administration, Maryland; Task Manager—Provided Task Management and technical support for on behalf of the Maryland Port Administration for the preparation of Spill Prevention Control and Countermeasure Plans for multiple Maryland Port Administration facilities. The Spill Prevention Control and Countermeasure Plans were prepared for five Maryland Port Administration facilities including the Cambridge, Fairfield, Masonville, North Locust Point, and South Locust Point Marine Terminals. Efforts included conducting site inspections and preparation of the Spill Prevention Control and Countermeasure Plans in accordance with 40 CFR 112 and EPA Spill Prevention Control and Countermeasure Regulation (EPA 540-I-01-006, October 2002).
Project Date: August 2006 – November 2007

Dundalk Marine Terminal Air Monitoring Program; Maryland Environmental Service on behalf of the Maryland Port Administration, Maryland; Task Manager, Senior Technical Support—Field Engineer responsible for developing and implementing a complex air monitoring program at the 570-acre site. The project is the result of a regulatory consent order between the Maryland Port Administration and the Maryland Department of the Environment. The Maryland Department of the Environment is concerned over the potential for exposure of the adjoining communities of hexavalent chromium that is present in high concentrations in the site fill material. The project has been designed to have nine individual ambient air monitoring stations, each to measure atmospheric concentrations of hexavalent chromium and total suspended particulate matter. A unique monitoring method has been developed that will quantify concentrations below 1 nanogram per cubic meter. A meteorological monitoring station has also been established on the site.
Project Date: October 2006 – 2014; 2019 – Present

Indoor Air Quality Assessment and Microbial Survey, Princess Anne, Maryland; State Highway Administration; Senior Technical Support—Performed an indoor air quality and microbial survey for a public sector client. In response to employee complaints, an indoor air quality screening and microbial evaluation was performed in an effort to determine the cause of employee health complaints and unidentified odors.
Project Date: May–June 2006

Air Permitting and Emission Inventory Management; Grubb and Ellis/Citicorp Financial, Silver Spring, Maryland; Air Quality Compliance Activities, Task Manager, and Field Technical Operations—Provided client support and project management to assure timely submittal of quarterly and annual Maryland Department of the Environment Emissions Certification Reports for an electrical generation facility providing essential back-up power for critical financial transactions. Coordinate and implement emissions testing as a field technical compliance specialist to provide actual process emission data.
Project Date: January 2007 – 2014; 2019 – Present

Source Testing Oversight and Coordination; Perdue Agri-Recycle, Seaford, Delaware; Field Engineer—Field Engineer responsible for managing field activities and providing technical liaison between plant personnel and source testing firms to provide a clear picture of plant-wide air emissions sources. This state-of-the-art facility converts chicken farm agricultural waste to commercial fertilizer products. Instrumental in providing diagnostic testing to aid in implementation of process design changes to aid in air quality compliance and emissions reduction.
Project Date: September 2006 – 2014; 2019 – Present

Comprehensive Environmental Permitting; Agro-Iron Chesapeake, Baltimore, Maryland; Technical Support —Provided technical support during comprehensive environmental permitting activities for a new inorganic

chemical process facility for manufacturing inorganic water treatment chemicals, including iron chlorides, iron sulfates, aluminum sulfate, sodium aluminate, and sodium hypochlorite. An existing inorganic chemical processing facility was being retrofitted and refurbished for this purpose. Project elements included, investigation of air and water permitting pathways in support of project planning; and identification, preparation, and negotiation of the required approvals and permits. These included Baltimore City Erosion and Sediment Control Plan and Stormwater Management Plan approvals, with the associated maintenance and performance bond agreements; the Stormwater Pollution Prevention Plan required under the National Pollutant Discharge Elimination System General Permit for Stormwater Discharge from Industrial Activities; the Accidental Release Prevention program; and the Air Quality Permit to Construct application.
Project Date: February 2007 – 2014; 2019 – Present

Other Project Experience

Industrial Hygiene Services and Hazardous Materials Abatement Management, The Milton S. Hershey Medical Center, Hershey, Pennsylvania—Managed projects and personnel including subcontractors for Hazardous Material Abatement projects ranging from small scale, short duration asbestos removal projects to long term capital improvement multimedia hazardous material abatement projects.

Laboratory Audit and Industrial Hygiene Survey, The Maryland Motor Fuels Laboratory, Linthicum, Maryland —Performed health and safety audits on a yearly cycle for laboratory operations including laboratory operations review, engineering control suitability review, occupational exposure risk determination, and exposure sampling.

Facility-Wide Occupation Exposure Assessment, Confidential Industrial Client, Huntingdon, Pennsylvania— Developed and implemented a facility-wide industrial hygiene sampling protocol to assess potential occupational exposure from process hazards. Sampling strategies were developed as a result of a facility inspection and a thorough understanding of industrial processes and associated hazards.

Adrian Hughes, CSP, ASP, PG
Safety and Health Manager/ Alternate Site Safety and Health Officer

This page intentionally left blank

Adrian Hughes, V; PG,ASP,CSP

Safety Professional/Industrial Hygienist

With over 15 years of safety and health experience covering over 135 non-overlapping months, Mr. Hughes provides supervision/oversight, quality control (QC), and safety and health responsibilities on site involving excavations, heavy equipment, remediation system installation and operation, drilling, and environmental sampling (surface water, process water, groundwater, sediment, soil, and subsurface and surface vapor). He is responsible for daily health and safety meetings, ensuring Accident Prevention Plan (APP) compliance, and daily quality control reports. Mr. Hughes is trained and experienced in performing and demonstrating calibration of monitoring equipment; providing health and safety oversight and/or environmental monitoring during drilling, excavations and trenching, and/or environmental sampling activities; providing on-site training relating to project safety; preparing Site Safety and Health Plans (SSHP); implementation of emergency procedures; performing air monitoring; and selecting, wearing, and training others regarding personal protective equipment (PPE). Mr. Hughes has conducted accident investigations, performed deficiency tracking, and implemented corrective actions.

Qualifications

Education

B.S.; Towson University; Geology; 2000

Specialized Training

Certified Safety Professional; 2020-Present
Associate Safety Professional; 2016-Present
Professional Geologist (KY); 2013-Present
OSHA 40-Hour HAZWOPER; 2005
OSHA 8-Hour HAZWOPER Refresher; 2006-Present
OSHA 8-Hour Supervisor Training; 2012-Present
OSHA 30-Hour Construction Oversight; 2011
Excavation Safety Training (OSHA 1926.650-652)
Smith System Driver; 2007-2011
Loss Prevention System 8-Hour; 2007
DOT Hazardous Materials; 2007
DOT Security Awareness; 2007
IATA Dangerous Goods Transportation; 2007
Federal Railroad Administration; 2007-2009
ASTM Certification for Phase I-II Environmental Site Assessments; 2009
Innovex X-Ray Fluorescence (XRF); 2010-Present
CPR and First Aid (Current Due to State of Emergency)
Bloodborne Pathogens; 2021-2022
Radon Measurement (2012-Present)
Competent Person Fall Protection (2016-Present)
Asbestos Inspector/Mgt Planner (2019-Present)

Professional Experience

Safety Program Manager - Contaminated Building Demolition Program; United States Army; Edgewood Area of Aberdeen Proving Ground, Maryland
(31 Total Months; October 2018-Present)

- Fulfilled above role for oversight of the planning and demolition of chemical and biological agent contaminated buildings performed by third-party contractor to USACE-Huntsville. Activities to date included planning document review (APP/SSHP/Sub-Plans) for demolition, asbestos abatement, chemical/biological/radiological contamination characterization and remediation, environmental sampling, environmental monitoring, and environmental assessment.

Responsibilities included:

- Perform third-party health and safety oversight during above activities while reporting to the APG Directorate of Public Works' Installation Safety Office, USACE-Baltimore (CENAB), USACE-Huntsville, and State of Maryland entities;
- Generated daily reports and provided to stakeholders;
- Reviewed and ensured compliance of the asbestos abatement plan, demolition plan, hazardous energy control plan and other related sub-plans (ensuring state and federal compliance).
- Perform audits, near-miss evaluations, accident and incident investigations, and performed concurrent operations with Boards-of-Investigation.

SSHO, Associate Safety and Health Manager, & Competent Person; Demolition, Environmental Assessment, and Environmental Remediation; United States Air Force, Nellis AFB, Nevada (5 Total Months; June-October 2018)

- Fulfilled above role for site activities including well installation, construction and grading activities, munitions clearance and soil remediation, demolition of multi-story above ground structures, recycling of Conex villages, oversight of asbestos abatement, lead decontamination of onsite materials, IDW management and sampling, work zone and PPE enforcement, fall protection & aerial lift usage, ladder use, radiologically-contaminated media sampling, isotopic analysis of aqueous media, review and implementation of ancillary chemical safety submissions (CSS) and biological safety submissions (BSS), conducted air monitoring (site contaminants/nuisance dust, reviewed structural engineer surveys, and demolition plans.

Responsibilities included:

- Perform health and safety oversight during above activities;
- Performed and enforced site and equipment inspections;
- Generated corrective actions following daily and/or weekly inspections;
- Perform health and safety oversight during activities described above, competent person for fall protection, aerial lift usage, and ladder usage;
- Assisted with onsite operations following QCS including QC over onsite delivery of materials & equipment;
- Followed site-specific excavation permit utility avoidance prior to intrusive activities;
- Present daily safety briefings consistent with the APP and SSHP (and associated sub plans) for site physical/chemical/biological/radiological hazards – generated and enforced APP/SSHP/SubPlans onsite;
- Conduct daily site safety and health inspections for job zones
- Reviewed and ensured compliance of the asbestos abatement plan, demolition plan, hazardous energy control plan and other related sub-plans (ensuring state and federal compliance)
- Prepare safety and health compliance memoranda and site indoctrination procedures
- Calibrate and document calibration of monitoring and/or screening equipment prior to use
- Direct, distribute, and inspect appropriate PPE to site personnel (Level D and Mod Level D)
- Maintain and enforce appropriate PPE use

SSHO & Competent Person; Environmental Sampling Activities; United States Army Environmental Command, Various Installations
(2 Total Months; March and April 2018)

- SSHO for site activities including multi-media environmental sampling; well installation, development, and sampling; boating activities and float plan generation; IDW management and sampling; work zone establishment and enforcement; environmental monitoring; ladder use; IDW management and sampling; and heavy equipment usage.

Responsibilities included:

- Perform health and safety oversight during above activities
- Performed site-specific training on PPE, general safety, equipment inspections, and quality control
- Performed and enforced site and equipment inspections
- Generated corrective actions following daily and/or weekly inspections, if required
- Perform health and safety oversight during activities described above, competent person for fall protection, aerial lift usage, and ladder usage
- Assisted with onsite operations following QCS including QC over onsite delivery of materials & equipment
- Followed site-specific excavation permit utility avoidance prior to intrusive activities
- Present daily safety briefings consistent with the APP and SSHP (and associated sub plans) for site physical/chemical/biological/radiological hazards – generated and enforced APP/SSHP onsite
- Conduct daily site safety and health inspections for job zones
- Prepare safety and health compliance memoranda and site indoctrination procedures
- Calibrate and document calibration of monitoring and/or screening equipment prior to use
- Direct, distribute, and inspect appropriate PPE to site personnel (Level D and Mod Level D)
- Maintain and enforce appropriate PPE use

SSHO & Competent Person; Environmental Sampling Activities; United States Air Force, Various Installations
(11 Total Months; March-May, July, September through December 2017 and January, February, & May 2018)

- SSHO for site activities including multi-media environmental sampling; well installation, development, and sampling; boating activities and float plan generation; IDW management and sampling; work zone establishment and enforcement; environmental monitoring; ladder use; IDW management and sampling; and heavy equipment usage.

Responsibilities included:

- Perform health and safety oversight during above activities
- Performed and enforced site and equipment inspections
- Generated corrective actions following daily and/or weekly inspections, if required

- Perform health and safety oversight during activities described above, competent person for fall protection, aerial lift usage, and ladder usage
- Assisted with onsite operations following QCS including QC over onsite delivery of materials & equipment
- Followed site-specific excavation permit utility avoidance prior to intrusive activities
- Present daily safety briefings consistent with the APP and SSHP (and associated sub plans) for site physical/chemical/biological/radiological hazards – generated and enforced APP/SSHP onsite
- Conduct daily site safety and health inspections for job zones
- Prepare safety and health compliance memoranda and site indoctrination procedures
- Calibrate and document calibration of monitoring and/or screening equipment prior to use
- Direct, distribute, and inspect appropriate PPE to site personnel (Level D and Mod Level D)
- Maintain and enforce appropriate PPE use

SSHO; Puchack Well Field Superfund Site in Pennsauken, NJ; EPA Region 3 via Leidos/SERAS (1 Month; August 2017):

- SSHO for site activities including high-pressure injections, sampling and field analysis of hexavalent chromium-contaminated media, heavy equipment usage, air monitoring, and heat stress monitoring.

Responsibilities included:

- Perform health and safety oversight during above activities
- Present daily safety briefings that included awareness training for site physical/chemical/biological hazards
- Calibrate and document calibration of monitoring and/or screening equipment prior to use (PID/YSI)
- Develop, implement, and ensure compliance with the APP/SSHP
- Conduct safety site inspections (initial, periodic, daily) to evaluate work conditions for job zones
- Prepare health and safety compliance memoranda
- Direct, distribute, and inspect appropriate PPE to site personnel and maintain/enforce appropriate PPE use

SSHO & Competent Person; Victory Village Munitions and Explosives of Concern Investigation; United States Coast Guard; Concord, California
(1 Month; June 2017)

- SSHO for site activities including multi-media environmental sampling, digital geophysical mapping; vegetation clearance, removal, and construction debris removal; intrusive MEC investigation; IDW management and sampling; work zone establishment and enforcement; environmental monitoring; ladder use; IDW management and sampling; target reacquisition and investigation; and heavy equipment usage.

Responsibilities included:

- Perform health and safety oversight during above activities
- Performed and enforced site and equipment inspections
- Generated corrective actions following daily and weekly inspections, if required
- Perform health and safety oversight during activities described above
- Assisted with onsite operations following QCS including QC over onsite delivery of materials & equipment
- Followed site-specific excavation permit utility avoidance prior to intrusive activities
- Present daily safety briefings consistent with the APP and SSHP (and associated sub plans) for site physical/chemical/biological hazards – generated and enforced APP/SSHP onsite
- Conduct daily site safety and health inspections for job zones (grids/sub-grids)
- Prepare safety and health compliance memoranda and completed site indoctrination procedures
- Calibrate and document calibration of monitoring and/or screening equipment prior to use
- Direct, distribute, and inspect appropriate PPE to site personnel (Level D and Mod Level D)
- Maintain and enforce appropriate PPE use

SSHO & Competent Person; Geotechnical and Radiological Investigation for USACE at a Confidential Site in Baltimore
(1.5 Months; January and February 2017)

- SSHO for site activities including well installation, aerial lift usage, deep geotechnical boring installation, radiological monitoring, radiological contamination delineation, hot and cold stress monitoring, IDW management, radiological zone delineation including work zone establishment and enforcement, and heavy equipment usage – all within an active manufacturing facility. Competent person for fall protection, aerial lift usage, and ladder use.

Responsibilities included:

- Perform health and safety oversight during above activities
- Performed and enforced site and equipment inspections
- Generated corrective actions following daily, weekly, and monthly inspections
- Perform health and safety oversight during well installation, heavy equipment usage, chemical and radiological decontamination activities, soil sampling, and IDW characterization and offsite disposal
- Perform health and safety oversight during oversized load equipment delivery and site operations trailer delivery and exchange of soil and aqueous IDW (including chemical and radioactively-impacted IDW)
- Assisted with onsite QC operations following QCS including QC over onsite delivery drilling materials
- Followed site-specific excavation permit utility avoidance prior to well installation activities
- Completion of audit process and near miss investigations
- Present daily safety briefings consistent with the APP and SSHP (and associated sub plans) for site physical/chemical/biological/ and radiological hazards
- Conduct daily site safety and health inspections for job zones
- Prepare safety and health compliance memoranda and site indoctrination procedures
- Develop, implement, and ensure compliance with the APP
- Calibrate and document calibration of monitoring and/or screening equipment prior to use
- Direct, distribute, and inspect appropriate PPE to site personnel (Level C, Level D, and Mod Level D)
- Maintain and enforce appropriate PPE use

SSHO & Competent Person; FMY-02 Sanitary Landfill Intrusive Investigation at Joint Base Myer-Henderson Hall in Arlington, VA
(1.5 Months; November and December 2016)

- SSHO for site activities including vapor intrusion monitoring, monitoring point installation, site survey, monitoring well installation, utility avoidance, IDW management and characterization, environmental monitoring, cold stress monitoring, work zone establishment and enforcement, and heavy equipment usage.

Responsibilities included:

- Perform health and safety oversight during above activities
- Performed and enforced site and equipment inspections
- Generated corrective actions following daily, weekly, and monthly inspections
- Perform health and safety oversight during well installation, heavy equipment usage, decontamination activities, soil sampling, and IDW characterization and offsite disposal
- Perform health and safety oversight during oversized load equipment delivery and site operations trailer delivery and exchange of granular activated carbon (used and unused)
- Assisted with onsite QC operations following QCS including QC over onsite delivery drilling materials
- Followed site-specific excavation permit utility avoidance prior to well installation activities
- Completion of audit process and near miss investigations
- Present daily safety briefings consistent with the APP and SSHP (and associated sub plans) for site physical/chemical/biological/ and radiological hazards
- Conduct daily site safety and health inspections for job zones
- Prepare safety and health compliance memoranda and site indoctrination procedures
- Develop, implement, and ensure compliance with the APP
- Calibrate and document calibration of monitoring and/or screening equipment prior to use
- Direct, distribute, and inspect appropriate PPE to site personnel (Level D and Mod Level D)
- Maintain and enforce appropriate PPE use

SSHO & Competent Person; Building 235 Soil Excavation at Joint Base Myer-Henderson Hall in Arlington, VA
(2 Months; August and September 2016)

- SSHO for site activities including excavation, trenching, asphalt removal, traffic protection, IDW management and characterization, air monitoring, fall protection, ladder use, work zone establishment, contaminated medium sampling, heat stress monitoring, direct-push drilling, air-knifing/utility avoidance, and heavy equipment usage.

Responsibilities included:

- Perform health and safety oversight during above activities
- Performed and enforced site and equipment inspections
- Generated corrective actions following daily, weekly, and monthly inspections
- Enforced tenets of excavation safety plan and evacuation plan
- Perform health and safety oversight during excavation, soil boring heavy equipment usage, decontamination activities, soil sampling, and IDW characterization and offsite disposal
- Perform health and safety oversight during oversized load equipment delivery and site operations trailer delivery and exchange of granular activated carbon (used and unused)
- Assisted with onsite QC operations following QCS including QC over onsite delivery of clean fill
- Followed site-specific excavation permit utility avoidance with high-pressure air knifing in potentially contaminated soils prior to direct-push soil sampling activities
- Completion of audit process and near miss investigations
- Present daily safety briefings consistent with the APP and SSHP (and associated sub plans) for site physical/chemical/biological/ and radiological hazards
- Conduct daily site safety and health inspections for job zones
- Prepare safety and health compliance memoranda and site indoctrination procedures
- Develop, implement, and ensure compliance with the APP
- Calibrate and document calibration of monitoring and/or screening equipment prior to use
- Direct, distribute, and inspect appropriate PPE to site personnel (Level D and Mod Level D)
- Maintain and enforce appropriate PPE use

SSHO and Competent Person; Remedial Investigation at the Former York Naval Ordnance Plant in York, PA (3 Months; June, July, and October 2016)

- SSHO for site activities including contaminated media sampling, safety and health monitoring, direct-push and hollow-stem auger drilling, IDW characterization and management, heavy equipment usage, digital geophysical mapping, and intrusive MEC-related activities.

Responsibilities included:

- Perform health and safety oversight during above activities including heavy equipment use, inspections, monitoring, and corrective actions
- Perform health and safety oversight during soil boring and sampling activities, heavy equipment usage, , and groundwater sampling
- Assisted with onsite quality control operations and quality control document submission
- Completion of audit process and near miss investigations
- Present daily safety briefings consistent with the APP and SSHP for site physical, chemical, biological, and radiological hazards
- Conduct daily site safety and health inspections for job zones
- Prepare safety and health compliance memoranda
- Develop, implement, and ensure compliance with all safety-related documents
- Calibrate and document calibration of monitoring and/or screening equipment prior to use
- Direct, distribute, and inspect appropriate PPE to site personnel (Level D and Mod Level D)
- Maintain and enforce appropriate PPE use

SSHO and Competent Person; White Swan-Sun Cleaners' Source Area Superfund Site in Wall Township, NJ (5 Months; January through May 2016)

- SSHO for site activities including asbestos assessment and abatement, respiratory protection and monitoring, tree and vegetation removal, excavation of surface soils with heavy equipment, asphalt removal, vegetation clearance and tree felling, traffic protection, well installation and development with heavy equipment, IDW management and assessment, air monitoring, fall protection, ladder use, permanent fence installation, contaminated media sampling, heat and cold-stress monitoring, exchange of granular activated carbon, and high-pressure air sparge and soil vapor extraction system installation and monitoring for a chlorinated solvent-contaminated site.

Responsibilities included:

- Perform health and safety oversight during above activities including heavy equipment use, inspections, and corrective actions
- Perform health and safety oversight during Rotosonic well installation activities, heavy equipment usage, high-pressure well development activities, and sampling groundwater
- Perform health and safety oversight during oversized load equipment delivery and site operations trailer delivery and exchange of granular activated carbon (used and unused)
- Assisted with onsite quality control operations following QCS
- Completion of audit process and near miss investigations
- Perform daily safety briefings consistent with the APP and SSHP for site physical/chemical/biological/ and radiological hazards
- Ensure site workers abided by Respiratory Protection Program and followed respirator-use procedures
- Conduct daily site safety and health inspections for job zones
- Prepare safety and health compliance memoranda
- Develop, implement, and ensure compliance with the APP
- Calibrate and document calibration of monitoring and/or screening equipment prior to use
- Direct, distribute, and inspect appropriate PPE to site personnel (Level D, Mod Level D, and Level C)
- Maintain and enforce appropriate PPE use

SSHO; Operational Range Assessment Program (ORAP) Phase II Quantitative Assessment at Fort Sill, OK (5 months; January, May, June, July, and August 2014 with abandonment in November 2015):

- SSHO for site activities including well installation (Rotosonic) and high-pressure well development, subsequent well abandonment, sampling of environmental media (surface water, groundwater, and sediment), moving heavy equipment, and heavy equipment usage for managing soil stocks under conditions requiring heat-stress monitoring

Responsibilities included:

- Perform health and safety oversight during Rotosonic well installation activities, heavy equipment usage, high-pressure well development activities, and sampling of surface water, groundwater, and sediment (including incremental sampling)
- Present daily safety briefings that included awareness training for site physical/chemical/ biological hazards
- Calibrate and document calibration of monitoring and/or screening equipment prior to use
- Develop, implement, and ensure compliance with the APP
- Conduct site inspections to evaluate work conditions for job zones
- Perform initial and daily site health and safety inspections
- Prepare health and safety compliance memoranda
- Direct, distribute, and inspect appropriate PPE to site personnel
- Maintain and enforce appropriate PPE use

SSHO; ORAP Phase II Quantitative Assessments at Fort Knox, KY, Fort Leonard Wood, MO; Fort Campbell, KY, Fort Huachuca, AZ, and Fort Irwin, CA (23 non-overlapping months; September 2011 through April 2013, November & December 2013, January 2014-June 2015, and July-October 2015):

- SSHO for site activities including multi-media environmental sampling (surface water, groundwater, and sediment), dye-tracing investigations, boating access to locations, and operations involving UXO-avoidance.

Responsibilities included:

- Perform health and safety oversight during the activities listed above
- Present daily safety briefings that included awareness training for site physical/chemical/ biological hazards
- Calibrate and document calibration of monitoring and/or screening equipment prior to use
- Develop, implement, and ensure compliance with the APP
- Conduct site inspections to evaluate work conditions for job zones

- Perform initial and daily site health and safety inspections
- Prepare health and safety compliance memoranda
- Direct, distribute, and inspect appropriate PPE to site personnel
- Maintain and enforce appropriate PPE use

SSHO; Puchack Well Field Superfund Site in Pennsauken, NJ; EPA Region 3
(17 months; May 2012 through September 2013):

- SSHO for site activities including well installation (Rotosonic) and development, sampling of impacted groundwater, moving heavy equipment, and operations and maintenance of an injection system to inject sodium lactate amendment into the subsurface to remediate dissolved hexavalent chromium within three vertically-discrete aquifers.

Responsibilities included:

- Perform health and safety oversight during well installation activities
- Present daily safety briefings that included awareness training for site physical/chemical/ biological hazards
- Calibrate and document calibration of monitoring and/or screening equipment prior to use (PID/YSI)
- Develop, implement, and ensure compliance with the APP
- Conduct site inspections to evaluate work conditions for job zones
- Perform initial and daily site health and safety inspections
- Prepare health and safety compliance memoranda
- Direct, distribute, and inspect appropriate PPE to site personnel
- Maintain and enforce appropriate PPE use

SSHO; ORAP Phase II Quantitative Assessment at Fort Campbell, KY
(4 months; January, March, May, and July 2013):

- SSHO for Rotosonic drilling, borehole installation; dye injections, placement, and monitoring; hydraulic aquifer testing under pressurized conditions; and sinkhole capacity testing.

Responsibilities include:

- Perform health and safety oversight during well installation activities
- Present daily safety briefings that included awareness training for site physical/chemical/ biological hazards
- Supplement unexploded ordnance (UXO) qualified personnel providing specific munitions of explosive concern (MEC) awareness and recognition training
- Calibrate and document calibration of monitoring and/or screening equipment prior to use (YSI)
- Develop, implement, and ensure compliance with the APP
- Conduct site inspections to evaluate work conditions for job zones
- Perform initial and daily site health and safety inspections
- Prepare health and safety compliance memoranda
- Direct, distribute, and inspect appropriate PPE to site personnel
- Maintain and enforce appropriate PPE use

SSHO; ORAP Phase II Quantitative Assessment at Fort Bragg, NC
(3 months; November 2011 through December 2011 and December 2015):

- SSHO for drilling, installation (Mud Rotary), and development of monitoring wells to assess groundwater.

Responsibilities include:

- Perform health and safety oversight during well installation activities
- Present daily safety briefings that included awareness training for site physical/chemical/ biological hazards
- Supplement unexploded ordnance (UXO) qualified personnel providing specific munitions of explosive concern (MEC) awareness and recognition training
- Calibrate and document calibration of monitoring and/or screening equipment prior to use (PID/YSI)
- Develop, implement, and ensure compliance with the APP
- Conduct site inspections to evaluate work conditions for job zones
- Perform initial and daily site health and safety inspections
- Prepare health and safety compliance memoranda
- Direct, distribute, and inspect appropriate PPE to site personnel

- Maintain and enforce appropriate PPE use

SSHO; ORAP Phase II Quantitative Assessment at McGuire-Dix-Lakehurst AFB, NJ (2 months; October 2011 through November 2011):

- SSHO for drilling activities (Direct Push and Hollow-Stem Auger) and installation and development of monitoring wells to assess groundwater quality.

Responsibilities include:

- Perform health and safety oversight during well installation activities
- Present daily safety briefings that included awareness training for site physical/chemical/ biological hazards
- Supplement UXO-qualified personnel providing specific MEC awareness and recognition training
- Calibrate and document calibration of monitoring and/or screening equipment prior to use (PID/YSI)
- Develop, implement, and ensure compliance with the SSHP
- Conduct site inspections to evaluate work conditions for job zones
- Perform initial and daily site health and safety inspections
- Prepare health and safety compliance memoranda
- Direct, distribute, and inspect appropriate PPE to site personnel
- Maintain and enforce appropriate PPE use

SSHO; Site Characterization of Arsenic Contaminated Soil at Hull Street in Baltimore, MD (1 month; September 2011):

- SSHO for drilling activities (Hollow-Stem Auger) to assess soil contamination

Responsibilities include:

- Perform health and safety oversight during boring installation activities
- Present daily safety briefings that included awareness training for site physical/chemical/ biological hazards
- Calibrate and document calibration of monitoring and/or screening equipment prior to use (PID)
- Educate personnel on sampling procedures consistent within the work plan
- Develop, implement, and ensure compliance with the SSHP
- Conduct site inspections to evaluate work conditions for job zones
- Perform initial and daily site health and safety inspections
- Prepare health and safety compliance memoranda
- Direct, distribute, and inspect appropriate PPE to site personnel
- Maintain and enforce appropriate PPE use

SSHO; Borrow Soil Sampling for the Brown Station Landfill in Upper Marlboro, MD (3 months; May 2011 through July 2011):

- SSHO for drilling activities (Hollow-Stem Auger) and excavations to assess soil contamination

Responsibilities include:

- Perform health and safety oversight during well installation activities
- Present daily safety briefings that included awareness training for site physical/chemical/ biological hazards
- Calibrate and document calibration of monitoring and/or screening equipment prior to use (PID)
- Develop, implement, and ensure compliance with the SSHP
- Perform initial and daily site health and safety inspections
- Prepare health and safety compliance memoranda
- Direct, distribute, and inspect appropriate PPE to site personnel
- Maintain and enforce appropriate PPE use
- Educate site personnel regarding heavy equipment operation
- Ensure safe operation around heavy equipment

SSHO; Site Characterization of Subsurface Mercury Vapors in Baltimore, MD (2 months; May 2010 through June 2010):

- SSHO for drilling activities (Hollow-Stem Auger and Direct-Push) to install soil vapor wells and sample for subsurface mercury vapor

Responsibilities include:

- Perform health and safety oversight during well installation activities
- Perform health and safety oversight during soil vapor well installation activities
- Present daily safety briefings that included awareness training for site physical/chemical/ biological hazards
- Calibrate and document calibration of monitoring and/or screening equipment prior to use (PID, multi-meter, landfill meter, and vapor extraction pumps)
- Educate personnel on sampling procedures consistent within the work plan
- Develop, implement, and ensure compliance with the SSHP
- Conduct site inspections to evaluate work conditions for job zones
- Perform initial and daily site health and safety inspections
- Prepare health and safety compliance memoranda
- Direct, distribute, and inspect appropriate PPE to site personnel
- Maintain and enforce appropriate PPE use

SSHO; Multiple Sites - Maryland State Highway Administration Well Abandonment in Western MD (3 months; November 2009 through January 2010):

- SSHO for well abandonment activities, including heavy equipment, for deep bedrock wells

Responsibilities include:

- Perform health and safety oversight during well abandonment activities
- Present daily safety briefings that included awareness training for site physical/chemical/ biological hazards
- Calibrate and document calibration of monitoring and/or screening equipment prior to use (PID)
- Educate personnel on sampling procedures consistent within the work plan
- Develop, implement, and ensure compliance with the SSHP
- Conduct site inspections to evaluate work conditions for job zones
- Perform initial and daily site health and safety inspections
- Prepare health and safety compliance memoranda
- Direct, distribute, and inspect appropriate PPE to site personnel
- Maintain and enforce appropriate PPE use

SSHO; Intrusive Archaeological Investigation via Rotosonic Drilling at Meldahl Dam in Maysville, KY (2 months; September 2009 through October 2009):

- SSHO for drilling (Rotosonic) activities to obtain subsurface archaeological artifacts

Responsibilities include:

- Present daily safety briefings that included awareness training for site physical/chemical/ biological hazards
- Educate personnel on sampling procedures consistent within the work plan
- Develop, implement, and ensure compliance with the SSHP
- Conduct site inspections to evaluate work conditions for job zones
- Perform initial and daily site health and safety inspections
- Prepare health and safety compliance memoranda
- Direct, distribute, and inspect appropriate PPE to site personnel
- Perform health and safety oversight during deep borehole installation activities
- Maintain and enforce appropriate PPE use

SSHO; Multiple Sites - New Jersey Power and Light - Belmar, Boonton, and Cape May, NJ (8 months; January 2009 through August 2009):

- SSHO for excavation, drilling and well installation (Air Rotary and Hollow-Stem Auger), and environmental sampling activities for coal tar and related contaminated sites.

Responsibilities include:

- Perform health and safety oversight during well installation activities
- Present daily safety briefings that included awareness training for site physical/chemical/ biological hazards

- Calibrate and document calibration of monitoring and/or screening equipment prior to use (PID and FID)
- Monitor air quality at the site and inform site personnel with results as needed
- Educate personnel on sampling procedures consistent within the work plan
- Develop, implement, and ensure compliance with the SSHP
- Conduct site inspections to evaluate work conditions for job zones
- Perform initial and daily site health and safety inspections
- Perform health and safety oversight during multimedia sampling activities including soil, sediment, surface water, and groundwater
- Educate site personnel regarding heavy equipment operation
- Direct, distribute, and inspect appropriate PPE to site personnel
- Maintain and enforce appropriate PPE use
- Document health and safety deficiencies and subsequent corrective measures

SSHO; Chlorinated Solvent Plume Remediation - BASF Facility and Trustwood Parcel in Williamsburg, VA (19months; June 2007 through December 2008):

- SSHO for excavation, drilling, well installation (Hollow-Stem Auger), injection, remediation, and environmental sampling activities for a chlorinated solvent contaminated site

Responsibilities include:

- Perform health and safety oversight during well installation activities
- Present daily safety briefings that included awareness training for site physical/chemical/ biological hazards
- Calibrate and document calibration of monitoring and/or screening equipment prior to use (PID and FID)
- Monitor air quality at the site and inform site personnel with results as needed
- Monitor and screen soils and/or drill cuttings using a PID
- Perform health and safety oversight during multimedia sampling activities including soil, sediment, surface water, and groundwater
- Perform health and safety oversight during excavation activities
- Perform health and safety oversight during high-pressure injection activities
- Develop and implement the work plan
- Ensure compliance with the work plan
- Educate personnel on sampling procedures consistent within the work plan
- Develop, implement, and ensure compliance with the SSHP
- Conduct site inspections to evaluate work conditions for job zones
- Perform initial and daily site health and safety inspections
- Educate site personnel regarding heavy equipment operation
- Direct, distribute, and inspect appropriate PPE to site personnel
- Maintain and enforce appropriate PPE use
- Document health and safety deficiencies and subsequent corrective measures

SSHO; Sykesville Oil Spill Superfund Site in Sykesville, MD (10 months; June 2006 through March 2007):

- SSHO for excavation, drilling and well installation (Hollow-Stem Auger and Air Rotary), remediation, air sparging and soil vapor extraction, and environmental sampling activities

Responsibilities include:

- Perform health and safety oversight during well installation activities
- Present daily safety briefings that included awareness training for site physical/chemical/ biological hazards
- Calibrate and document calibration of monitoring and/or screening equipment prior to use (FID)
- Monitor air quality at the site and inform site personnel with results as needed
- Monitor and screen soils and/or drill cuttings using a PID
- Perform health and safety oversight during excavation activities
- Perform health and safety oversight during high-pressure pumping and treating activities
- Develop, implement, and ensure compliance with the SSHP
- Conduct site inspections to evaluate work conditions for job zones

- Perform initial and daily site health and safety inspections
- Educate site personnel regarding heavy equipment operation
- Direct, distribute, and inspect appropriate PPE to site personnel
- Maintain and enforce appropriate PPE use
- Document health and safety deficiencies and subsequent corrective measures

SSHO; Subsurface Investigation at a Former Asphalt Recycling Facility in Baltimore, MD (4 months; February 2006 through May 2006):

- SSHO for drilling and well installation (Hollow-Stem Auger and Air Rotary) and environmental sampling activities

Responsibilities include:

- Present daily safety briefings that included awareness training for site physical/chemical/ biological hazards
- Calibrate and document calibration of monitoring and/or screening equipment prior to use (PID/YSI)
- Monitor air quality at the site and inform site personnel with results as needed
- Monitor and screen soils and/or drill cuttings using a PID
- Perform health and safety oversight during multimedia sampling activities including soil, sediment, surface water, and groundwater
- Perform health and safety oversight during well installation activities (groundwater and soil gas)
- Perform health and safety oversight during high-pressure recovery activities
- Develop and implement the work plan
- Ensure compliance with the work plan
- Educate personnel on sampling procedures consistent within the work plan
- Develop, implement, and ensure compliance with the SSHP
- Conduct site inspections to evaluate work conditions for job zones
- Perform initial and daily site health and safety inspections
- Educate site personnel regarding heavy equipment operation
- Direct, distribute, and inspect appropriate PPE to site personnel
- Maintain and enforce appropriate PPE use
- Document health and safety deficiencies and subsequent corrective measures

SSHO; Chlorinated Solvent Plume Remediation – Former Film Manufacturer in Charlestown, WV (6 months; August 2005 through January 2006):

- SSHO for excavation, drilling, well installation (Air Rotary), injection, remediation, and environmental sampling activities

Responsibilities include:

- Perform health and safety oversight during well installation activities
- Present daily safety briefings that included awareness training for site physical/chemical/ biological hazards
- Calibrate and document calibration of monitoring and/or screening equipment prior to use (PID/YSI)
- Monitor and screen soils and/or drill cuttings using a PID
- Perform health and safety oversight during multimedia sampling activities including soil, sediment, surface water, sludge, and groundwater
- Perform health and safety oversight during well installation activities
- Perform health and safety oversight during excavation activities
- Perform health and safety oversight during high-pressure injection activities
- Develop and implement the work plan
- Ensure compliance with the work plan
- Educate personnel on sampling procedures consistent within the work plan
- Develop, implement, and ensure compliance with the SSHP
- Conduct site inspections to evaluate work conditions for job zones
- Perform initial and daily site health and safety inspections
- Educate site personnel regarding heavy equipment operation
- Direct, distribute, and inspect appropriate PPE to site personnel

- Maintain and enforce appropriate PPE use
- Document health and safety deficiencies and subsequent corrective measures

SSHO; Various Sites – Voluntary Cleanup Program in Baltimore, MD
(6 months; February 2005 through July 2005):

- SSHO for excavation, drilling, well installation, injection, remediation, and environmental sampling activities (Hollow-Stem Auger; Direct-Push; Air-Rotary; Rotosonic).

Responsibilities include:

- Present daily safety briefings that included awareness training for site physical/chemical/ biological hazards
- Calibrate and document calibration of monitoring and/or screening equipment prior to use (PID and FID)
- Monitor air quality at the site and inform site personnel with results as needed during excavations
- Monitor and screen soils and/or drill cuttings using a PID
- Perform health and safety oversight during multimedia sampling activities including soil, sediment, surface water, groundwater, and soil vapor
- Perform health and safety oversight during well installation (groundwater and soil vapor) activities
- Develop and implement the work plan
- Ensure compliance with the work plan
- Educate personnel on sampling procedures consistent within the work plan
- Develop, implement, and ensure compliance with the SSHP
- Conduct site inspections to evaluate work conditions for job zones
- Perform initial and daily site health and safety inspections
- Educate site personnel regarding heavy equipment operation
- Direct, distribute, and inspect appropriate PPE to site personnel
- Maintain and enforce appropriate PPE use

SSHO; Towson University Subsurface Assessment of Assateague and Chincoteague Islands; Assateague Island, MD and Chincoteague Island, VA
(2 months; March 2001 through April 2001):

- SSHO for drilling activities and installation of soil borings (Direct Push) for sampling and characterization of hydric soils.

Responsibilities include:

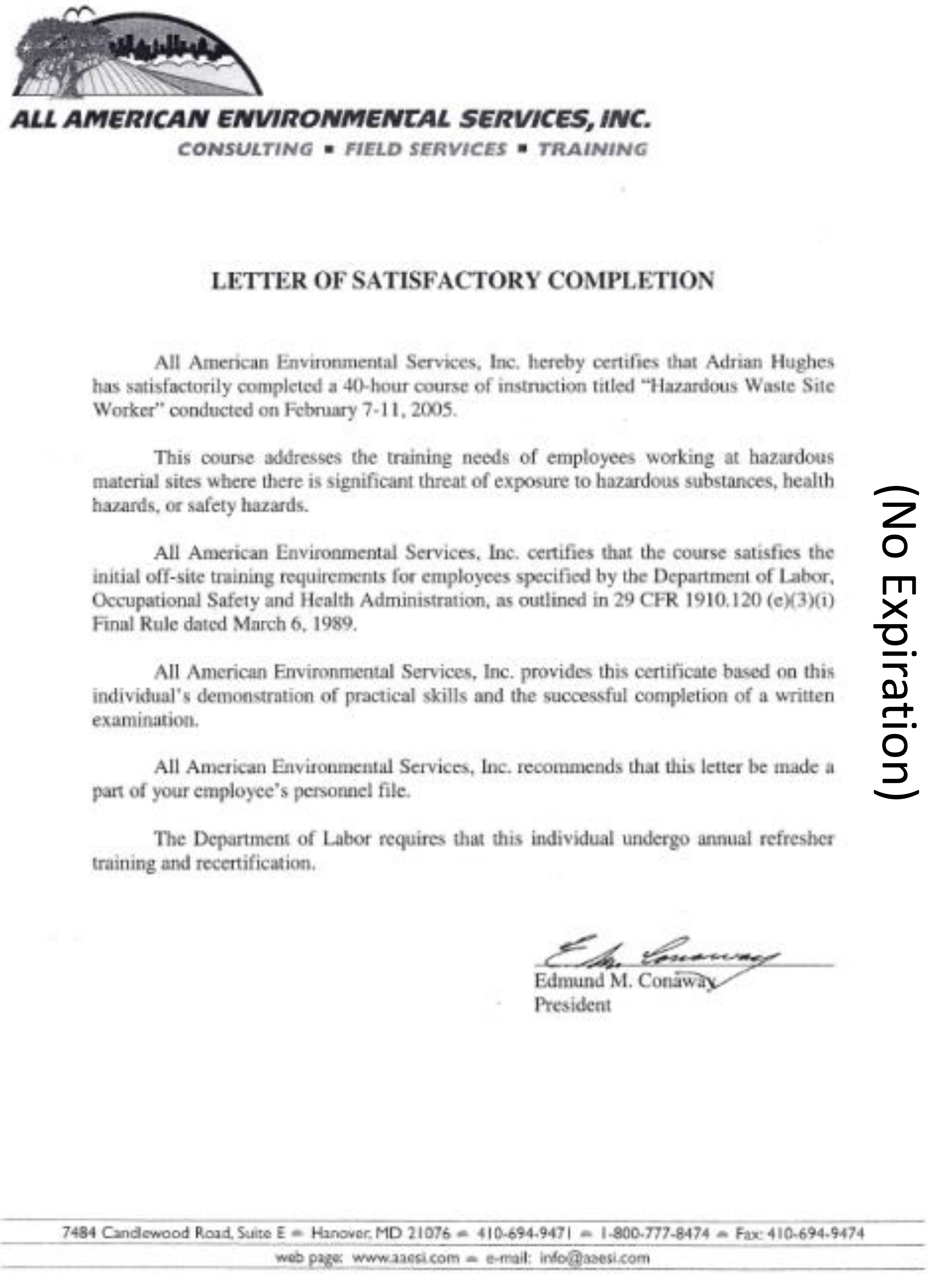
- Perform health and safety oversight during well installation activities
- Present daily safety briefings that included awareness training for site physical/chemical/ biological hazards
- Calibrate and document calibration of monitoring and/or screening equipment prior to use
- Develop, implement, and ensure compliance with the SSHP
- Conduct site inspections to evaluate work conditions for job zones
- Perform initial and daily site health and safety inspections
- Prepare health and safety compliance memoranda
- Train site personnel on the uses and maintenance of PPE
- Direct, distribute, and inspect appropriate PPE to site personnel
- Maintain and enforce appropriate PPE use

Hughes Safety and Health Certifications

1.	Cover Page	(No Expiration)	(00/00/0000)
2.	40-Hour HAZWOPER Original	(No Expiration)	(02/11/2005)
3.	8-HR Supervisor	(No Expiration)	(04/02/2012)
4.	30-HR Construction	(No Expiration)	(05/24/2011)
5.	Excavation Safety	(No Expiration)	(01/18/2013)
6.	Radon Home Measurement	(No Expiration)	(02/17/2012)
7.	CP Fall Protection (24-Hr)	(No Expiration)	(05/22/2016)
8.	APP Training	(No Expiration)	(06/06/2017)
9.	Ladder Safety Training	(No Expiration)	(05/15/2016)
10.	24-Hour USACE CP Fall Protection	(No Expiration)	(01/06/2017)
11.	Construction Management	(No Expiration)	(03/20/2017)
12.	Certified Safety Professional	(No Expiration)	(02/14/2020)
13.	Associate Safety Professional	(No Expiration)	(05/25/2016)
14.	Professional Geologist (KY)	(No Expiration)	(09/30/2015)
15.	USACE CQM Training	(Five Years)	(12/03/2015)
16.	*First Aid/CPR* (Training on 1 Dec 2021)*	*(Biannual)*	*(03/08/2018)*
17.	Bloodborne Pathogen	(Annual)	(11/21/2022)
18.	8-HR Refresher (HAZWOPER)	(Annual)	(01/21/2021)
19.	Medical Surveillance	(Annual)	(12/28/2020)
20.	Respirator Use Clearance	(Annual)	(12/28/2020)
21.	OPSEC Level 1 Training	(Annual)	(03/11/2021)
22.	Anti-Terrorism Level 1 Training	(Annual)	(08/31/2021)
23.	EPA/MDE Asbestos Inspector	(Initial)	(01/24/2019)
24.	EPA/MDE Asbestos Management Planner (AMP)	(Initial)	(02/15/2019)
25.	EPA Asbestos Inspector/AMP Refresher	(Annual)	(03/18/2021)
26.	EA UXO Awareness Training	(Annual)	(12/16/2021)

***Note**: This list presents all of the certifications for this individual; however, only pertinent certifications for the site-specific work may be presented in each Accident Prevention Plan.*

Original 40-Hour HAZWOPER Letter (No Expiration)



ALL AMERICAN ENVIRONMENTAL SERVICES, INC.
CONSULTING ▪ FIELD SERVICES ▪ TRAINING

LETTER OF SATISFACTORY COMPLETION

All American Environmental Services, Inc. hereby certifies that Adrian Hughes has satisfactorily completed a 40-hour course of instruction titled "Hazardous Waste Site Worker" conducted on February 7-11, 2005.

This course addresses the training needs of employees working at hazardous material sites where there is significant threat of exposure to hazardous substances, health hazards, or safety hazards.

All American Environmental Services, Inc. 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 outlined in 29 CFR 1910.120 (e)(3)(i) Final Rule dated March 6, 1989.

All American Environmental Services, Inc. provides this certificate based on this individual's demonstration of practical skills and the successful completion of a written examination.

All American Environmental Services, Inc. recommends that this letter be made a part of your employee's personnel file.

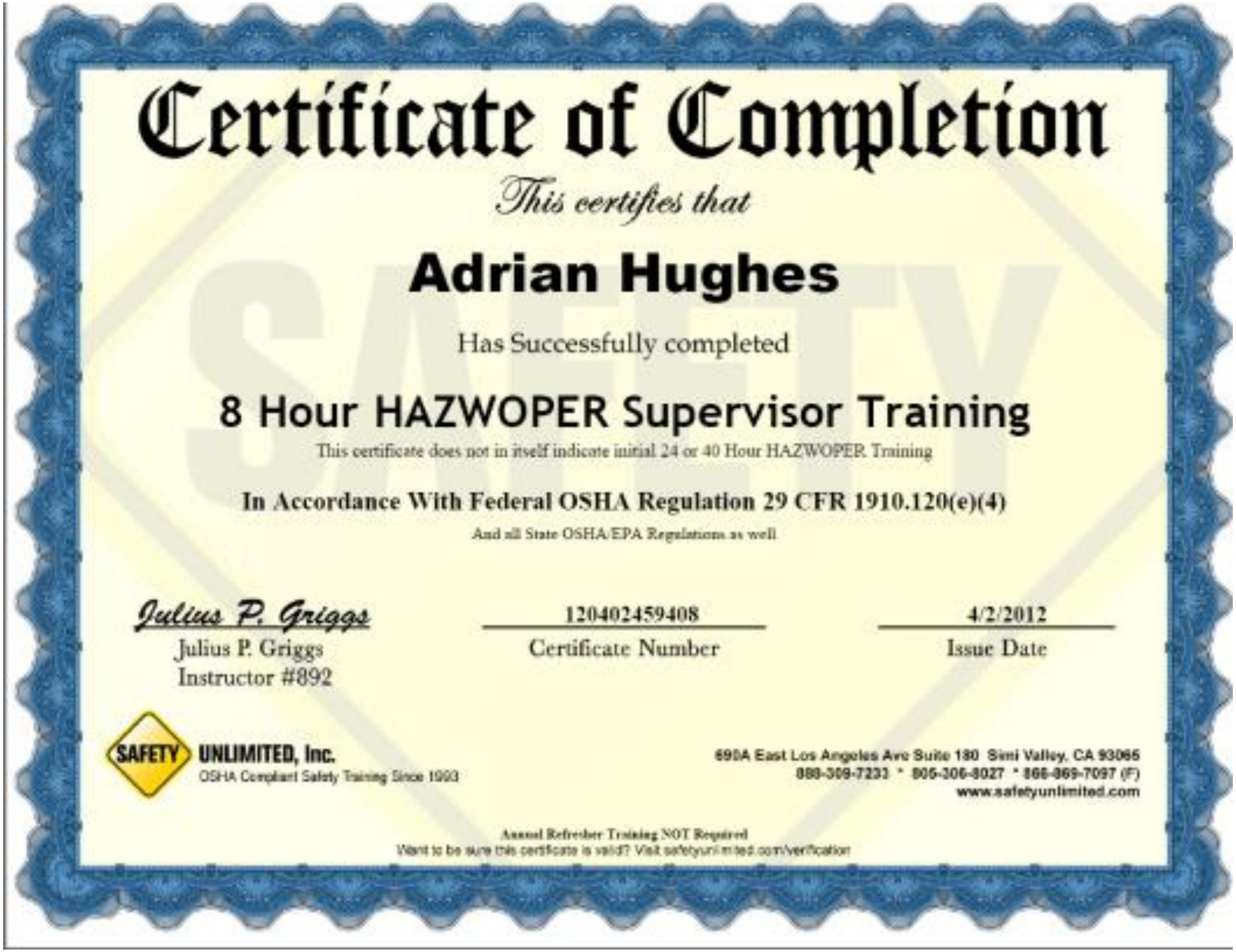
The Department of Labor requires that this individual undergo annual refresher training and recertification.

E. M. Conaway

Edmund M. Conaway
President

7484 Candlewood Road, Suite E ▪ Hanover, MD 21076 ▪ 410-694-9471 ▪ 1-800-777-8474 ▪ Fax: 410-694-9474
web page: www.aaesi.com ▪ e-mail: info@aaesi.com

8-Hour Supervisor Training
(Does Not Expire)



Certificate of Completion

This certifies that

Adrian Hughes

Has Successfully completed

8 Hour HAZWOPER Supervisor Training

This certificate does not in itself indicate initial 24 or 40 Hour HAZWOPER Training

In Accordance With Federal OSHA Regulation 29 CFR 1910.120(e)(4)

And all State OSHA/EPA Regulations as well

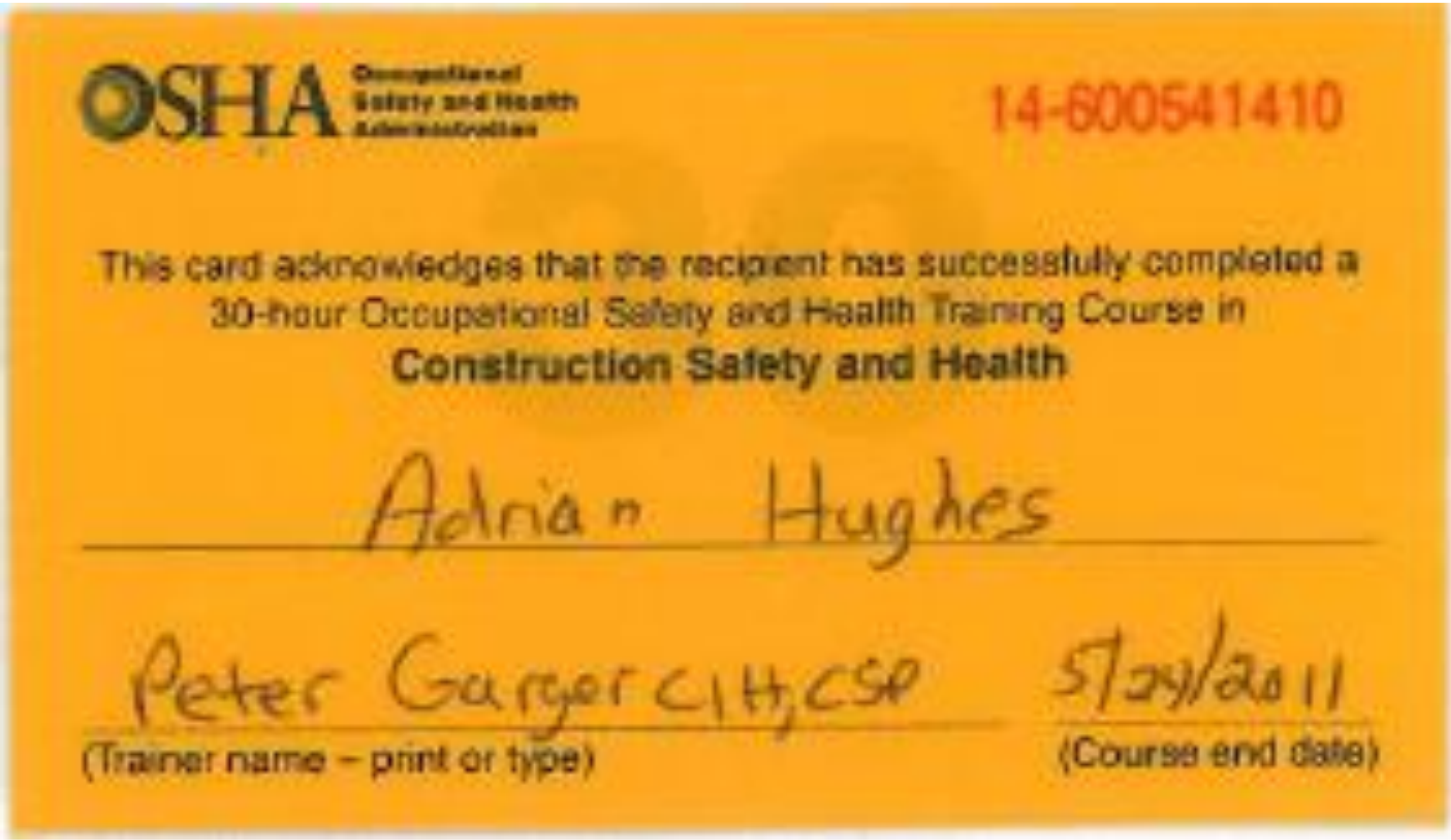
Julius P. Griggs	120402459408	4/2/2012
Julius P. Griggs Instructor #892	Certificate Number	Issue Date

SAFETY UNLIMITED, Inc.
OSHA Compliant Safety Training Since 1993

690A East Los Angeles Ave Suite 180 Simi Valley, CA 93065
888-309-7233 * 805-306-8027 * 866-869-7097 (F)
www.safetyunlimited.com

Annual Refresher Training NOT Required
Want to be sure this certificate is valid? Visit safetyunlimited.com/verification

OSHA 30-HR Construction
(Does Not Expire)



OSHA Occupational Safety and Health Administration

14-600541410

This card acknowledges that the recipient has successfully completed a 30-hour Occupational Safety and Health Training Course in

Construction Safety and Health

Adrian Hughes

Peter Garger CIH, CSP
(Trainer name – print or type)

5/24/2011
(Course end date)

Excavation Safety
(Does Not Expire)

ALL AMERICAN ENVIRONMENTAL SERVICES, INC.

This is to certify that

ADRIAN HUGHES

has successfully completed

"EXCAVATION SAFETY"
SATISFYING OSHA 29 CFR 1926.650-652

at

ALL AMERICAN ENVIRONMENTAL SERVICES, INC.
HANOVER, MARYLAND

School Director

JANUARY 18, 2013
EAE-1301

Radon Measurement Proficiency
(Does Not Expire)

RUTGERS

The New Jersey Agricultural Experiment Station
Office of Continuing Professional Education
And The
EASTERN REGIONAL RADON TRAINING CENTER

Presents this certificate to

ADRIAN HUGHES

For Successfully Completing the Requirements of

Radon Measurement Proficiency Course – Home Study

February 17, 2012
16 Hours

Edward V. Lipman, Jr.
Director
Office of Continuing Professional Education

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Mark G. Robson, PhD, MPH
Dean for Agricultural and Urban Programs

Competent Person Fall Protection
(Does not Expire)

CLICKSAFETY®

certifies that

ADRIAN HUGHES

has successfully completed ClickSafety's web-based training course:

C3 Competent Person, Fall Protection

This course was developed and presented by ClickSafety.com, Inc.

I confirm that I personally took the course listed above.

17412678	5/22/2016	3.75 HOURS	Adrian Hughes, V
SERIAL NUMBER	COMPLETION DATE	COURSE DURATION	STUDENT SIGNATURE

17412678

Accident Prevention Plan Training
(Does not Expire)

EA Engineering, Science,
and Technology, Inc., PBC

Certificate of Training

Presented to

Adrian Hughes, V; Associate Safety Professional, Professional Geologist

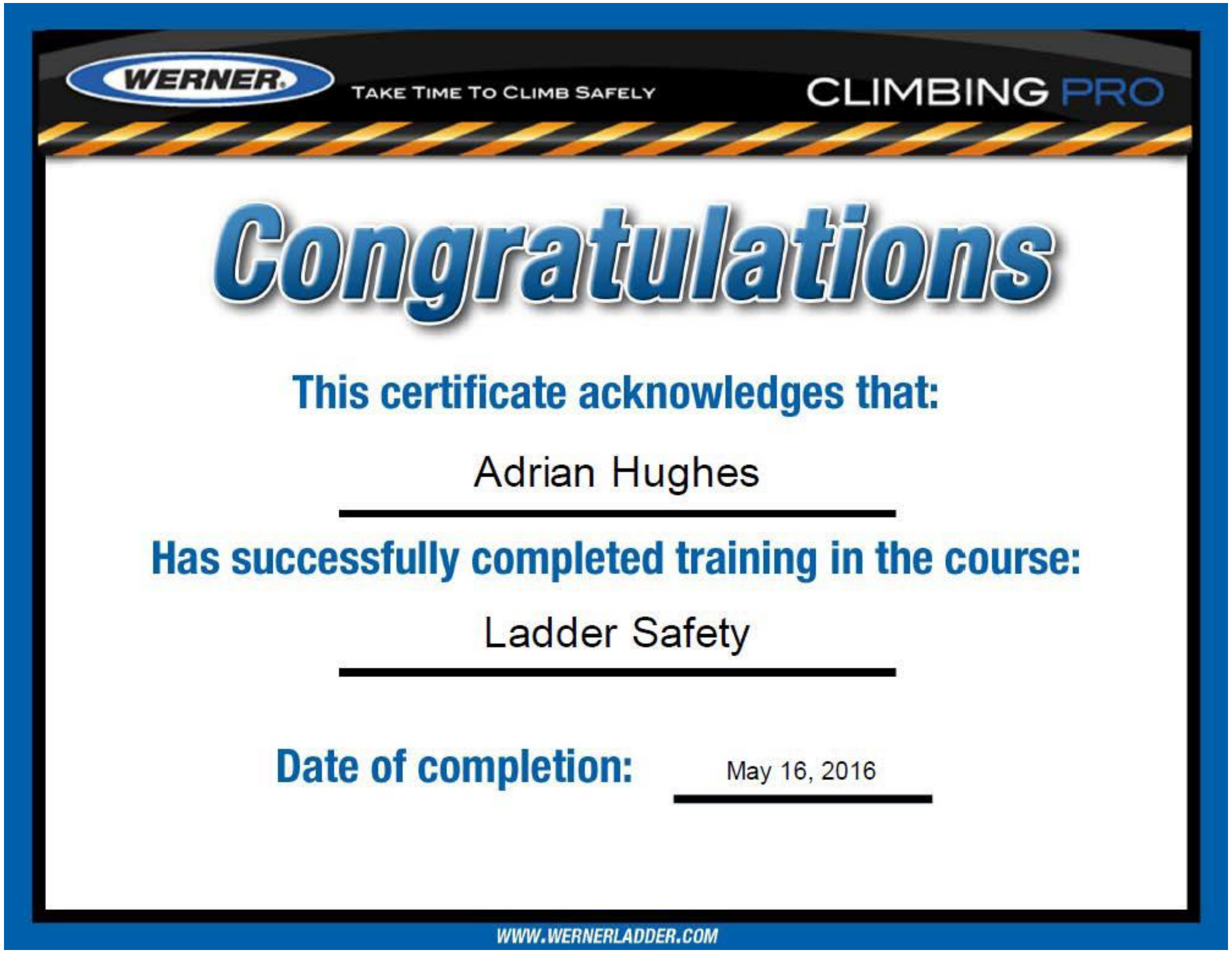
For Completion of

Accident Prevention Plan Training
6 June 2017

Presented by

Peter Garger, CIH, CSP – Director of Corporate Health and Safety
Frank Barranco, Ph.D., P.E., P.G. – Director of Quality Control
Brenda Herman, P.G. – Vice President/Program manager for USACE Baltimore District

Ladder Safety Course
(Does Not Expire)



WERNER

TAKE TIME TO CLIMB SAFELY

CLIMBING PRO

Congratulations

This certificate acknowledges that:

Adrian Hughes

Has successfully completed training in the course:

Ladder Safety

Date of completion: May 16, 2016

WWW.WERNERLADDER.COM

24-Hour Competent Person Fall Protection
(Does Not Expire)

Certificate of Training

THIS CERTIFIES THAT

Adrian Hughes V

HAS SUCCESSFULLY COMPLETED 24 HOUR COMPETENT PERSON IN FALL PROTECTION TRAINING IN ACCORDANCE WITH ANSI Z359.2, ANSI Z490.1, ANSI A10.32, EM 385-1

Luther Bunting
Trainer

January 4, 5, & 6, 2017
Date

LSCI

www.LancasterSafety.com

Phone: (888) 403-6026

Construction Management Training
(Does Not Expire)

EA Engineering, Science, and Technology, Inc., PBC

Certificate of Training

PRESENTED TO

Adrian Hughes

FOR COMPLETION OF

Construction Management Training

- Module 1 - Project Planning
- Module 2 - Controls and Documentation
- Module 3 - Risk Management

March 20, 2017

Instructor: Matthew Bowman, P.E., CCM
Awarded 3 PDHs

Certified Safety Professional Certification (CSP-37456)

Board of Certified Safety Professionals

CSP®

Upon the recommendation of the Board of Certified Safety Professionals,
by virtue of the authority vested in it, has conferred on

Adrian Hughes, V

the credential of

Certified Safety Professional

and has granted the title as evidence of meeting the qualifications and passing the required examination so long as this credential is not suspended or revoked and is renewed annually and meets all recertification requirements.

The wallet card is the official documentation of certification.

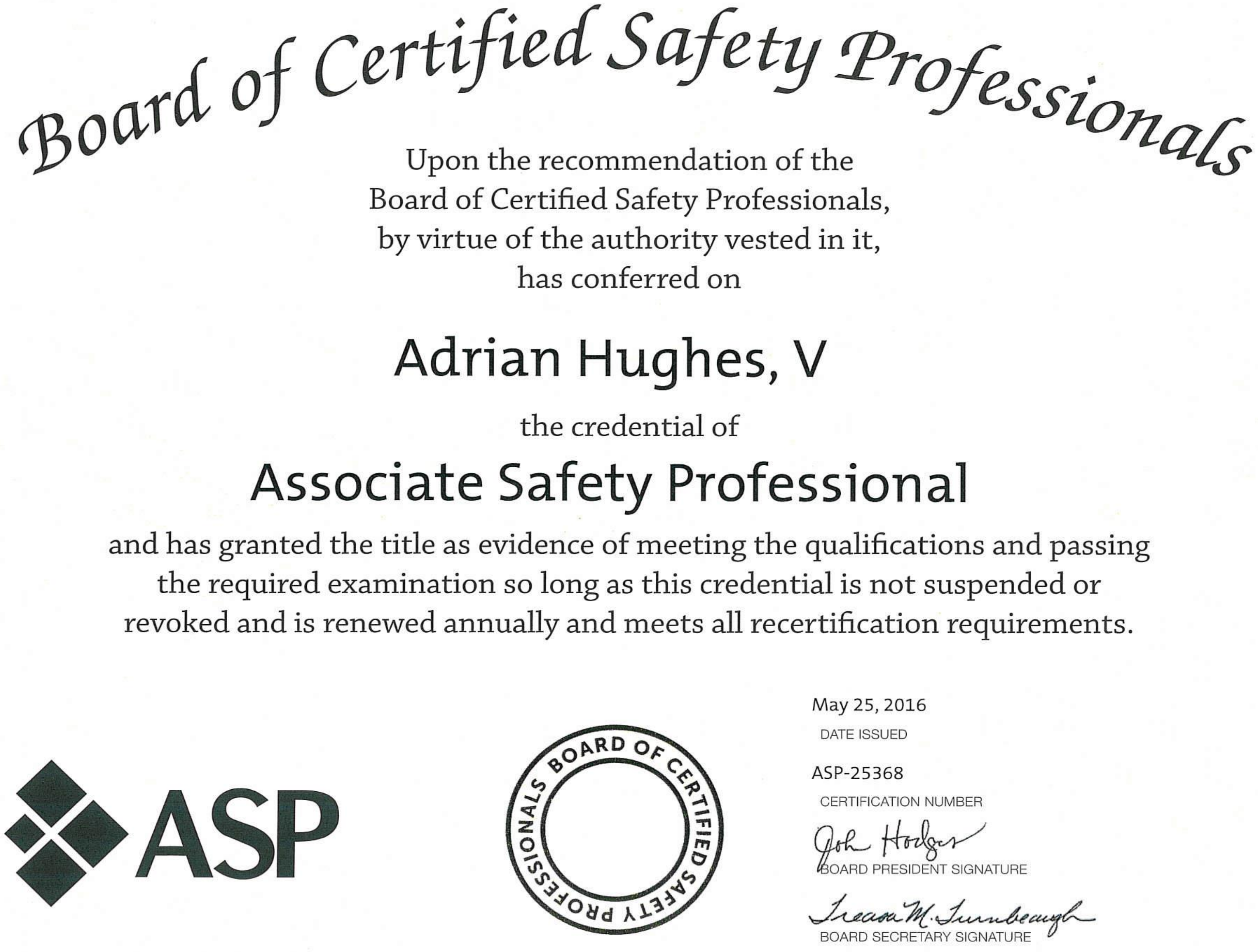
BOARD PRESIDENT SIGNATURE

Christy Uden
BOARD SECRETARY SIGNATURE

February 14, 2020
DATE ISSUED

CSP-37456
CERTIFICATION NUMBER

Associate Safety Professional Certification (ASP-25368)



Board of Certified Safety Professionals

Upon the recommendation of the
Board of Certified Safety Professionals,
by virtue of the authority vested in it,
has conferred on

Adrian Hughes, V

the credential of

Associate Safety Professional

and has granted the title as evidence of meeting the qualifications and passing the required examination so long as this credential is not suspended or revoked and is renewed annually and meets all recertification requirements.

May 25, 2016
DATE ISSUED

ASP-25368
CERTIFICATION NUMBER

John Hodges
BOARD PRESIDENT SIGNATURE

Treasa M. Turnbeaugh
BOARD SECRETARY SIGNATURE

This certification is renewed annually; however, a new certificate is not issued annually.

Professional Geologist
(Does Not Expire)

Commonwealth of Kentucky

Be it known that

Adrian Hughes

having qualified as required by act of the General Assembly,
is duly registered and is hereby authorized to practice
in the Commonwealth of Kentucky as a

Professional Geologist

In Testimony Whereof we have affixed our hand
and seal this 22nd day of April 20 14

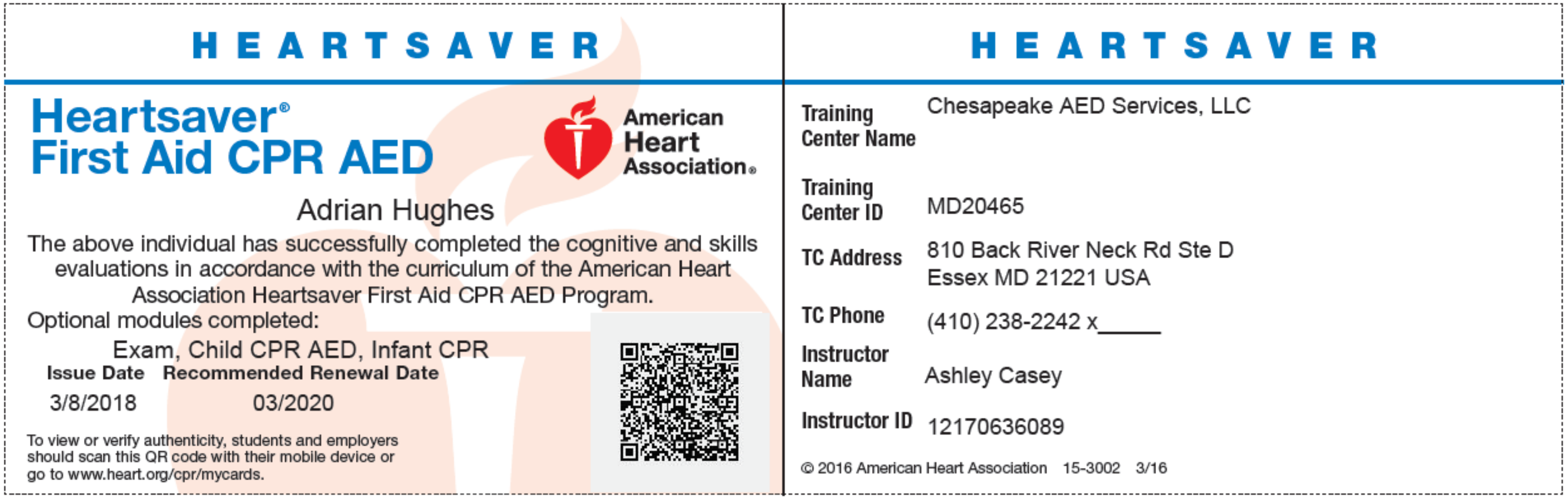
Chairman

Registration No. KY-2597

Issued by the Kentucky Board of Registration
for Professional Geologists

Kentucky Board of
Registration for
Professional Geologists
Certifies
Adrian Hughes
Professional Geologist
Kentucky
Registration Number: 2597
Expiration: 9/30/2017

First Aid/CPR
(Expires TBD)
(In-Person Classes Suspended Due to Global Pandemic)



HEARTSAVER

Heartsaver® First Aid CPR AED

American Heart Association®

Adrian Hughes

The above individual has successfully completed the cognitive and skills evaluations in accordance with the curriculum of the American Heart Association Heartsaver First Aid CPR AED Program.

Optional modules completed:

Exam, Child CPR AED, Infant CPR

Issue Date	Recommended Renewal Date
3/8/2018	03/2020

To view or verify authenticity, students and employers should scan this QR code with their mobile device or go to www.heart.org/cpr/mycards.

HEARTSAVER

Training Center Name	Chesapeake AED Services, LLC
Training Center ID	MD20465
TC Address	810 Back River Neck Rd Ste D Essex MD 21221 USA
TC Phone	(410) 238-2242 x_____
Instructor Name	Ashley Casey
Instructor ID	12170636089

Directions

1. Cut along dotted lines
2. Fold both halves together
3. Use adhesive to combine halves

Blood-Borne Pathogen Training
(Expires 11/21/2022)

EA Engineering, Science,
and Technology, Inc.

Certificate of Training

PRESENTED TO

Adrian Hughes, V

FOR COMPLETION OF

Blood-Borne Pathogen Training
IAW 29 CFR 1910.130

21 November 2021

Peter Garger, CIH, CSP

Peter Garger, CIH, CSP

UXO Awareness Training
(Expires 12/16/2022)

Certificate of Training

Presented to

Adrian Hughes

For Completion of

Annual UXO Awareness Training

December 16, 2021

Rick Hanoski, Vice President, PMP, CQA
National Service Line Program Manager Munitions Response

Mike Wright
Site Safety and Health Officer

This page intentionally left blank

Michael E. Wright

Site Health and Safety Officer

Mr. Wright has experience as a Geologist and Site Safety and Health Officer in the environmental consulting industry. He also has experience in the environmental and geotechnical drilling industry.

Professional Experience

Environmental Drilling**—**Strong understanding of various drilling techniques used in the environmental industry to install monitoring/injections wells. Responsibilities included well installation and well development on sites governed by HAZWOPER due to various impacted environmental media. He has performed environmental monitoring for airborne contaminants, temperature-related stress monitoring, and hazard assessment and control.

Health and Safety (2018-2022)

Experience with health & safety oversight including assisting with health & safety plan development, implementation of health & safety plan, site inspections to evaluate work conditions for potential job site hazards, ensuring use of proper personal protective equipment (PPE), inspecting PPE for damage, investigating reports of hazardous conditions and taking actions as appropriate to remedy the situation, subcontractor oversight, ensuring proper use/calibration and maintenance of safety and monitoring equipment, ensuring air sampling/monitoring was properly performed, and oversight of subcontractors.

Education

B.S./Geology/2018 (SUNY Oswego)

Specialized Training

OSHA 40-Hour Hazardous Waste Operations and Emergency Response Training; 2018
OSHA 8-Hour Hazardous Waste Operations and Emergency Response Refresher; 2019
OSHA 8-Hour Hazardous Waste Operations and Emergency Response Supervisor Training; 2019
OSHA 10-Hour Construction Safety Training; 2019
OSHA 30-Hour Construction Safety Training; 2020
Confined Space Entry Training; 2019
Asbestos Awareness Training; 2021
NYSDEC Erosion and Sediment Control Training; 2020
Loss Prevention Systems Training Certification
CRP, AED, First Aid Training; 2021
Blood Borne Pathogen Training; 2021

Professional Affiliations/Appointments

Geological Society of America

Experience

Years with EA: 2
Total Years: 4

EA Project Experience

SSHO and Competent Person; Environmental Sampling Activities AGFA Corporation, Shoreham NY
14 of 28 Months (April 2019 to Present)

SSHO for site activities including annual well inspections for onsite and offsite monitoring wells and repaired damaged well pads on offsite wells. Performed sampling of environmental media, earthwork, intrusive activities, and site monitoring.

- Perform health and safety oversight during above activities
- Performed site-specific training on PPE, general safety, equipment inspections, and quality control
- Performed and enforced site and equipment inspections
- Generated corrective actions following daily and/or weekly inspections, if required
- Perform health and safety oversight during activities described above,
- Present daily safety briefings consistent with the APP and SSHP (and associated sub plans) for site physical/chemical/biological/radiological hazards – generated and enforced APP/SSHP onsite
- Conduct daily site safety and health inspections for job zones
- Prepare safety and health compliance memoranda and site indoctrination procedures
- Calibrate and document calibration of monitoring and/or screening equipment prior to use
- Direct, distribute, and inspect appropriate PPE to site personnel
- Maintain and enforce appropriate PPE use

SSHO and Competent Person; Environmental Sampling Activities; National Heatset Printing Site, East Farmingdale, New York; New York State Department of Environmental Conservation

6 of 28 Months (April 2019 to Present)

SSHO for site activities including groundwater sampling and collection for volatile organic compounds using U.S. Environmental Protection Agency low flow pumping techniques. Performed monthly operation and maintenance for three onsite treatment systems and one offsite treatment system. Performed personal and perimeter screening for volatile organic compounds, management of investigation-derived waste, heavy equipment oversight, and hazard evaluation and control.

- Perform health and safety oversight during above activities
- Performed site-specific training on PPE, general safety, equipment inspections, and quality control
- Performed and enforced site and equipment inspections
- Generated corrective actions following daily and/or weekly inspections, if required
- Perform health and safety oversight during activities described above,
- Present daily safety briefings consistent with the APP and SSHP (and associated sub plans) for site physical/chemical/biological/radiological hazards – generated and enforced APP/SSHP onsite
- Conduct daily site safety and health inspections for job zones
- Prepare safety and health compliance memoranda and site indoctrination procedures
- Calibrate and document calibration of monitoring and/or screening equipment prior to use
- Direct, distribute, and inspect appropriate PPE to site personnel
- Maintain and enforce appropriate PPE use

SSHO and Competent Person; Environmental Sampling Activities; Perfection Plating, Watervliet, New York; New York State Department of Environmental Conservation
4 of 28 Months (April 2019 to Present)

SSHO for site activities including groundwater sampling for hexavalent chromium using bailers as well as per- and polyfluoroalkyl substances using U.S. Environmental Protection Agency low flow techniques. Performed PPE assessments, reviewed hazard evaluation and controls, equipment and personnel decontamination, air and temperature related monitoring, and IDW management.

- Perform health and safety oversight during above activities
- Performed site-specific training on PPE, general safety, equipment inspections, and quality control
- Performed and enforced site and equipment inspections
- Generated corrective actions following daily and/or weekly inspections, if required
- Perform health and safety oversight during activities described above,
- Present daily safety briefings consistent with the APP and SSHP (and associated sub plans) for site physical/chemical/biological/radiological hazards – generated and enforced APP/SSHP onsite
- Conduct daily site safety and health inspections for job zones
- Prepare safety and health compliance memoranda and site indoctrination procedures
- Calibrate and document calibration of monitoring and/or screening equipment prior to use
- Direct, distribute, and inspect appropriate PPE to site personnel
- Maintain and enforce appropriate PPE use

SSHO and Competent Person; Injection Oversight, Roxy Cleaners, North Greenbush, New York; New York State Department of Environmental Conservation
1 of 28 Months (2019)

SSHO for site activities including long-term groundwater monitoring, and performance of an ozone injection pilot study to remediate groundwater and installation of two overburden injection trenches. Also, oversight for bioremediation injections on three bedrock wells using an inflatable packer and a trash pump to pressure inject and two overburden trenches via gravity feeding.

- Perform health and safety oversight during above activities
- Performed site-specific training on PPE, general safety, equipment inspections, and quality control
- Performed and enforced site and equipment inspections
- Generated corrective actions following daily and/or weekly inspections, if required
- Perform health and safety oversight during activities described above

- Assisted with onsite operations following QCS including QC over onsite delivery of materials & equipment
- Present daily safety briefings consistent with the APP and SSHP (and associated sub plans) for site physical/chemical/biological/radiological hazards – generated and enforced APP/SSHP onsite
- Conduct daily site safety and health inspections for job zones
- Prepare safety and health compliance memoranda and site indoctrination procedures
- Calibrate and document calibration of monitoring and/or screening equipment prior to use
- Direct, distribute, and inspect appropriate PPE to site personnel (Level D and Mod Level D)
- Maintain and enforce appropriate PPE use

SSHO and Competent Person; Construction and UXO Oversight; Hancock Field Air National Guard Base Site; Syracuse, New York; U.S. Army Corps of Engineers–Omaha District
3 of 28 Months (April 2019 to Present)
SSHO for site activities including oversight of contractors preforming the demolition and removal of a firing-in buttress as well as the unexploded ordnance clearance of munitions present in timbers removed during the demolition. Conducted daily air monitoring and daily field reports.

- Perform health and safety oversight during above activities
- Performed site-specific training on PPE, general safety, equipment inspections, and quality control
- Performed and enforced site and equipment inspections
- Generated corrective actions following daily and/or weekly inspections, if required
- Perform health and safety oversight during activities described above, competent person for fall protection, aerial lift usage, and ladder usage
- Assisted with onsite operations following QCS including QC over onsite delivery of materials & equipment
- Followed site-specific excavation permit utility avoidance prior to intrusive activities
- Present daily safety briefings consistent with the APP and SSHP (and associated sub plans) for site physical/chemical/biological/radiological hazards – generated and enforced APP/SSHP onsite
- Conduct daily site safety and health inspections for job zones
- Prepare safety and health compliance memoranda and site indoctrination procedures
- Calibrate and document calibration of monitoring and/or screening equipment prior to use
- Direct, distribute, and inspect appropriate PPE to site personnel (Level D and Mod Level D)
- Maintain and enforce appropriate PPE use

SSHO and Competent Person; Drilling and Groundwater Sampling; Paulus – Phase II Environmental Site Assessment – EJ Victory Site; Johnson City, New York; Paulus Development
2 of 28 Months
SSHO for site activities including oversight of the installation and development of seven overburden monitoring wells around the former EJ Victory Building. Also collected groundwater samples for per- and polyfluoroalkyl substances at three monitoring well locations using low flow purging techniques.

- Perform health and safety oversight during above activities
- Performed site-specific training on PPE, general safety, equipment inspections, and quality control
- Performed and enforced site and equipment inspections
- Generated corrective actions following daily and/or weekly inspections, if required
- Perform health and safety oversight during activities described above
- Assisted with onsite operations following QCS including QC over onsite delivery of materials & equipment
- Followed site-specific excavation permit utility avoidance prior to intrusive activities
- Present daily safety briefings consistent with the APP and SSHP (and associated sub plans) for site physical/chemical/biological/radiological hazards – generated and enforced APP/SSHP onsite
- Conduct daily site safety and health inspections for job zones
- Prepare safety and health compliance memoranda and site indoctrination procedures
- Calibrate and document calibration of monitoring and/or screening equipment prior to use
- Direct, distribute, and inspect appropriate PPE to site personnel (Level D and Mod Level D)
- Maintain and enforce appropriate PPE use

HEARTSAVER

Heartsaver® First Aid CPR AED

American Heart Association.

Frank DeSantis

has successfully completed the cognitive and skills evaluations in accordance with the curriculum of the American Heart Association Heartsaver First Aid CPR AED Program.

Optional modules completed:

Issue Date

1/8/2021

Training Center Name

American Medical Response (AMR) of Central New York

Training Center ID

NY04334

Training Center City, State

Syracuse, NY

Training Center Phone Number

(315) 701-7094

Renew By

01/2023

Instructor Name

Susan Burnett

Instructor ID

01170525452

eCard Code

216007970456

QR Code

To view or verify authenticity, students and employers should scan this QR code with their mobile device or go to www.heart.org/cpr/mycards.

20-3002 1/21

American Heart Association.
2020
CPR & ECC
GUIDELINES

Certificate

Michael Wright

has successfully completed

Heartsaver® First Aid CPR AED Online Portion

Congratulations on learning lifesaving skills with the American Heart Association. Hands-on skills practice and testing, conducted by an authorized AHA BLS or Heartsaver Instructor, is required to receive a Heartsaver First Aid CPR AED course completion card.

For greater success, it is recommended the hands-on skills session be conducted shortly after completing the online portion. Please take this certificate with you to your hands-on skills session.

This certificate does not constitute successful completion of the full Heartsaver First Aid CPR AED Course.

Path Taken: Heartsaver Total

Topics Included

Survivor Story (Superintendent)
Hands-Only CPR
Adult CPR, AED, and Choking Relief
Drug Overdose
Water Safety
Key Steps of First Aid (Finding the Problem*)
Precautions (Exposure to Blood & Removing Gloves*)
Breathing Problems (Asthma)
Breathing Problems
Allergic Reactions (Using an Epinephrine Pen*)
Heart Attack
Fainting
Diabetes and Low Blood Sugar
Stroke
Seizures
External Bleeding* (Direct Pressure and Bandaging & Tourniquets)
Shock
Wounds (Eye, Nose, and Tooth Injuries)
Penetrating and Puncturing Injuries
Amputation
Internal Bleeding
Head, Neck, and Spinal Injuries
Broken Bones and Sprains
Burns and Electrical Injuries
Bites and Stings
Heat-Related Emergencies
Cold-Related Emergencies
Poison Emergencies
Risks of Smoking/Vaping
Benefits of Healthy Lifestyle

IMP2273SY9KD
Certificate Number

01/03/2022 23:18:12
Date Completed

Mike Wright

has successfully completed this online course

Bloodborne Pathogens Online Course

August 20, 2021

American
Red Cross

AdvanceOnline Solutions Online Institute

Certificate of Completion

Michael Wright

has met the online course completion requirements for

OSHA 30-Hour Construction Safety

This student has completed the formal instruction for the 30-Hour Construction Outreach Program. Topics covered in this program were Introduction to OSHA, Managing Safety and Health, Struck-by and Caught-In or Between Hazards, Personal Protective Equipment, Hearing Conservation, Respiratory Protection, Lead and Crystalline Silica, Asbestos, GHS Hazard Communication, Electrical Safety, Hand and Power Tools, Fall Protection, Ladder Safety, Excavations, Scaffolds, Crane Safety, Heavy Equipment, Forklift Safety, Materials Handling, Permit-Required Confined Spaces, Fire Safety, Welding and Cutting, Concrete and Masonry, Steel Erection, and Ergonomics.

As an OSHA Outreach Training Program trainer, I affirm that I have conducted this OSHA Outreach Training Program training class in accordance with OSHA Outreach Training Program requirements. I will document this class to my OSHA Authorizing Training Organization. Upon successful review of my documentation, I will provide each student their course completion card within 90 calendar days of the end of the class. — Rick Gleason

Instructor Rick Gleason
Course ID A0310
Certificate ID 6745_1684262

Date 4/14/2020 2:25:00 PM
Time Online 30:28:30
AdvanceOnline Solutions, Inc.
1811 Bering Drive, Suite 430
Houston, Texas 77057
www.advanceonline.com
(713) 621-1100

AdvanceOnline SOLUTIONS

NEW YORK
STATE OF
OPPORTUNITY

Department of
Environmental
Conservation

Endorsed Training

Certificate of Completion

MICHAEL E. WRIGHT

Is hereby awarded this Certificate signifying completion of the course:

"NYS DEC 4-Hour Erosion and Sediment Control Training"

Attested Day of Training: 03/16/2020

*Assigned Trainee Stormwater Identification Number – **SWT #«032020-13***

This Erosion and Sediment Control (E&SC) Training is Endorsed by the NYS Department of Environmental Conservation, Division of Water, for "Trained Contractors" and Certain "Qualified Inspectors" who must receive 4 hours of E&SC training every three years to satisfy requirements under the Construction Activity State Pollution Discharge Elimination System (SPDES) General Permit.

Expiration: 3 years from date of training

Instructed by: John E. Folchetti, P.E. (NYSDEC **SWT #0045-T**)

http://www.dec.ny.gov/chemical/8699.html#DEC ~ 625 Broadway, 4th Floor, Albany NY 12233-3505 ~ (518) 402-8111 ~ DWSWtrng@gw.dec.state.ny.us

Certificate of Completion

This certifies that

Michael E. Wright

has successfully completed

8 Hour HAZWOPER Refresher Training

Refresher certification does NOT necessarily indicate initial 24 or 40 Hour HAZWOPER certification

In Accordance w/Federal OSHA Regulation 29 CFR 1910.120(e) & (p)

And all State OSHA/EPA Regulations as well including 29 CFR 1926.65 for Construction.

This course (Version 3) is approved for 8 Contact Hours (0.8 CEUs) of continuing education per the California Department of Public Health for Registered Environmental Health Specialist (REHS) (Accreditation # 044).

Safety Unlimited, Inc., Provider #5660170-2, is accredited by the International Association for Continuing Education and Training (IACET) and is accredited to issue the IACET CEU. As an IACET Accredited Provider, Safety Unlimited, Inc. offers CEUs for its programs that qualify under the ANSI/IACET Standard. Safety Unlimited, Inc. is authorized by IACET to offer 0.8 CEUs for this program.

Julius P. Griggs

Julius P. Griggs
Instructor #892

2112275313332
Certificate Number

12/27/2021
Issue Date

ACCREDITED
IACET
PROVIDER

Scan this code or visit safetyunlimited.com/v to verify certificate.

SAFETY UNLIMITED, Inc.
OSHA Compliant Safety Training Since 1993

2139 Tapo St., Suite 228 Simi Valley,CA 93063
(855) 784-2677 or 805 306-8027
https://www.safetyunlimited.com

Proof of initial certification and subsequent refresher training is NOT required to take refresher training

Certificate of Completion

This certifies that

Michael E. Wright

has successfully completed

8 Hour HAZWOPER Supervisor Training

This certificate does not in itself indicate initial 24 or 40 Hour HAZWOPER Training

In Accordance With Federal OSHA Regulation 29 CFR 1910.120(e)(4)

And all State OSHA/EPA Regulations as well including 29 CFR 1926.65 for Construction.

This course is approved for 8 Contact Hours (0.8 CEUs) of continuing education per the California Department of Public Health for Registered Environmental Health Specialist (REHS) (Accreditation # 044)

Safety Unlimited, Inc., Provider #5660170-2, is accredited by the International Association for Continuing Education and Training (IACET) and is accredited to issue the IACET CEU. As an IACET Accredited Provider, Safety Unlimited, Inc. offers CEUs for its programs that qualify under the ANSI/IACET Standard. Safety Unlimited, Inc. is authorized by IACET to offer 0.8 CEUs for this program.

Julius P. Griggs	1912304313332	12/30/2019
Julius P. Griggs Instructor #892	Certificate Number	Issue Date

ACCREDITED
IACET
PROVIDER

Scan this code or visit safetyunlimited.com/v to verify certificate.

SAFETY UNLIMITED, Inc.
OSHA Compliant Safety Training Since 1993

2139 Tapo St., Suite 228 Simi Valley,CA 93063
(888) 309-SAFE (7233) or 805 306-8027
https://www.safetyunlimited.com

Annual Refresher Training NOT Required

This page intentionally left blank

Certificate of Completion

This certifies that

Michael E. Wright

has successfully completed

Asbestos Awareness Training

Certification is NOT for Asbestos Abatement

In Accordance With Federal OSHA and EPA Regulations

29 CFR 1910.1001(j)(7), 29 CFR 1915.1001(k)(9), 29 CFR 1926.1101(k)(9), 40 CFR Part 763 Subpart G and State OSHA/EPA Regulations

This course is approved for 2 Contact Hours (0.2 CEUs) of continuing education per the California Department of Public Health for Registered Environmental Health Specialist (REHS) (Accreditation # 044)

Safety Unlimited, Inc., Provider #5660170-2, is accredited by the International Association for Continuing Education and Training (IACET) and is accredited to issue the IACET CEU. As an IACET Accredited Provider, Safety Unlimited, Inc. offers CEUs for its programs that qualify under the ANSI/IACET Standard. Safety Unlimited, Inc. is authorized by IACET to offer 0.2 CEUs for this program.

Julius P. Griggs	21081762313332	8/17/2021
Julius P. Griggs Instructor #892	Certificate Number	Issue Date

ACCREDITED IACET PROVIDER

SAFETY UNLIMITED, Inc.
OSHA Compliant Safety Training Since 1993

2139 Tapo St., Suite 228 Simi Valley,CA 93063
(855) 784-2677 or 805 306-8027
https://www.safetyunlimited.com

Scan this code or visit safetyunlimited.com/v to verify certificate.

Annual Refresher Training Required

NATIONAL
ENVIRONMENTAL TRAINERS

Certificate of Completion

Michael Wright

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 (OSHA HAZWOPER Regulations). This course has been awarded 6.68 Industrial Hygiene CM Points by the American Board of Industrial Hygiene-Approval Number 13334. This course is also eligible for 3.33 Continuance of Certification (COC) points from the Board of Certified Safety Professionals.

Signature of Instructor

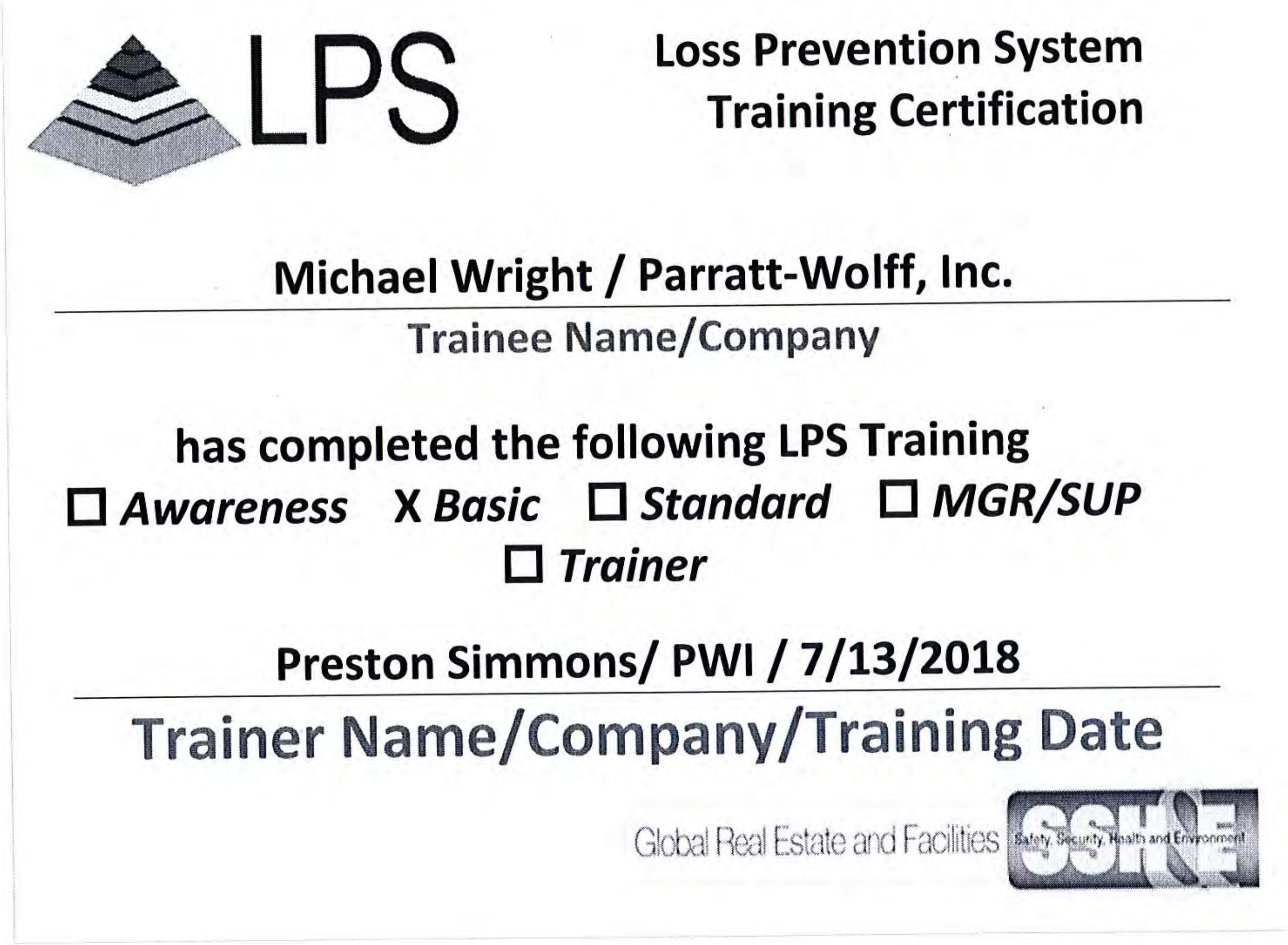
REGISTERED PROFESSIONAL INDUSTRIAL HYGIENIST
CLAY BEDNARZ

NATIONAL
ENVIRONMENTAL
TRAINERS Inc. ®
07/02/2018

Certificate Number: 959407
www.nationalenvironmentaltrainers.com

Clay A. Bednarz, MS, RPIH

The Official Site of Environmental Health & Safety Training®



LPS

Loss Prevention System
Training Certification

Michael Wright / Parratt-Wolff, Inc.

Trainee Name/Company

has completed the following LPS Training

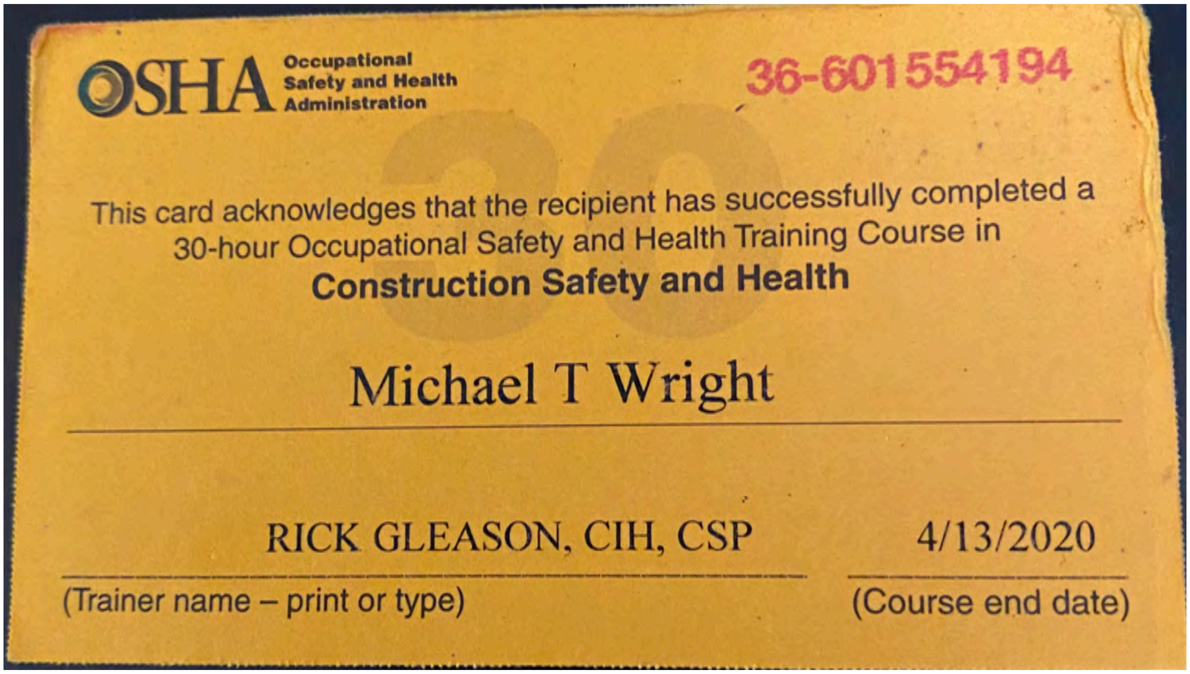
☐ ***Awareness*** **X *Basic*** ☐ ***Standard*** ☐ ***MGR/SUP***

☐ ***Trainer***

Preston Simmons/ PWI / 7/13/2018

Trainer Name/Company/Training Date

Global Real Estate and Facilities SSHE Safety, Security, Health and Environment



OSHA Occupational Safety and Health Administration

36-601554194

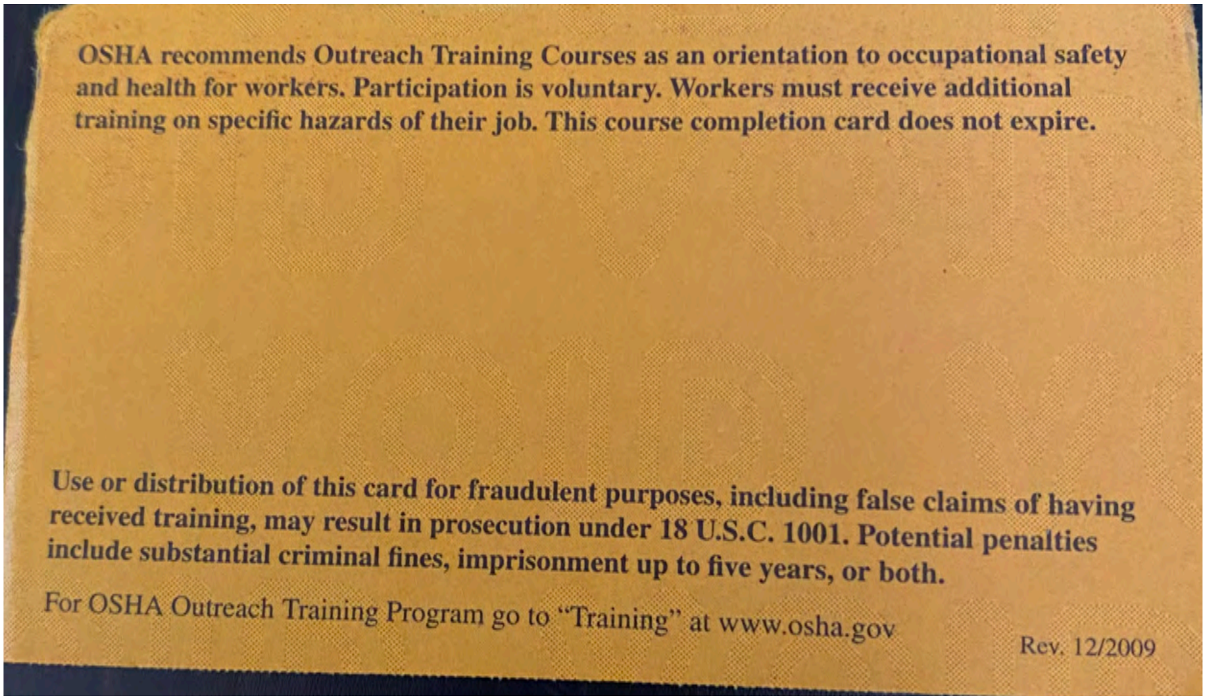
This card acknowledges that the recipient has successfully completed a 30-hour Occupational Safety and Health Training Course in

Construction Safety and Health

Michael T Wright

RICK GLEASON, CIH, CSP
(Trainer name – print or type)

4/13/2020
(Course end date)



OSHA recommends Outreach Training Courses as an orientation to occupational safety and health for workers. Participation is voluntary. Workers must receive additional training on specific hazards of their job. This course completion card does not expire.

Use or distribution of this card for fraudulent purposes, including false claims of having received training, may result in prosecution under 18 U.S.C. 1001. Potential penalties include substantial criminal fines, imprisonment up to five years, or both.

For OSHA Outreach Training Program go to "Training" at www.osha.gov

Rev. 12/2009

Syracuse Builders Exchange
FOUNDED 1872

THIS CERTIFIES THAT

MICHAEL WRIGHT

successfully completed the OSHA 10-Hour Construction Outreach Course and is therefore awarded this

CERTIFICATE OF COMPLETION

Given this 6th Day of September 2019

As an OSHA authorized trainer, I verify I have conducted this OSHA outreach training course in accordance with OSHA Outreach Training Program requirements. I will document this class to my authorizing OSHA Training Organization. Upon successful review of my documentation, I will provide each student their certification card within 90 days of the end of class.

Lisa C. B

Lisa Brownson, Instructor - Safety Source Consultants, 7009 Lakeshore Rd, Cicero, NY 13039

lisa.brownson@gmail.com

Frank DeSantis
Technical Manager

This page intentionally left blank

Frank DeSantis, Jr.

Scientist

Mr. DeSantis is a scientist with 19 years of experience in the biological and environmental fields. His experience includes performing all phases of the Comprehensive Environmental Response, Compensation, and Liability Act and Resource Conservation and Recovery Act for a variety of state and federal clients. Examples include Phase I and Phase II assessments in support of the Army Operational Range Assessment Program, conducting remedial action–operation and long-term management activities in support of the U.S. Air Force and Army Environmental Command environmental programs; performing site characterizations and pre-design investigations in support of U.S. Air Force performance-based remediation programs; performing remedial investigations and feasibility studies, remedial design, construction management, and site management for EA's New York State Department of Environmental Conservation (NYSDEC) standby contract.

Mr. DeSantis' current responsibilities include providing program management and technical support to a variety of environmental projects.

Education

Graduate Work/Environmental and Forest Biology; 32 credit hours (State University of New York College of Environmental Science and Forestry)

B.S./Environmental and Forest Biology/2000 (State University of New York College of Environmental Science and Forestry)

Specialized Training

OSHA 40-Hour Hazardous Waste Operations and Emergency Response Training
OSHA 8-Hour Hazardous Waste Operations and Emergency Response Refresher
OSHA 8-Hour Hazardous Waste Operations Supervisor Training
30-hour Construction Safety and Health
Permit Required Confined Space Training
Accident Prevention Plan Training; 2015
CPR and First Aid Training

Experience

Years with EA: 15 Total Years: 19

Professional Experience

Program Management—Deputy Program Manager for EA's NYSDEC Engineering Services Standby Contract D009806 with a total value of $50 million. Provides program management for preliminary site assessments, site characterizations, remedial investigation/feasibility study, and remedial design/remedial actions throughout New York. Responsibilities include program management and compliance with NYSDEC Contract D009806 terms, completion of site visits and scoping sessions, review and advancement of work assignments, assessment of conflicts of interest, staff management, and budget preparation and reporting. Provides program review of engineering services costing, work plans, field sampling plans, quality assurance project plans and health and safety plans. Provides coordination of multiple site investigations field efforts, staff and project scheduling, and subcontractor management.

Project and Staff Management—Provided project management for preliminary site assessments, site characterizations, remedial investigation/feasibility study, and remedial design/remedial actions. Responsibilities include the completion of engineering services costing, work plan development and review, field sampling plans, quality assurance project plans and health and safety plan development, coordination of multiple site investigations field efforts, staff and project scheduling, subcontractor management, and principal point of contact. In addition, responsibilities include interaction and advisement with clients, contract managers, and regulatory officials. Previously managed work assignments under an NYSDEC Superfund Engineering Services contract, task orders under the Army Environmental Command Environmental Remediation Award Contract, and a subcontract under the Air Force Performance-Based Remediation contract. Responsibilities include completion of site visits and scoping sessions, review and advancement of work assignments, assessment of conflicts of interest, staff management, and budget preparation and reporting.

Environmental Remediation—Performed remedial evaluations and assisted in the management and design of remedial activities. Projects included excavation and disposal of contaminated soil, operation of groundwater pump and treat systems, *in situ* bioremediation, chemical oxidation, and munitions response. Project types included former gasoline stations, fire training areas, munitions sites, and industrial properties.

EA Project Experience

Construction Management, West Islip, New York; NYSDEC Region 1; Project Manager—Project Manager for construction management of an approximately $20 million environmental construction project for NYSDEC involving remediation of a metals-contaminated stream and lake. Prepared change orders, field orders, responded to contractor requests for information, reviewed contractor applications for payment. Managed contractors, staffing requirements, budget allocations and review, provided lead technical support field changes, oversaw completion reports and site management plan development.
Project Date: January 2019 – January 2021

Remedial Design, West Islip, New York; NYSDEC Region 1; Project Manager—Project Manager for all aspects of the remedial design for NYSDEC to address a metals-contaminated stream and lake. Prepared remedial design documents for NYSDEC in accordance with Division of Environmental Remediation-10 guidelines. Identified data gaps necessitating a pre-design investigation to inform site restoration requirements, and stormwater management needs. Managed multiple subcontractors, staffing requirements, budget allocations and review, identified data gaps, and provided lead technical support for site investigation activities. Coordinated and managed the successful implementation of interim remedial measures to restore stream flow and limit stormwater runoff impacts.
Project Date: December 2017 – January 2019

Remedial Investigation and Feasibility Studies, West Islip, New York; NYSDEC Region 1; Project Manager—Project Manager for all aspects of the remedial investigation/feasibility study at two operable units for NYSDEC. Prepared remedial investigation/feasibility study reports for NYSDEC in accordance with Division of Environmental Remediation-10 guidelines. Identified remedial action objectives and conducted a feasibility study for known environmental impacts associated with former site operations and disposal activities, including an assessment of sediment and soil impacts and delineation based on field investigation. Selected appropriate remedial technologies for regulatory review and comment. Managed multiple subcontractors, staffing requirements, budget allocations and review, identified data gaps, and provided lead technical support for site investigation activities. Coordinated and managed the successful implementation of interim remedial measures to restore stream flow and limit stormwater runoff impacts.
Project Date: April 2016 – November 2018

Environmental Remediation Services, U.S. Army Environmental Command, Remedial Action-Operation/Long-Term Management at Picatinny Arsenal, New Jersey; Project Manager—Project Manager for a Task Order under the Environmental Remediation Multiple Award contract for the performance of remedial action-operation and long-term management activities at 84 sites at Picatinny Arsenal, New Jersey. Task Order consists of performing multi-media sampling (surface water, groundwater, sediment, and biological) as part of site monitoring programs, land use and land use control inspections, remedial injections to address impacted groundwater, well abandonment, wetland assessments, subcontractor oversight, and report writing.
Project Date: July 2015 – Present

Performance-Based Remediation, Versar/Air Force Civil Engineer Center, Niagara Falls Air Reserve Station, New York; Deputy Project Manager—Managing and providing technical direction for the investigation and remediation of 13 sites at Niagara Falls Air Reserve Station. This is a 7-year performance-based remediation contract, with the objective of achieving site closure for 7 sites and advancing the other sites as close to site closure as possible. Sites include JP-4 releases, drum storage areas, landfills, fire-training pits, gasoline tank release and oil

underground storage tank sites. Primary responsibilities include managing field efforts involving collection of surface water and groundwater, reviewing and approving project documents, including NYSDEC-approved Quality Assurance Project Plans, Sampling and Analysis Plans, and Health and Safety Plans, and reports. Responsible for developing multi-faceted technical approaches for each site to complete the remedial objectives within the period-of-performance. The work includes targeted investigations to fill data-gaps, excavation to remove small source areas, and injections of various compounds to remediate the site's contaminants of concern. The project has aggressive schedules for each site and requires the management of staffing, effort, budget and schedule to meet the milestones required by the project.
Project Date: 2012 – Present

Remedial Investigation/Feasibility Study, Camp Smith New York; U.S. Army Corps of Engineers–Baltimore District; Investigation Manager—Investigation manager for remedial investigation of a metals-impacted tidal marsh at Camp Smith, New York. Oversaw development of project documents including Work Plans and Quality Assurance Project Plans, and Accident Prevention Plan prepared in accordance with Uniform Federal Policy-Quality Assurance Project Plan and Engineer Manual 385-1-1 guidance. Coordinated sampling of sediments, surface water, and fish tissue. Compiled and managed associated report deliverables.
Project Date: 2013

Expanded Range Investigation, Fort Drum New York; U.S. Army Corps of Engineers–Baltimore District—Investigation manager for metals sediment investigation downstream of several small arms ranges at Fort Drum, New York. Oversaw development of project documents including Preliminary Technical Approach/refined Conceptual Site Model, and site-specific Quality Assurance Project Plan, Work Plan, and Accident Prevention Plan prepared in accordance with Uniform Federal Policy-Quality Assurance Project Plan and Engineer Manual 385-1-1 guidance. Coordinated sampling of sediment downstream of active small arms ranges. Reviewed and approved report deliverables.
Project Date: 2013

Operational Range Assessment Program Phase II, U.S. Army Corps of Engineers–Baltimore District; Task Manager—Task Manager for Phase II assessments and for active Army and Army National Guard ranges throughout the Northeast Installation Management Area. Primary responsibilities included preliminary technical approach development, writing and development of Quality Assurance Project Plans, organizing and coordinating and performing associated sampling activities, report writing, mapping, and GIS data acquisition and analysis. Served as lead Quality Assurance Project Plan author and surface water task manager for Camp Smith, New York and assisted in Quality Assurance Project Plan development and sample collection for Fort Drum, New York. ***Project Date: September 2008 – 2012***

Operational Range Assessment Program, Phase II Quantitative Assessments; U.S. Army Corps of Engineers – Baltimore and Omaha Districts; Project Scientist/Task Manager—Project Scientist responsible for Uniform Federal Policy Quality Assurance Project Plan development, coordination and sampling events, as well as data analysis and report writing. Sampling includes utilizing U.S. Environmental Protection Agency Method 1638 "Clean Hands/Dirty Hands" for ultra trace metals analysis in surface water, sediment grab sampling, and groundwater sampling from both existing wells and newly installed monitoring wells. Task Manager Responsibilities include coordination with installation personnel, managing the field sampling staff, and coordinating with the laboratories and data validator.
Project Date: September 2009 – 2012

Operational Range Assessment Program Phase I, U.S. Army Corps of Engineers–Baltimore District; Team Member—Performed Phase I assessments and conceptual site model developments for active Army and Army National Guard ranges throughout the Northeast Installation Management Area. Primary responsibilities included report writing, mapping, and GIS data acquisition and analysis. Served as lead author for several Phase I reports including: Fort Bliss, Texas; Camp Smith, New York; and Fort Richardson, Arkansas; various Maine Army National Guard Sites, Maine; and various West Virginia Army National Guard Sites, West Virginia. Also handled quality control/template management for GIS figures for many additional Operational Range Assessment Program sites.
Project Date: March 2007 – December 2009

Installation-Wide Groundwater Monitoring; Site Manager—Managed field effort and technical support during the completion of installation wide groundwater monitoring in support of the 914th MSG/CEV, Niagara Falls Air Reserve Station, Niagara Falls, New York. The purpose of this effort was to provide operations and maintenance and groundwater sampling support to evaluate the effectiveness of the remedial technologies in support of the installation's Installation Restoration Program efforts.
Project Date: 2010–2011

Fort Drum State Pollution Discharge Elimination System Permitting Support, Fort Drum, New York; U.S. Army Corps of Engineers–Kansas City; GIS Analyst—EA reviewed Fort Drum Stormwater Pollution Prevention Plans for compliance issues and prepared site maps and Notices of Intent for permit coverage under the NYSDEC State Pollution Discharge Elimination System Multi-Sector General Permit for Stormwater Discharges Associated with Industrial Activities GP-0-06-002. Work included revising Stormwater Pollution Prevention Plans per regulatory comments and preparing final documents for permit coverage. EA is currently working on compiling documents and amendments into a comprehensive Stormwater Pollution Prevention Plan.
Project Date: April 2009 – 2014

Non-Department of Defense Non-Operational Defense Sites Inventory, U.S. Army Corps of Engineers–Western Region—Performed preliminary historical research and site visits for locations of former Non-Department of Defense owned firing ranges used by the Army National Guard in North Dakota and Montana.
Project Date: May 2008 – December 2009

Oasis Fuel Point, Fort Drum, New York; U.S. Army Corps of Engineers–Baltimore District—Responsible for using the American Petroleum Institute light non-aqueous phase liquid Distribution and Recovery Model to address petroleum-impacted soils at the P-2069 Oasis Fuel Point, Fort Drum, New York. Conducted a geostatistical analysis of American Petroleum Institute model output to calculate the extent, volume and recoverable volume of product at the site. Also responsible for generation of figures for associated reports.
Project Date: August 2007 – Present

Surfactant Enhanced Aquifer Remediation; U.S. Army Corps of Engineers–Baltimore District, Baltimore, Maryland—Responsible for groundwater monitoring, light non-aqueous phase liquid modeling using the American Petroleum Institute light non-aqueous phase liquid Distribution and Recovery Model. Also responsible for generation of report figures and maps.
Project Date: 2009

Chem Core Site; NYSDEC—Conducted groundwater sampling and monitoring for volatile organic compounds at monitoring wells surrounding the groundwater remediation system. Utilized ArcView/Geographic Information System to establish a contaminant plume and groundwater contours and flow at the site. Conducted monthly operation and maintenance system checks and prepared Quarterly Operation and Maintenance Reports for the site.
Project Date: 2009 – Present

William Benson Landfill; NYSDEC—Field work consisting of groundwater sampling and landfill gas monitoring in support of long term site monitoring. Also supplied GIS support for various other NYSDEC projects.
Project Date: March 2008

Storonske Cooperage; NYSDEC—Fieldwork consisting of groundwater sampling and monitoring in support of long-term site monitoring. Also supplied GIS support for various other NYSDEC projects.
Project Date: July 2009

Valley Falls Dry Cleaners; NYSDEC—Fieldwork consisting of groundwater sampling monitoring in support of long term site monitoring. Also supplied GIS support for various other NYSDEC projects.
Project Date: July 2009

Perfection Plating; NYSDEC—Fieldwork consisting of groundwater sampling monitoring in support of long term site monitoring. Also supplied GIS support for various other NYSDEC projects.
Project Date: July 2009

List of Technical Skills and Specializations

- Chemical immobilization
- Data analysis
- Geographic and statistical modeling
- GIS (IDRISI, and ESRI)
- Global Positioning System/VHS radio-tracking
- Population/habitat modeling
- Spatial analysis
- Surface water, sediment, groundwater, soil sampling
- Wildlife surveys

Grant Reeder
Field Quality Control Manager

This page intentionally left blank

Grant W. Reeder

Geologist

Mr. Reeder is a geologist in EA's Syracuse, New York office. He spent his initial 6 months with EA in proposal development with EA's Corporate Marketing Group. He received his Bachelor of Science degree in Geology in 2016 at St. Lawrence University, and his Master of Science degree in Geology at the University of Vermont in 2018, where he investigated the geochemical behaviors of lead in soils.

Education

M.S./Geology/2018 (University of Vermont)
B.S./Geology *cum laude* with honors/2016 (St. Lawrence University)

Specialized Training

OSHA 40-Hour Hazardous Waste Operations and Emergency Response Training (December 2018)
OSHA 8-Hour Hazardous Waste Operations and Emergency Response Refresher (December 2020)
OSHA 8-Hour Hazardous Waste Operations and Emergency Response Supervisor (December 2019)
USACE Construction Quality Management for Contractors (CQM-C) (February 2020)

Experience

Years with EA: 4 Total Years: 4

Professional Experience

***Geologist*—**Prepares analytical and evaluation reports for co-mingled contaminants in multiple media. Multi-media sampling experience includes groundwater purging and sampling (peristaltic pump, submersible pump, bladder pump, and FLUTe), sediment core processing, surface soil sampling, surface water sampling, and soil vapor intrusion sampling, at federal and New York State Superfund sites. Has also performed oversight and lithologic logging during bedrock drilling operations at a New York State Superfund site, and during overburden drilling operations at a Federal Superfund site. Has conducted sampling for various suites of analyses, including volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), pesticides, metals, per- and polyfluoroalkyl substances (PFAS), as well as sanitary and monitored natural attenuation parameters. Has also conducted non-intrusive site inspections as part of Phase I environmental site assessments (ESAs) for commercial clients.

***Quality Control*—**Served as quality control manager on various federal projects, including serving as the full-time onsite contractor's quality control system manager (CQCSM) at the Puchack Well Field Superfund site in Pennsauken, New Jersey and the Fort Leonard Wood Landfills Multi-Site Remedial Action project at Fort Leonard Wood, Missouri in addition to other smaller-scale sampling projects. Prepares and presents preparatory, initial, and follow-up meetings/inspections. Ensures that work being performed is in accordance with approved specifications. Prepares daily Quality Control Reports.

***Planning Document/Report Writing*—**Served as primary author on various planning documents and report deliverables for federal, state, and commercial clients. Prepared Uniform Federal Policy (UFP)-Quality Assurance Project Plans (QAPPs) for the Puchack Well Field Superfund Site Phase 2 Remedial Action and the West Point Lacrosse Field projects. Served as primary author or supported preparation of planning documents, remedial investigation reports, monitoring reports, evaluation reports, decision documents, and ESAs.

***Schedule Management/Cost Tracking*—**Manages the project schedule and tracks weekly cost accruals for the Puchack Well Field Superfund Site Phase 2 Remedial Action project. Tasks include conducting monthly schedule updates and preparing weekly 3-week look-ahead schedules in Oracle Primavera P6, as well as project cost summary report and earned value curve updates for weekly cost calls with the U.S. Army Corps of Engineers (USACE) and U.S. Environmental Protection Agency (EPA).

Proposals and Marketing Support—Worked as a Marketing Apprentice, preparing proposals and supporting business development activities in the Hunt Valley corporate office. Assisted with the preparation of municipal, state, and federal proposals. Collaborated with project managers and key personnel to identify crucial requirements from the Request for Proposal and to devise proposal win themes. Assisted with document preparation, gathering of corporate resumes and project summaries, and evaluation of existing documents to ensure consistency with win themes and compliance with the Request for Proposal. Also assisted with the development of proposal schedules and outlines. At the end of this apprenticeship in December 2018, transferred to EA's Syracuse, New York office as a

Geologist.

Selected Publications and Presentations

Nagel-Myers, J., I. Mastorakos, P. Yuya, and G. Reeder. 2019. Modelling crushing crab predation on bivalve prey using finite element analysis. *Historical Biology*, published online 04 December 2019, 1-10. DOI: 10.1080/08912963.2019.1699555.

Reeder, G. 2018. Microscale controls on lead speciation in soils: a framework for sustainable remediation: M.S. Thesis Defense, presented to the geology department of the University of Vermont, Burlington, Vermont.

Reeder, G., A. Rossi, K. Czyzyk, L. Williamson, and N. Perdrial. 2018. Bioaccessible Lead in Burlington (Vermont) soils: field and microscale controls. Presented at Northeast Geological Society of America Conference in Burlington, Vermont (oral session).

Perdrial, N., J. Perdrial, J. Armfield, and G. Reeder. 2018. Expanding the concept of the critical zone from terrestrial to planetary systems: what can we learn about weathering on Mars. Presented to Martian Research Team, Johnson Space Center, Houston, Texas.

Reeder, G., J. Nagel-Myers, J. Mastorakos, and P. Yuya. 2016. Crushing predation on bivalve species: finite element analysis of durophagous predator/prey interaction. Presented at Northeast Geologic Society of America conference in Albany, New York (poster session).

EA Project Experience

Fort Leonard Wood Landfills Multi-Site Remedial Action, Fort Leonard Wood, Missouri; USACE–Kansas City District; CQCSM—Onsite CQCSM for the Fort Leonard Wood Landfills project. The project involves clearing and grubbing, onsite burning, access road installation, and installation of additional clay cap material. Helped prepare preconstruction surveys at each landfill. Maintains dig permits and burn permits for each landfill and serves as a primary liaison between EA and USACE. Prepares Daily Quality Control Reports. Conducts preparatory meetings for each definable feature of work and conducts initial and follow-up inspections. Performs submittal review and uploads submittal items to USACE's Resident Management System (RMS). Runs weekly progress meetings with USACE, EA, and subcontractor personnel.
Project Date: 2021 – Present

Phase 2 Remedial Action at the Puchack Well Field Superfund Site, Pennsauken, New Jersey; USACE–Kansas City District; Costing/Schedule Manager/Geologist/CQCSM—EA is implementing the second phase of remedial action at the Puchack Well Field Superfund Site in Pennsauken, New Jersey, which involves injection of sodium lactate to treat hexavalent chromium plumes in three overburden aquifers. EA's scope of work includes installing approximately 100 injection, monitoring, or extraction wells (being performed by a subcontractor), baseline sampling of new and existing wells, injection operations, and performance monitoring. Served as primary author of the UFP-QAPP. Tracks subcontractor performance, such as sonic drilling progress and well installation to the linear foot, and daily investigation-derived waste manifests to accurately provide an updated project cost summary report and earned value curve to the client on a weekly basis. Conducts monthly project schedule updates using Oracle Primavera P6. Participated in the pre-drilling baseline sampling of existing injection, monitoring, and extraction wells in October 2019. Collected samples for laboratory analysis and performed onsite screening for hexavalent chromium and ferrous iron using a HACH kit. Sampling was conducted using EPA low-flow purging and sampling methodology with submersible Grundfos pumps and YSI ProDSS water quality meters in accordance with the UFP-QAPP and Injection Work Plan with periodic oversight by CDM Smith (the design engineer) and USACE–Philadelphia. Temporary well points were installed by the drilling contractor to further delineate middle aquifer contamination near the former source area. Purged and sampled temporary well points using a manual check valve and YSI ProDSS water quality meter in accordance with the UFP-QAPP and the Injection Work Plan. Other tasks have included procurement of rental equipment and assisting with the preparation of New Jersey Department of Environmental Protection well permits.

Onsite CQCSM since September 2020. Conducts preparatory meetings for each definable feature of work and conducts initial and daily follow-up inspections. Ensures that site work, including drilling, well development, groundwater sampling, and sodium lactate injections are being performed in accordance with the project specifications and approved requests for information(RFIs)/Government directives. Prepares RFIs as necessary to solicit information from the client or to propose changes to operating procedures and/or materials. Identifies and tracks deficiencies, as necessary. Reviews field forms daily and prepares daily Quality Control Reports.
Project Date*: *2019–2021

Remedial Investigation/Feasibility Study, Dzus Fasteners Company, Inc. Site Operable Unit (OU) 5, West Islip, New York; New York State Department of Environmental Conservation; Geologist—Participated in a sediment sampling field event in April and May 2019 as part of the OU5 (Willetts Creek tidal area and surrounding floodplain) remedial investigation. Wastes associated with the Dzus Fasteners Company include oils, heavy metals, and salts. Upstream portions of Willetts Creek, including Lake Capri are currently in the remediation phase. This field event was conducted to further delineate cadmium and chromium impacts discovered during a previous sediment investigation at OU 5. EA hired a subcontractor to collect 6-foot long/4-inch diameter vibracores from 90 sampling locations in the tidal creek area, as well as two background locations. Responsible for processing cores supplied by the sampling team, which included opening sediment cores using power shears, characterizing sediment, placing sediment in sample jars, and preparing chain-of-custody documents for the analytical laboratory. Sediment was characterized and sampled based on homogenized sample intervals (0-6, 6-12, 12-24, 24-36, 36-48, 48-60, and 60-72 in., unless otherwise specified due to pronounced stratigraphic boundaries). Sediment characteristics noted during processing included color, grain size, sediment type (clay, silt, sand, gravel), consistency, plasticity, water content, presence of macro-organics, and smell. Assisted with the preparation of the Remedial Investigation Report. ***Project Date*: *2019***

Groundwater Long-Term Monitoring, Horseshoe Road Superfund Site, Sayreville, New Jersey; USACE–Kansas City District; Geologist—EA has been tasked with 4 years of long-term monitoring at the Horseshoe Road Superfund Site in Sayreville, New Jersey, where VOCs, SVOCs, and metals are contaminants of concern. Served as primary author of the UFP-QAPP. Participated in the January 2020 and September 2020 quarterly sampling events. Conducted synoptic gauging and low-flow groundwater sampling of onsite monitoring wells utilizing EPA SCRIBE sample management methodology.
Project Date*: *2019–2021

West Point Installation Restoration Program/RCRA Landfills, West Point, New York; USACE–Baltimore District; Geologist/Quality Control Manager—EA is conducting long-term maintenance, groundwater/leachate/surface water monitoring, and flare system operation and maintenance at various Installation Restoration Program/Resource Conservation and Recovery Act landfills on the U.S. Military Academy (West Point) Installation property. Participated in the August 2019 annual groundwater monitoring event at Cragston Landfill. A round of synoptic water levels was collected upon arrival onsite. Groundwater was collected from monitoring wells using EPA Low Flow methodology with submersible Grundfos pumps and leachate was collected from the leachate collection tank using a peristaltic pump for 6 New York Codes, Rules, and Regulations, New York State Department of Environmental Conservation Part 360 Baseline Parameters. Prepared the CLIN 0036 Construction Completion Report (additional Operation and Maintenance at the Motor Pool). Quality Control Manager for the Spring 2020 long-term maintenance work, which included clearing drainage swales of vegetation and debris and crack-sealing select West Point parking lots. Prepared daily quality control reports.
Project Date*: *2019–2020

Environmental Services at the U.S. Military Academy Preparatory School Underground Storage Tank /Petroleum, Oils, and Lubricant Site, U.S. Army Garrison – West Point, West Point, New York; USACE–

Baltimore District; Geologist—Re-routing of Sinclair Pond Brook during construction of a new lacrosse field between 2010 and 2014 exposed a petroleum seep from the western bank, instigating a series of preliminary investigations, which recommended that a remedial investigation/feasibility study be conducted for the site. EA is conducting the remedial investigation/feasibility study, which includes surface soil, sediment, groundwater, and surface water sampling for VOCs, SVOCs/PAHs, diesel range organics, and PCBs. Served as primary author of the UFP-QAPP and assisted with responses to client comments on the draft Accident Prevention Plan.
Project Date*:** ***2019–2020

Cornell-Dubilier Electronics Superfund Site Groundwater Long-Term Monitoring, Middlesex County, South Plainfield, New Jersey; USACE–Kansas City District; Geologist/Field Lead—This task order involves the implementation of a long-term monitoring program consisting of semi-annual groundwater sampling to address PCB and chlorinated solvent contamination in groundwater and evaluate the potential for natural attenuation and biodegradation. Prepared text regarding the nature and extent and trend analysis of VOCs (trichloroethene and dichloroethene), PCBs, metals, and pesticide concentrations within shallow, intermediate, and deep groundwater intervals for the Year 1 Long-Term Monitoring Report. Prepared Mann Kendall plots for each well to quantify concentration trends (increasing, decreasing, stable, or no trend) for trichloroethene, dichloroethene, and PCBs utilizing long-term monitoring data gathered in, and prior to, 2018. Participated in the June 2019 annual sampling event, which included sampling onsite and offsite FLUTe wells for PCBs, VOCs, metals, and pesticides utilizing EPA SCRIBE methodology. Field lead for the July 2020 annual sampling event. Procured field materials, including rental equipment, investigation-derived waste drums, nitrogen canisters, and third-party bottleware. Coordinated site work with the client and town officials. Responsible for preparing daily field reports.
Project Date: 2019–2020

Dover Municipal Well No. 4 Superfund Site Long-Term Monitoring, Dover, NJ; USACE-Kansas City District; Field Lead/CQCSM—Field lead for the March 2020 groundwater sampling event at the Dover Municipal Well No. 4 Superfund Site. Sampled for VOCs via passive diffusion bags and collected sample volume for monitored natural attenuation parameters via low-flow sampling procedures with peristaltic pumps. Sampling was conducted utilizing EPA SCRIBE sample management methodology. Prepared daily field reports that were sent to the client. Onsite CQCSM for the one-day September 2020 monitoring event, which consisted of passive diffusion bag sampling for VOCs only. Ensured that sampling procedures were in accordance with project specifications, ensured sample labels and packing were in accordance with SCRIBE methodology, and prepared a daily Quality Control Report.
Project Date: 2020

Roxy Cleaners, North Greenbush, New York; New York State Department of Environmental Conservation; Geologist—EA is responsible for performing site management activities on behalf of New York State Department of Environmental Conservation including long-term groundwater monitoring and groundwater remediation. Prepared an analytical report for groundwater monitoring results for 1,4-dioxane and PFAS and prepared a subcontractor solicitation record and certification package for the data validation subcontractor. Conducted oversight of the drilling subcontractor during injection well installation in the bedrock aquifer in March 2019, which included lithologic logging of the boreholes. Solicited bids for biodiffusers for Pilot Study injections into the overburden aquifer, as well as bids for an investigation-derived waste contractor. Prepared the 2019 Quarter 4 Quarterly Report for the treatment system operation and maintenance, including discussion of treatment system performance and concentration trends of VOCs in treatment system extraction wells post-injection.
Project Date*:** ***2019–2020

Military Munitions Response Program Non-Time Critical Removal Action, Firing-in-Buttress (MRS SR002), Hancock Field Air National Guard Base, Syracuse, New York; USACE–Omaha District and Air National

Guard; Geologist—EA conducted a non-time critical removal action to mitigate risk of munitions of explosive concern, contaminated soil, and debris associated with the former Firing-in-Buttress, to human health and the environment. No munitions and explosives of concern were found during the non-time critical removal action, and munitions debris including 20-millimeter target practice projectiles and fragments were removed from soil and the Firing-in-Buttress structure. The Firing-in-Buttress structure was demolished, and soil samples indicated that all onsite soil was unimpacted by munitions constituents (including lead and copper). Prepared a Proposed Plan and Record of Decision with no further action as the selected remedy. Both documents were accepted by the government.
Project Date*: *2019–2020

Phase I ESA, Multiple Locations; Commercial Clients; Investigator/Report Author—Conducted multiple Phase I ESAs for multiple commercial clients. The Phase I process involves a comprehensive, non-intrusive site investigation; review of available federal, state, and local records (including historical maps, aerial photographs, permits, environmental assessments, etc.) provided by government Freedom of Information Law requests or by a data acquisition subcontractor; and interviewing site owners, government officials, and the client regarding their knowledge of historical site operations and/or known or potential contamination sources. The Phase I ESA report includes a discussion of findings, identification of any findings (*via* records, interviews, or onsite observations) that constitute a Recognized Environmental Condition, and EA's recommendations for further action. Conducted the site inspection, records review, and interviews, and compiled the Phase I ESA Report for the following sites:

- **LS Power – Seneca Pump Station, Warren, Pennsylvania; LS Power Equity Advisors, LLC; Investigator**—Conducted the site inspection for a Phase I ESA at the Seneca Pump Station in Warren, PA. The Seneca Pump Station is a hydroelectric generating facility on the Alleghany Reservoir. Conducted interviews with station personnel, and performed a comprehensive inspection of the property, noting potential environmental conditions onsite.
  Project Date*: *2020

- **American Management Association, 600 Ama Way, Saranac Lake, New York; American Management Association International; Investigator/Report Author**—Conducted the site inspection at the American Management Association property in Saranac Lake, New York, which contains multiple buildings constructed beginning in the late 19th century, on approximately 65 acres of land. Reviewed local records and interviewed local government officials at the town offices of the Village of Saranac Lake and the Town of St. Armand. Compiled the Phase I ESA Report.
  Project Date*: *2019

- **Paulus – Smith Supply, Syracuse, New York; Paulus Development Company, LLC; Investigator/Report Author—**Conducted the site inspection at the Smith Restaurant Supply building in Syracuse, New York as part of a potential real estate transaction. The six-story building onsite was constructed in the mid-19th century and was historically used primarily for manufacturing and storage. At the time the Phase I ESA was conducted, the building hosted a restaurant supply retail store on the first two floors, with assorted storage on the floors above. Compiled the Phase I ESA Report. Based on the findings of the Phase I ESA Report, EA scoped and performed a Phase II ESA, which included multi-media sampling for potential contaminants.
  Project Date*: *2019

- **Paulus – EJ Victory Building, Johnson City, New York; Paulus Development Company, LLC; Investigator/Report Author**—Conducted the site inspection at the EJ Victory building, a former shoe factory constructed in the early 20th century. The property consisted of a large-footprint, six-story building

with two parking areas. Conducted the site inspection with another EA employee, and compiled the Phase I ESA Report. Based on the findings of the Phase I ESA, EA was tasked with scoping and performing a Phase II ESA, which included multi-media sampling for potential contaminants.
Project Date*: *2019

Remedial Investigation/Feasibility Study, Gibson Scrapyard, Corning, New York; New York State Department of Environmental Conservation; Geologist—Participated in the December 2019 remedial investigation sampling event at the Gibson Scrapyard site in Corning, New York. Conducted surface water and surface soil sampling for VOCs, SVOCs, pesticides, herbicides, explosives, 1,4-dioxane, PCBs, metals (including mercury), cyanide, and PFAS. Since PFAS was an included parameter, stringent protocol was followed to avoid possible sample contamination (forgo showering and use of any cosmetic products on the day of sampling; wearing PFAS-free clothing, such as 100% cotton without waterproofing and polyvinyl chloride waders for surface water sampling; and copious hand washing and nitrile glove changing). Collected surface water samples from three locations in Narrows Creek starting at the furthest downstream location to minimize the risk of incidental inclusion of disturbed sediment in the samples. With the exception of the PFAS sample, samples were collected with a 1-liter graduated cylinder and transferred into their respective laboratory bottleware. The PFAS sample was collected first at each applicable sampling location by opening, filling, and closing the sample bottle underwater. Soil samples were collected from 0 to 6 inches below grade using a hand auger. Soil characteristics were documented prior to transferring soil into sample jars.
Project Date*: *2019

Perfection Plating, Watervliet, New York; New York State Department of Environmental Conservation; Geologist—EA conducts site management and quarterly monitoring and reporting at the Perfection Plating site in Watervliet, New York. Monitoring activities include monthly treatment system inspection and sampling by a subcontractor and quarterly groundwater sampling of onsite and offsite monitoring wells for total and hexavalent chromium. Prepared the 2019 Quarter 4 Quarterly Report, including discussion of treatment system performance and hexavalent chromium concentration trends.
Project Date*: *2019–2020

National Heatset Printing Site, East Farmingdale, New York; New York State Department of Environmental Conservation; Geologist—The National Heatset Printing Company operations consisted of lithographic tri-color printing of newspaper and periodical advertisements and the manufacture of lithographic printing plates. National Heatset had been using organic solvents at the site since 1983. National Heatset disposed of its chemical inventory by dumping the materials onto the soils and into a leaching pool located off the rear of the building on the northeast side of the property. The site is listed as a New York State Superfund site and currently has two onsite in-well stripping systems plus one offsite system operating. Participated in the February 2019 quarterly groundwater sampling event. Sampled monitoring wells onsite and offsite using EPA Low Flow methodology for volatile organic compound analysis. All wells were purged through a Horiba water quality meter to ensure pH, conductivity, turbidity, and dissolved oxygen parameters were stable prior to sampling. Assisted with completion of the chain-of-custody form as samples were collected, quality control of sample labels and purge logs, and packaging and shipping samples for laboratory analysis.
Project Date*: *2019

Long-Term Monitoring at Site SS005, Air Force Plan 59, Johnson City, New York; Air Force Civil Engineer Center; Geologist—Air Force Plant 59 is listed on the New York State Department of Environmental Conservation List of Inactive Hazardous Waste Sites and is located within a residential and commercial area. EA conducts annual groundwater monitoring of onsite and offsite monitoring wells for VOCs. Participated in the June 2019 annual sampling event, utilizing EPA Low Flow purging and sampling methodology with submersible Grundfos pumps and

Horiba U-52 water quality meters. Field lead for the June 2020 annual monitoring event. Scheduled the sampling event with the analytical laboratory and the water treatment plant. Procured rental equipment and field supplies. Responsible for preparing daily field reports.
Project Date*: *2019–2020

Admiral Cleaners, Watervliet, New York; New York State Department of Environmental Conservation; Geologist—This task order included the performance of soil vapor intrusion evaluations, remedial investigation, and feasibility study to delineate soil, soil vapor, and groundwater contamination from a former dry cleaners located in an urban area surrounded by commercial and residential properties. Participated in the Phase II soil vapor intrusion investigation in January 2019. Interacted with New York State Department of Environmental Conservation representative and property owners onsite during the field event. Collected 8 indoor air samples (5 basement/crawl space, 3 first floor), and 2 outdoor air samples (one upwind and one downwind of the dry cleaners building). Prepared subslab samples at two residences, both of which were abandoned: groundwater was at approximately the same level as the slab at one location and bubbled up upon drilling through the slab; EA was unable to pump air out of the subslab boring at the second location (very shallow depth to bedrock, exposed outcrop present in one corner of the basement). Completed sampling forms, assisted with chain-of-custody form preparation, and assisted with quality control of chain-of-custody forms and summa canister/flow regulator sample information tags prior to sending samples to the laboratory.
Project Date: 2019

Environmental Remediation Services, Picatinny Arsenal Remedial Action-Operation Long-Term Monitoring; Picatinny Arsenal, New Jersey; U.S. Army Environmental Command; Geologist—Geologist for Task Order under the Environmental Remediation Multiple Award contract for the performance of remedial action-operation and long-term management activities at 84 sites at Picatinny Arsenal, New Jersey. Task Order consists of performing multi-media sampling (surface water, groundwater, sediment, and biological) as part of site monitoring programs, land use and land use control inspections, remedial injections to address impacted groundwater, well abandonment, wetland assessments, subcontractor oversight, and report writing. Prepared an Evaluation Report for a TNT and RDX sampling event at Group 1 sites. Duties include updating existing geographic information system figures to display results of surface water, sediment, pore water, and soil sampling; developing data trend analyses to determine multi-media contamination pathways; and evaluating groundwater attenuation using first order decay assessment monitoring data and pore flushing models. Results of this report will be used to evaluate performance of the current remedy (monitored natural attenuation) and determine if additional remedial actions are necessary.
Project Date: 2019

Metal Etching Co., Inc., Freeport, New York; New York State Department of Environmental Conservation; Geologist—EA conducted post-closure site management and periodic monitoring and reporting at the Metal Etching Co., Inc site in Freeport, New York. Monitoring activities included annual sampling of onsite groundwater for VOCs, metals/mercury, PFAS, and monitored natural attenuation parameters, as well as indoor/outdoor air sampling of VOCs to assess the effectiveness of the operational sub-slab depressurization system in the site office building. Performed the annual indoor/outdoor air sampling in March 2019. Samples were collected using Summa canisters regulated for 24-hour sample collection.
Project Date: 2019

Other Project Experience

Microscale Controls on Lead Speciation In Soils: A Framework for Sustainable Remediation, Burlington, Vermont; University of Vermont, Geology Department; Graduate Researcher; 2016–2018—Master of Science thesis research project involving lead behavior in Burlington, Vermont soils. Burlington soil lead contamination is primarily sourced from weathering paint on the multitude of early 1900s buildings within city limits. The potential of a soil to immobilize heavy metal ions is dependent on the presence of adsorption sites, and the stability of metal species over the range of geochemical conditions present in the soil over time. Lead is a cumulative toxin that is enriched in much of the urban pedosphere due to historical use of lead-based paint and lead-amended gasoline. Because in situ remediation of lead is possible if the bioavailable fraction can be rendered inert, understanding lead-sorbent interactions is necessary to accurately and efficiently alter lead speciation in soils. The objectives of this study were to: (1) determine efficient ways to predict lead behavior at the field scale, and (2) characterize microscale controls on lead speciation. A combination of geospatial and analytical tools was used across a variety of spatial scales to provide the first multiscale analysis of microenvironment impact on lead speciation in soils. This research investigated lead distribution at the field scale (in Burlington, Vermont), and mobility at the microscale. The field-scale study has shown that the relationship between total lead and bioaccessible lead is not linear, in stark contrast to the existing conceptual model of this relationship. It was determined that the disproportional influence of fine-fraction lead in low total-lead soils results in elevated bioavailability. Microscale investigations determined that there is a positive correlation between the density of reactive microenvironments and the release of lead from contaminated soil, and that altered distributions of microenvironments significantly alters the rate of lead release. This research identifies specific mechanisms controlling lead behavior in soils at both the field and the microscale, which can be used to inform improvements to implementation of remediation. Defended thesis in August 2018.

Expanding the Concept of the Critical Zone from Terrestrial to Planetary Systems: What Can We Learn about Weathering on Mars; Burlington, Vermont; University of Vermont, Geology Department and the National Aeronautics and Space Administration; Research Assistant 2017–2018—Participated in all phases of experimental design (development, execution, solution analysis) and data interpretation for National Aeronautics and Space Administration-funded research to simulate weathering of Martian regolith in the event of human colonization of Mars. Experimental design involved dry-packing ~1.5 grams of Martian-analogue regolith (JSC-Mars-1A) into 0.9 centimeters × 2.1 centimeters (pack length) polypropylene copolymer columns, which were subsequently leached with a pH 2 HCl/H_2SO_4 influent solution prepared to mirror the composition of Martian atmosphere. Leaching experiments were performed in constant flow scenarios (144 hours, effluent collected in 2-hour intervals) as well as with freeze/thaw cycles under both terrestrial and induced Martian atmosphere (carbon dioxide bubbler placed in sealed influent solution). Effluent solution was analyzed for pH over the evolution of the leaching process and for Ca, Na, Mg, Fe, Al, Mn, K, and Si using ICP-OES. Results indicated that freeze/thaw cycles increase cation weathering rates, and that the introduction of carbon dioxide into the system accelerates the initial phase of weathering but has negligible effect on total leaching relative to terrestrial atmosphere. Presented findings at Johnson Space Center, Houston, Texas in March 2018.

Tim Reese, PE
Project Manager

This page intentionally left blank

Timothy A. Reese, P.E.

Senior Project Manager/Civil Engineer

Mr. Reese is a registered Professional Engineer with 32 years of experience in performing and managing complex environmental, construction and munitions and explosives of concern (MEC) projects. His experience includes environmental removal actions, radiological contaminated soil removal, MEC investigations and removals, landfill design, quality control engineering, and building construction/renovation. He is experienced in program and project management, bid preparation, development of technical and operational approaches, field supervisory activities, and coordination of subcontractors and liaison with local/state/federal agencies. Mr. Reese completed many large-scale projects for the U.S. Army Corps of Engineers (USACE), Naval Facilities Engineering Command, U.S. Environmental Protection Agency (EPA), Air Force Civil Engineer Center (AFCEC), as well as utilities and commercial and manufacturing clients.

Education
B.S./Civil Engineering/1989 (Syracuse University)

Registrations/Certifications
Professional Engineer—NJ (2008, No. 39951)

Specialized Training
OSHA 40-Hour Hazardous Waste Operations and Emergency Response Training; 1989
OSHA 8-Hour Hazardous Waste Operations and Emergency Response Refresher – Annually; 2022
OSHA 8-Hour Hazardous Waste Operations Supervisor Training; 1990
Construction Quality Management for Contractors, USACE; 2016
Material Potentially Presenting an Explosives Hazard (MPPEH) Training by NAVSEA, 2018
Geosynthetic Research Institute – Designing with Geosynthetics for Landfill Design, Drexel University
Hazardous Waste/Material Operations Training Course
U.S. Department of Transportation Regulation Training
IATA Training in the Shipment of Dangerous Goods
Visual Sample Plan Training
Bloodborne Pathogens Awareness Refresher Course; 2022
CPR and First Aid Training; Biannually; 2022

Professional Affiliations/Appointments
American Society of Civil Engineers
National Association of Ordnance and Explosive Waste Contractors
Society of American Military Engineers: Peninsula-VA, Baltimore and Chesapeake Post

Experience

Years with EA: 18	Total Years: 32

Professional Experience

***Munitions Response/Construction Support*—**Project Manager to provide construction support at the Engineering Proving Ground – Fort Belvoir, Virginia for the Fairfax County Parkway Connector Road project. This project entailed MEC construction support plan development and approval, MEC awareness training for construction personnel, geotechnical soil boring magnetometer surveys, and MEC disposal pit removal as well as certified industrial hygienist support. Project is 100 percent complete.

***Munitions Response/Remedial Investigation (RI)*—**
Project Manager for a $1.6 million site-wide munitions response RI of Fort Monroe, Virginia. This project entailed work plan development, geophysical prove-out, geophysical sampling, intrusive investigation, RI/feasibility study (FS) report preparation, and preparation of a Proposed Plan and Decision Document that reflect the U.S. Army's preferred alternative of no further action with Land Use Controls for addressing explosive hazards posed by MEC/material potentially presenting an explosive hazard at the site. Decision Document has been accepted by the Army as well as the Commonwealth of Virginia. Project is 100 percent complete.

***Site Investigation*—**Participated in the sampling and preparation of an Impoundment Characterization Report for a facility with 16 onsite lagoons encompassing 135 acres. Participated in an air monitoring program, utilizing open path spectroscopy, at the No.1 Superfund site in the nation. Involved in a drum investigation/inventory at a 2.2-acre Superfund site in New Jersey. Completed numerous groundwater sampling events.

Site Inspections—Conducted site inspections at 52 Formerly Used Defense Sites (FUDS) in the Northeast. Responsible for this $3.6 million project, which includes development of the site-specific conceptual site models for each munitions response site at each FUDS. The individual projects include historical records review, technical project planning meetings, work plan development and field execution, as well as preparing a site inspection report. Coordination of numerous stakeholders is required for the project execution and gaining concurrence on the recommendations for further study. In addition to preparing all six proposals under this ongoing task order, also assisted in the proposal development for their Continental/Outside Continental United States Huntsville contract award win in 2004/2005. Project is 100 percent complete.

Recurring Reviews—Project Manager for conducting recurring reviews/5-year reviews at six Military Munitions Response Program (MMRP) FUDS in Florida and the U.S. Virgin Islands. This USACE–Jacksonville District project is being completed by USACE–Huntsville. The project entails records review, technical project planning, work plan development, site reconnaissance, and reporting. Also attended site visits to ensure quality of project. Project is 100 percent complete.

Design/Construction**—**Modified and finalized landfill construction designs in support of a four-phase Resource Conservation and Recovery Act (RCRA)-permitted hazardous waste lagoon closure program. Material and performance specifications emphasized quality assurance/quality control for all geosynthetics materials. Inspected the initial construction of all systems at a RCRA hazardous waste landfill. Completed a design, specification, and bid package for a $400,000 high density polyethylene floating cover project for a 3-acre lagoon. Quality Assurance/Quality Control Engineer for a hazardous sludge dewatering facility. Responsibilities include testing and compiling data, evaluating submittals, performing onsite inspections, and daily coordination with the remedial contractor.

Environmental Documentation**—**Assisted in the preparation of RCRA Part B permit application for a hazardous waste landfill. Completed numerous building permits including one for a $23 million waste tar fuel blending facility. Evaluated new stormwater regulations and their impact upon several industrial companies.

Design Documentation**—**Assisted in the preparation of a soil RI/FS for, at one time, the largest organic chemical manufacturing facility in the United States. Compiled a Health and Safety Plan for a 600-acre top 200 Superfund facility. Developed final cap contours for an increased volume of 450,000 cubic yards during a landfill modification.

Selected Publications and Presentations

Presentation: Partnering with Stakeholders to Ensure a Successful Munitions Investigation at Fort Monroe, Virginia. 2010. The 2010 Department of Defense Explosives Safety Board Seminar. August.

Presentation: Partnering with Stakeholders to Ensure a Successful Munitions Investigation at Fort Monroe, Virginia. 2010. The 2010 Environment, Energy Security & Sustainability Symposium and Exhibition. June.

Presentation: Coastal Batteries FUDS Site Inspections. 2007. The 2007 Unexploded Ordnance (UXO) Countermine Forum. August.

Presentation: Radioactive Soil Removal – Project Management Issues. 1998. 21st Annual Soil Remediation Conference, University of Massachusetts. March.

Selected Professional Recognition

Official Commendation, Department of the Army. 2003. In recognition of outstanding support during planning and implementation of the USACE Lauderick Creek Chemical Warfare Materials Unexploded Ordnance Removal Project. July.

Certificate of Appreciation, Department of the Army. 1998. In recognition of outstanding support during planning and construction of U.S. Army's TEU Battalion Headquarters. August.

EA Project Experience

Tyndall Air Force Base (AFB), Florida, MMRP Optimized Remediation Contract; USACE–Omaha District and AFCEC, Tyndall FB; Project Manager—This project is a performance-based contract (PBC) with Basewide and site-specific performance objectives that are incorporated as contractual requirements. The scope includes remediation activities for five MMRP sites. The MMRP Optimized Remediation Contract will endeavor to substantially reduced long-term environmental liabilities and costs through optimized approaches to managing risk, reducing life cycle costs and/or reducing remedial timeframes, while improving understanding of conceptual site models and progressing sites towards response complete or site closeout. The activities include completing investigations; evaluating and determining remedies; and optimization, where practical, of remedial systems/remedial actions while complying with applicable federal, state, and local laws and regulations; and other applicable Base-specific requirements.

Project Manager for the entire $5.9 million contract. Responsible for entire project and has the authority to make decisions necessary to meet task performance objectives and milestones. The Project Manager supports the Program manager in overseeing project planning and reporting requirements, directing, and managing project resources, monitoring schedule and performance, conducting routine project status reviews, reporting project status, and maintaining project documentation. Responsible for the day-to-day management of activities at a specific site and manage all aspects of the work being performed on the sites, coordinate with the counterpart at Tyndall AFB, and report directly to the Program Manager.
Project Date: June 2021 – Present

MMRP and Hazardous, Toxic, and Radioactive Waste (HTRW) RI/FS through Decision Document, Iona Island Ammunition Depot FUDS, Stony Point, New York; USACE–Baltimore and New England Districts, Project Manager/Senior Technical Reviewer—This project involves performance of a MMRP and Installation Restoration Program (IRP) RI/FS for two active FUDS projects (MMRP and HTRW) at the Iona Island Ammunition Depot FUDS to determine whether further response action pursuant to Comprehensive Environment Response, Compensation, and Liability Act (CERCLA) and the National Contingency Plan is warranted. An MMRP RI/FS is being conducted to define the nature and extent of munitions of explosive concern and munitions constituents and to assess the potential hazards posed to human health and the environment by munitions and explosives of concern and/or munitions constituents (if present). The MMRP RI includes land-based digital geophysical mapping and advanced geophysical classification over open terrain, woodlands, and marshes and underwater dive teams at former loading docks to characterize the quantities, types and depths of munitions. An IRP RI/FS is being conducted for the HTRW project to define the nature and extent of hazardous substances in environmental media attributable to past Department of Defense activities at 19 areas of concern (including polycyclic aromatic hydrocarbons, metals, explosives, volatile organic compounds, and PCBs) and an additional 7 former building locations with potential explosives contamination that have not been previously investigated identified, and to evaluate risk to human health and ecological receptors. The IRP RI includes incremental sampling of onsite and background surface and subsurface soil, discrete sediment sampling along the Iona Island shoreline, and a completion of a shoreline reconnaissance survey to conduct a receptor and resource inventory of the shoreline and evaluate potential contaminant transport pathways to the shoreline.

Project Manager for environmental services for MMRP and IRP at the Iona Island Naval Ammunition Depot FUDS. Currently serving as Senior Technical Reviewer both MMRP and HTRW Project RI. Responsibilities include coordinating with the client and Project Delivery Team; attending project meetings and weekly project calls; preparing monthly project status reports; developing technical project planning presentations for USACE and regulators; assisting in development of HTRW Phase I and Phase II field investigation design; assisting in development of planning documents including Project Management Plan, Accident Prevention Plan, IRP and MMRP Quality Assurance Project Plans, HTRW Phase II Quality Assurance Project Plan Addendum, and community relations fact sheets; monitoring project schedules; coordinating with analytical laboratory; conducting and overseeing field activities including incremental sampling of surface and subsurface soil; data analysis; preparation of report figures and tables; overseeing development of technical reports and memorandums including data usability assessment, human health and ecological risk assessments, and RI report. Fieldwork for MMRP is completed as of July 2020. Phase II of HTRW fieldwork to occur in Spring/Summer 2021.

Site 61A Gambo Creek Ash Dump VDA1, Naval Support Facility Dahlgren, Dahlgren, Virginia (Contract No. N6247018O7014)—Senior technical reviewer assigned to assist in the Non-Time Critical Removal Action at Naval Support Facility Dahlgren's Site 61A. Work involves completing planning documents (Work Plan, Explosives Safety Submission, and Virginia Erosion Control and Sediment Plan), and field activities to remove shallow soils adjacent to Gambo Creek contaminated with hazardous, toxic, and radioactive waste constituents and MEC in accordance with a Virginia Department of Environmental Quality-approved Action Memorandum under CERCLA. Coordination with Naval Support Facility Dahlgren Explosive Safety Office to for planning and execution of MEC-related disposition and handling.
Project Date: September 2019 – Present

Waikoloa Maneuver Area Project 10-Sector 17D-Hapuna State Recreation Area Remedial Design, Hawai'i County, Island of Hawaii (Contract No. W912DY20D0073 Task Order W912DY 21F0377)—Senior technical reviewer assigned to assist a CERCLA remedial design at the WMA Sector 17D munitions response site under contract to USACE–Huntsville Center. This former U.S. Army maneuver area was utilized for amphibious craft operations and weapons training during and after World War II. EA is responsible for completing a historical data review and data gap analysis of previous work at the site to determine the need for further investigation and removal action at the site. A series of transects and grids will be utilized with advanced geophysical classification to identify high density areas at the site and determine the nature and extent of MEC and munitions constituents present at the site in previously-investigation parcels and determine the presence/absence of MEC in previously uninvestigated parcels. Right-of-entry permission is required to conduct the work and all right-of-entries are being coordinated through USACE–Honolulu District. Systematic project planning is being utilized to plan the work and engage project stakeholders both internally and externally. A remedial design report presenting results/findings and recommendations for future investigation/removal action, if necessary, will be completed.
Project Date: August 2021 – Present
Completion Date: 30 August 2026

MMRP RI/FS/Proposed Plan/Decision Document for Former Projects 1 and 19, FUDS, Waimea, Big Island, Hawaii; USACE–Huntsville and Hawaii District, Project Manager—This project involves performance of an MMRP RI/FS for Project 01 Areas A & G located at the Former Waikoloa Maneuver Area FUDS to determine whether further response actions pursuant to Comprehensive Environment Response, Compensation, and Liability Act (CERCLA) and the National Contingency Plan is warranted. The scope of this Contract is to finalize the RI Report and prepare an FS, if required; a Proposed Plan; and Decision Document in compliance with CERCLA, as amended, in accordance with current DoD, Army, and USACE Regulations and Guidance and all applicable Data Item Descriptions. The MMRP RI/FS is being conducted to define the nature and extent of munitions of explosive concern and munitions constituents and to assess the potential hazards posed to human health and the environment by munitions and explosives of concern and/or munitions constituents (if present). The results of the RI/FS will be used to develop the Proposed Plan and Decision Document. The Project includes Systematic Planning Meetings, Community Relations support, as well as development of Community Relations Plans, Archaeological Monitoring Plans, Ecological Resource Plans. Senior technical reviewer assigned to assist at the Project 1 and Project 19 Waikoloa Maneuver Area FUDS.
Project Date: August 2021 – Present

G-5 Range, Digital Geophysical Mapping/RI, Camp Lejeune, North Carolina for TIKIGAQ Construction; Project Manager—Project consisted of two phases: Phase One consisted of digital geophysical mapping of 25 acres of an active range area; and Phase Two consisted of the RI of 66 selected targets, supervising a 4-person UXO team, demo operations, inspection of material potentially presenting an explosive hazard items, and completing EA

chain-of-custody and DD1348-1A.
Project Date: August–December 2018

MEC Construction Safety Support for River Road Disposal Area, Harvey Point Defense Testing Activity, Hertford, North Carolina for TIKIGAQ Construction; Project Manager—Project Manager for Construction Support during removal of landfill debris and the soils that contained munition components. Managed a 4-person UXO team and conducted direct liaison as subcontractor to TIKIGAQ sifting of Construction. MK 15 MOD 4 practice bombs and other material potentially presenting an explosive hazard a/c related pyrotechnics were removed. Completed EA chain-of-custody and DD 1348-1A, shipped 4,280 pounds of material designated as safe to off-base recycler for final disposition.
Project Date: April–May 2018

Air Force Operational Range Assessment Program (ORAP) FY18 Air National Guard; Stell, Exton, Pennsylvania; Senior Technical Reviewer—Responsible for senior technical review of EA project team; supports Prime Contractor (Stell) with quality control and review of project plans and reports for operational range assessments on Air National Guard bases located in the Continental United States to involve site visits, field sampling activities, and conceptual site model development/refinement and reporting.
Project Date: 2018–2020

Whiteman AFB Munitions Constituents Migration Mitigation Study and Air Force ORAP Operational Range Assessments (ORAs); USACE–Sacramento; Project Manager; Contract No: W912DR15D0014 W9123819F0058—Project Manager for a munitions constituents migration study based on a previous assessment, which detected lead in soil at the combat arms complex at Whiteman AFB. Project also includes an ORAP Phase II assessment of three ranges onsite. EA has held monthly status calls with Whiteman AFB, AFCEC, and USACE-Sacramento District, since the beginning of the project. EA has prepared a Read Ahead Package and included a Preliminary Technical Approaches for all Phase II sites. EA has submitted the final Work Plan. The Work Plan included a Sampling and Analysis Plan, Quality Assurance Project Plan Worksheet #2, and Accident Prevention Plan. The Phase II sampling as well as the initial soil delineation of the Combat Arms Complex has been completed. The soil mitigation action was completed in the summer of 2021 with both hazardous and non-hazardous soil being excavated and disposed of off-site. The Phase II, Phase III, and Phase IV Reports have been submitted and accepted by the government and final data deliverables been provided.
Project Date: August 2019 – February 2022

Nevada Test and Training Range Munitions Constituents Migration Mitigation Study; USACE–Sacramento; Project Manager; Contract No: W9128F-13-D-0006-CM02—Project Manager for a munitions constituents migration study based on a previous assessment, which detected explosive compounds in soil (ephemeral washes) downstream of target areas (munitions constituents source areas) in close proximity to the Nevada Test and Training Range South Range boundary. In addition, metals and perchlorate were detected in groundwater collected from existing production wells. Soil and groundwater detections were below project screening levels; however, one groundwater sample, collected from a well, exceeded the EPA screening value for the explosive 2,6-dinitrotoluene. EA was tasked with the investigation of the source of the explosive in the drinking water production well, including the assessment of munitions constituents sources on abutting and adjacent ranges, along with an inventory of current and historical ranges, Nevada Test and Training Range boundary confirmation information, the revised Nevada Test and Training Range conceptual site model, and risk assessments (human health and ecological risk, as needed). The investigation is currently underway with the installation of three monitoring wells, completing eight quarters of groundwater sampling, performing perchlorate speciation, conducting a background soil study, and collection of soil samples for explosives and depleted uranium. Final report has been submitted and acted by USACE, AFCEC, and installation.

Project Date: August 2017 – 2020

FY21 Air Force ORAP ORAs at Various Continental Locations in the Southwest and Midwest; AFCEC at Joint Base San Antonio Lackland, Texas for USACE–Sacramento District, California; Project Manager; Contract No: W9128F18D0026-W9123821F0103 —Responsible for project management, technical review of project deliverables, and oversight of EA project team (geologists/data processers/geographic information systems, subcontractors, and UXO technicians) and management of key subcontractor (Weston) with quality control and review of project plans, site visits/fieldwork, and reports for ORAs on Air Force and Air National Guard bases located in the Continental United States involving site visits/teleconference, field sampling activities, and conceptual site model development/refinement and reporting.
Project Date: September 2020 – Present

FY20 Air Force ORAP ORAs at Various Continental Locations in the southeast; Weston Solutions, Inc., West Chester, Pennsylvania; Project Manager—Responsible for project management, technical review of project deliverables, and oversight of EA project team (geologists/data processers/geographic information systems, subcontractors, and UXO technicians); supports prime contractor (Weston) with quality control and review of project plans, site visits/fieldwork, and reports for ORAs on Air Force and Air National Guard bases located in the Continental United States involving site visits/teleconference, field sampling activities, and conceptual site model development/refinement and reporting.
Project Date: 2020 – Present

Air Force ORAP (Continental United States FY13, West Region FY14, Mid-West Region FY14, and Continental and Outside Continental United States FY16, FY17, FY18, and FY19); USACE–Sacramento District, California; Project Manager—Responsible for project management, review and oversight of subcontractors, technical review of project deliverables, and input on technical approaches as EA Project Manager on FY13, FY14, FY16, FY17, FY18, and FY19 contracts performing a total of 73 ORAs. Also served as senior technical reviewer for several ORAs performed on Air Force and Air National Guard bases located in the Continental United States and outside the Continental United States that have involved site visits, field sampling activities, and conceptual site model development/refinement and reporting.
Project Date: 2014 – February 2022

FY18 Air Force ORAP ORAs at Various Continental and Overseas Locations; AFCEC at Joint Base San Antonio Lackland, Texas for USACE–Sacramento District, California; Project Manager; Contract No: W9128F-13-D-0006-CM02—Project entails completing Phase I and Phase II Assessments at 8 Continental U.S. Air Force Installations in California, Nevada, and Arizona. EA has held monthly status calls with AFCEC and USACE-Sacramento District, since the beginning of the project. EA has prepared a Read Ahead Package for each of the installations and included a Preliminary Technical Approaches for all Phase II sites. EA has submitted the final Work Plan for review. The Work Plan included a Sampling and Analysis Plan, Quality Assurance Project Plan Worksheet #2, and Accident Prevention Plan. EA has submitted the Work Plan, conducted all site visits, submitted all trip reports and submitted final reports for 7 of the 8 installations. All fieldwork have been completed without any safety incidents, and Reports have been developed and submitted to the government.

FY17 Air Force ORAP ORAs at Various Continental and Overseas Locations; AFCEC at Joint Base San Antonio Lackland, Texas for USACE–Sacramento District, California; Senior Technical Reviewer / Deputy Project Manager; Contract No: W9128F-13-D-0006-CM02—Project entails completing Phase I and Phase II

Assessments at 11 Continental U.S. Air Force Installations, 2 Outside Continental United States Air Force Installations, and 5 Air National Guard Installations. EA has held monthly status calls with AFCEC, Air National Guard, and USACE-Sacramento District, since the beginning of the project. EA has prepared a Read Ahead Package for each of the installations and included a Preliminary Technical Approaches for all Phase II sites. The Work Plan included a Sampling and Analysis Plan, Quality Assurance Project Plan Worksheet #2, and Accident Prevention Plan. EA has submitted the Work Plan, conducted all site visits, submitted trip reports and reports for all 18 installations.
Project Date: July 2017 – July 2019

FY16 Air Force ORAP ORAs at Various Continental and Overseas Locations; AFCEC at Joint Base San Antonio Lackland for USACE–Sacramento District, California, Texas; Project Manager; Contract No: W9128F-13-D-0006-CM02—Project entails completing Phase I, 5-year Phase I, 5-year Phase I/Initial Phase II, 5-year Phase I/ Phase II, and Phase II Assessments at 11 Continental U.S. Air Force Installations, 4 Outside Continental United States Air Force Installations, and 5 Air National Guard Installations. EA has held monthly status calls with AFCEC, Air National Guard, and USACE–Sacramento District, since the beginning of the project. EA has prepared a Read Ahead Package for each of the installations and included a Preliminary Technical Approaches for all Phase II sites. EA has submitted the Work Plan, conducted all site visits, and submitted all trip reports and reports for all 20 installations.
Project Date: September 2016 – May 2018

Fort Polk Remedial Action/Surface Clearance; USACE–Fort Worth District; Project Manager—Prepared Developed a Uniform Federal Policy–Quality Assurance Project Plan Work Plan to conduct surface clearance at two munitions response sites at Fort Polk where MEC were identified. Surface clearance has been completed at both munitions response sites and Site-Specific Final Reports and After Action Report have been submitted. Further Action Reports have been submitted and accepted by Louisiana Department of Environmental Quality.
Project Date: December 2016 – December 2020

Federal Highway Administration Eastern Federal Lands Division (under contract to Cherry Hill Construction, Inc.); Naval Station Norfolk – Norfolk, Virginia, Munitions Response/Construction Support for the Interstate-564 (I-564) Intermodal Connector; Project Manager—EA, under contract to Cherry Hill Construction, Inc., provided support at the Interstate-564 (I-564) Intermodal Connector road construction project. EA developed a work plan for the Gate 6 Utility Relocation Project at Naval Station Norfolk for the management of petroleum-contaminated soil and water that may be encountered. The Gate 6 Utility Relocation Project is complete, with EA disposing of approximately 8,000 gallons oily water and 248 tons of oil contaminated soil. Project also included various media sampling, MEC Construction Support, and MEC Awareness Training for construction personnel.
Project Date: February 2016 – March 2018

Geophysical Investigation for U.S. Coast Guard through General Services Administration at U.S. Coast Guard Property Victory Village Housing, Concord, California; Project Manager—EA, under contract to General Services Administration, performed a geophysical and intrusive investigation at the 27.5-acre U.S. Coast Guard Victory Village Housing Unit, Concord, California due to historical finds of MEC. As Project Manager oversaw the development of a Work Plan for the collection of digital geophysical mapping data and intrusive investigation of potential anomalies that may be MEC, conducted the digital geophysical mapping and intrusive investigation, and provided a final report. EA has completed all tasks and the project has been accepted by the General Services Administration and U.S. Coast Guard.
Project Date: December 2016 – November 2017

Yuma Environmental Remediation Services; U.S. Army Environmental Command; Senior Technical Reviewer—Provided senior technical review of planning (work plan and Explosives Safety Submission) and reporting documents for this interim removal action for the former mortar impact area contaminated with UXO.
Project Date: August 2015 – Present

Volk Field MMRP Interim Removal Action; Omaha, Nebraska; USACE–Omaha District; Deputy Project Manager—Serving as Deputy Project Manager for multiple munitions response sites at Volk Field Combat Readiness Training Center. Project includes Engineering Evaluation/Cost Analysis; Action Memorandum; Interim Removal Action; After Action Report; Proposed Plan; and Decision Document. Interim Removal Action activities include surface and subsurface clearance of MEC and munitions debris and removal of lead-contaminated soil.
Project Date: September 2013 – 2017

Volk Field MMRP RI/FS; Omaha, Nebraska; USACE–Omaha District; Deputy Project Manager—Serving as Deputy Project Manager for multiple munitions response sites at Volk Field Combat Readiness Training Center. Project includes RI and FS at three munitions response sites. Fieldwork is complete and Final RI Report has been submitted.
Project Date: September 2014 – 2018

Development of Range (Life Cycle Management) Guide; Update of the Military Munitions Rule (MMR) Fact Sheet; and, Update of the MMR Summary Guide, for AFCEC at Joint Base Sam Antonio Lackland, Texas; Project Manager; Contract No: FA8903-08-D-8791-0046—EA prepared Draft and Final Quality Program Plans for the Range Life Cycle Management Guide, MMR, Fact Sheet Update, and MMR Summary Guide. **Task 3a–Range Life Cycle Management Guide**—EA developed the first of its kind, Range Life Cycle Management Guide, per AFCEC's request. The Range Life Cycle Management Guide was fashioned based on a Tiger-Team Outline provided by AFCEC to EA at the beginning of the project. The Range Life Cycle Management Guide was produced to provide guidance and information related to range life cycle management from range design/redesign considerations through range disposition/closure procedures ("cradle to grave"). The manual provides guidance and procedures for the Air Force for a holistic range management approach to ensure compliance with all applicable federal, state, and local environmental and safety laws, and Department of Defense and Air Force directives while reducing environmental impacts and enhancing operational capabilities. The guide followed the standard Air Force Manual format (AFI 33-360). The Draft Guide was submitted on 29 May 2015, the Draft Final was submitted on 24 September 2015, and the Final was submitted on 22 December 2015. EA addressed very complex comments provided by 15+ Air Force personnel between the Draft, Draft Final, and Final versions. Following submittal of the Final version, the Range Life Cycle Management Guide was provided to Air Force personnel in the field for beta testing. **Task 3b–MMR Fact Sheet**—EA updated and revised the December 2000 MMR Fact Sheet, which was developed under the PRO-ACT program on behalf of AFCEC. EPA, in consultation with Department of Defense and the states, published the MMR that specifies when conventional and chemical military munitions become hazardous waste subject to Subtitle C of the RCRA. The fact sheet assists the Air Force in complying with the Federal MMR and munitions regulations. **Task 3c–State MMR Summary Guide**—EA updated the May 2006 MMR Summary Guide. EPA delegated RCRA program administration and enforcement authority to the states as such states either adopted the federal rule or developed their own regulations that are at least as stringent as those of the federal program. The MMR Summary Guide served to illustrate the key differences between federal and state regulations and assist the Air Force in complying with the federal MMR and munitions regulations for each state.
Project Date: 12 July 2014 – 11 January 2016

ORAP Continental United States Assessments, FY13; AFCEC at Joint Base San Antonio Lackland, Texas; Project Manager- Contract No: W9128F-10-D-0022-CM01—EA prepared Draft, Draft Final, and Final Work Plan. The Work Plan included a Sampling and Analysis Plan, Quality Assurance Project Plan Worksheet #2, and Accident Prevention Plan. The Project Work Plan presented an introduction to ORAP; backgrounds on each of the installations; project organization; task descriptions for each installation (Phase I Qualitative Assessments, Phase I Updates, Phase II Quantitative Assessments, and Phase II Updates); project planning, records, and reporting requirements; and the project schedule. Work included performing a Phase I Assessment and/or Phase I Assessment Update at Shaw AFB, Langley AFB, Davis-Monthan AFB, Beale AFB, and Vandenberg AFB. Phase II Quantitative Assessments, and Phase II Updates were completed at Luke AFB, Edwards AFB, March AFB, and Nellis AFB. EA addressed comments provided by the installation and AFCEC between the Draft, Draft Final, and Final versions of the Assessment Reports.
Project Date: 26 September 2013 – 31 August 2015

ORAP Continental United States Assessments, FY14 West; AFCEC at Joint Base San Antonio Lackland, Texas; Project Manager; Contract No: W9128F-10-D-0022-CM02—EA prepared Draft, Draft Final, and Final Work Plan. The Work Plan included a Sampling and Analysis Plan, Quality Assurance Project Plan Worksheet #2, and Accident Prevention Plan. The Project Work Plan presented an introduction to ORAP; backgrounds on each of the installations; project organization; task descriptions for each installation (Phase I Qualitative Assessments, Phase I Updates, Phase II Quantitative Assessments, and Phase II Updates); project planning, records, and reporting requirements; and the project schedule. Work included performing a Phase I Assessment and/or Phase I Assessment Update at Travis AFB, Malmstrom AFB, and F.E. Warren AFB. Phase II Quantitative Assessments, and Phase II Updates were completed at Joint Base Elmendorf-Richardson, Mt. Home, Hill, and Fairchild AFBs. EA addressed comments provided by the installation and AFCEC between the Draft, Draft Final, and Final versions of the Assessment Reports.
Project Date: 11 June 2015 – 29 January 2016

ORAP Continental United States Assessments, FY14 Midwest; AFCEC at Joint Base San Antonio Lackland, Texas; Project Manager; Contract No: W9128F-10-D-0022-CM03—EA prepared Draft, Draft Final, and Final Work Plan. The Work Plan included a Sampling and Analysis Plan, Quality Assurance Project Plan Worksheet #2, and Accident Prevention Plan. The Project Work Plan presented an introduction to ORAP; backgrounds on each of the installations; project organization; task descriptions for each installation (Phase I Qualitative Assessments, Phase I Updates, Phase II Quantitative Assessments, and Phase II Updates); project planning, records, and reporting requirements; and the project schedule. Work included performing a Phase I Assessment and/or Phase I Assessment Update at Buckley AFB, McConnell AFB, Minneapolis-St. Paul ARS, Offutt AFB, Holloman AFB, Grand Forks AFB, and Dyess AFB. Phase II Quantitative Assessments, and Phase II Updates were completed at U.S. Air Force Academy, Whiteman AFB, Ellsworth AFB, and Minot AFB. EA addressed comments provided by the installation and AFCEC between the Draft, Draft Final, and Final versions of the Assessment Reports.
Project Date: 28 July 2014 – 28 January 2016

MMRP RI, Arnold AFB, Tennessee; USACE–Omaha; Project Manager—Managed $1.794 million performance-based contract task order to perform RI at three munitions response sites. Developed Explosive Site Plans and Work Plan with Uniform Federal Policy-Quality Assurance Project Plan. Supported USACE–Omaha with Major Command, Regulator Tier 1 meetings as well as Restoration Advisory Board meeting. Project included excavating 90,000 anomalies as well as performing munitions constituents sampling. A total of 50 MEC items were identified during the RI, which required handling, storing, and/or demolition. Remedial investigation field work as well as all reporting are complete.
Project Date: September 2012 – August 2014

MMRP RI, Langley AFB, Virginia; USACE–Omaha; Project Manager—Managing $2.368 million performance-based contract task order to perform RI at five munitions response sites. Developed Explosive Site Plans and Work Plan with Uniform Federal Policy Quality Assurance Project Plan, as well as No Further Action Indicated – Explosive Safety Submission. Supporting USACE–Omaha with Major Command, Regulator Tier 1 meetings as well as Restoration Advisory Board meetings. Munitions response sites include Historic Bombing Range (MU 157, MU 157a, and MU 157b), and Skeet Range (TS 158 and TS 158a). Project includes 200+ acres of digital geophysical mapping surveying and investigation of approximately 2,900 anomalies as well as 300+ munitions constituent samples of various media. The final RI Report was accepted by USACE-Omaha, U.S. Air Force, Virginia Department of Environmental Quality, and EPA.
Project Date: September 2010 – May 2016

MMRP RI, Alpena Combat Readiness Training Center; Alpena, Michigan; USACE–Omaha; Project Manager—Managed performance-based contract RI for the Small Arms Burn Kettle munitions response site at the Alpena Combat Readiness Training Center. Directed the development of the Explosive Site Plan and Work Plan with Uniform Federal Policy Quality Assurance Project Plan. The Explosive Site Plan was approved by Department of Defense Explosives Safety Board and the draft final Work Plan was approved by USACE–Omaha, Army National Guard and state regulators. Performed MAJCOM meeting support. Project included a complete surface removal of the 14-acre munitions response site as well as a subsurface investigation and removal of 2.5 acres per the statistical sampling design with a 95 percent confidence that there will be less than 1.0 MEC per acre remaining. Approximately 80 munitions constituents (including polycyclic aromatic hydrocarbons for fuels used during the burning) samples of various media were collected to fully characterize the nature and extent of munitions constituents. RI Report has been reviewed by USACE–Omaha, Air National Guard and the regulators. The project is complete and closed out.
Project Date: August 2011 – January 2014

MMRP RI/FS, Moody AFB, Georgia; USACE–Omaha; Project Manager—Managed performance-based contract RI/FS at two munitions response sites, including 40-millimeter Grenade Range (TM001), and Former Skeet Range (TS001). Directed the development of the Explosive Site Plan and Work Plan with Uniform Federal Policy-Quality Assurance Project Plan. The Explosive Site Plan has been approved by Department of Defense Explosives Safety Board and the final Work Plan has been approved by the Air Force. Performed Major Command meeting support. Project included a complete surface and subsurface removal at the 2-acre 40-millimeter Grenade Range as well as 100+ munitions constituent samples of various media in the Former Skeet Range. RI/FS Report has been reviewed by USACE–Omaha and Moody AFB. EA completed a wetlands delineation following the draft final RI/FS Report and the new wetlands acreage was used in the FS costing. The project is complete and closed out.
Project Date: August 2011 – December 2014

MMRP Removal Action at Atlantic Research Corporation Facility Gainesville, Virginia; Commercial Client/Sequa; Project Manager—Managed $130,000 contract to perform UXO Construction Support and Removal Action Services at this former manufacturing facility. Work Plan was developed within 1 week. Approximately 12,000 pounds of propellant and one hundred and fifty 81-millimeter mortars have been excavated from three thermal treatment units.
Project Date: May–October 2011

MMRP Site Inspections at National Guard Sites in Central Region—Task Manager for USACE–Baltimore and Sacramento districts and National Guard Directorate conducting CERCLA site inspections at former range sites utilized by State Army National Guard Units. Coordinated initial Historical Records Reviews and associated Historical Records Review Report. Participated in Technical Project Planning meetings with six individual states. Assisted and reviewed the development of the Site Inspection Work Plan. Assisted in logistical coordination for

field teams. Conducted field activities and associated sampling investigations. Prepared and reviewed Munitions Response Site Prioritization Protocol scoring sheets. Reviewed Final Site Inspection Reports.
Project Date: 2010–2013

USACE–Huntsville and Baltimore Districts; Continental/Outside of Continental United States Contract, MMRP Site Inspections at Multiple FUDS in the Northeast; Project Manager—EA, under contract to Alion Science and Technology, conducted site inspections at 52 FUDS in the Northeast. Responsible for this $3.6 million project, which includes development of the site-specific conceptual site models for each munitions response site at each FUDS. The individual projects include historical records review, technical project planning meetings, work plan development and field execution, as well as preparing a site inspection report. Numerous stakeholder coordination is required for the project execution and gaining concurrence on the recommendations for further study. In addition to preparing all six proposals under this ongoing task order, also assisted Alion in the proposal development for their continental/outside continental U.S. Huntsville contract award win in 2004/2005.
Project Date: May 2005 – September 2010

U.S. Army, Fort Monroe, Virginia, MEC RI; Project Manager—EA was authorized by U.S. Army Environmental Command to conduct a Munitions Response RI for 13 munitions response areas at U.S. Army Garrison Fort Monroe (Fort Monroe). Fort Monroe located in Hampton Roads, Virginia, has a long history of military use beginning in 1812 for use as a coastal defense and later for training purposes. Fort Monroe was selected for closure pursuant to the Congressionally-authorized 2005 Base Realignment and Closure process. To facilitate transfer of the real property from U.S. Army control, EA will collect information to determine the prevalence of MEC from historic use at Fort Monroe. All work at Fort Monroe will be conducted in accordance with the Defense Environmental Restoration Program under the Munitions Response RI category. Specific objectives of this
RI include: (1) conduct a CERCLA RI to determine the nature and extent of MEC, including a geophysical prove-out, geophysical survey of selected areas of each of the13 munitions response areas including a portion of the Dog Beach offshore water area, and an intrusive investigation of selected anomalies; (2) prepare a CERCLA FS to analyze alternatives for risk management and/or response actions; and (3) prepare a Proposed Plan and Decision Document that reflect the U.S. Army's preferred alternative for addressing explosive hazards posed by MEC/material potentially presenting an explosive hazard at Fort Monroe. Decision Document has been accepted by the Army as well as the Commonwealth of Virginia. Project is 100 percent complete.
Project Date: September 2008 – March 2011

U.S. Army, Fort Monroe, Virginia (through ERT), Land Use Control Implementation Plan; Project Manager—As a follow-on project to EA's Fort Monroe project, EA under contract to ERT, is completing a Land Use Control Implementation Plan as well an awareness program for the Base Realignment and Closure Act office. Awareness program includes signage, pamphlets and video.
Project Date: September 2011 – April 2012

Federal Highway Administration Eastern Federal Lands Division (under contract to Cherry Hill Construction, Inc.); Engineering Proving Ground – Fort Belvoir, Virginia, Munitions Response/ Construction Support for the Fairfax County Parkway Connector Road; Project Manager—EA, under contract to Cherry Hill Construction, Inc., provided construction support at the Engineering Proving Ground – Fort Belvoir, Virginia for the Fairfax County Parkway Connector Road project. Project entailed MEC Construction Support Plan development and approval, MEC Awareness Training for construction personnel, Geotechnical Soil Boring Magnetometer Surveys, and MEC Disposal Pit Removal as well as certified industrial hygienist support. Project is 100% complete
Project Date: July 2008 – Present

USACE–Huntsville and Jacksonville Districts; Worldwide Environmental Remediation Services Contract, MMRP Recurring Reviews at Multiple Sites; Project Manager—EA, under contract to EOTI, Inc., conducted recurring reviews/5-year reviews at six MMRP FUDS in Florida and the U.S. Virgin Islands. This USACE–Jacksonville District project was completed by USACE–Huntsville. The project entailed records review, technical project planning, work plan development, site reconnaissance, and reporting. Also attended site visits to ensure quality of project.
Project Date: June 2010 – July 2012

U.S. Air Force, Eielson AFB, Alaska, MEC Geophysical Screening and Anomaly Removal at the Garrison Slough; Lead Design Engineer—Assisted in and provided senior technical review of the remediation design and geophysical prove-out plan for the MEC removal from the Eielson AFB Garrison Slough. Fieldwork was completed in May 2007, under budget and ahead of schedule. Over 600 anomalies were removed from below the waterline, which allowed a polychlorinated biphenyl-contaminated sludge removal project to continue.
Project Date: April 2006 – November 2007

U.S. Air Force, Andersen AFB, Guam, Remediation Design for Urunao Dumpsites 1 and 2; Lead Design Engineer—Assisted in and provided senior technical review of the remediation design and explosive safety submission preparation for these two dumpsites. Conducted site visits/walks to this remote site during the conceptual design phase as well as during the 30 percent design phase. Met with Air Force personnel to discuss design, plans, specifications, calculations and removal action cost estimate.
Project Date: January 2004 – September 2006

Aberdeen Proving Ground – Directorate of Safety, Health and Environment; Project Manager—Responsible for four projects under EA’s two (large and small business) Base Environmental Support contracts at Aberdeen Proving Ground. Projects include long-term monitoring and maintenance of three landfills, and long-term maintenance at Graces Quarters and Carroll Island which include biannual MEC sweeps and providing debris removal at Other Edgewood study area. Provide senior technical review for all MEC-related projects at Aberdeen Proving Ground. In addition to preparing the proposals for these four proposals, assisted in preparation and participated in the oral presentation for these two contracts as well as numerous other task orders under these contracts.
Project Date: December 2004 – July 2010

Riverfront Development Corporation, Wilmington, Delaware, Christina Landing Voluntary Cleanup Program; Project Manager—Responsible for this $1 million+ project that included the voluntary cleanup of this former browns field site in Wilmington, Delaware into a residential development. Implemented the remedial actions that were approved by the state to allow this $400+ million project to proceed. The remedial actions included soil hot spot removal (30,000 cubic yards), onsite containment, and installation of vapor barriers and venting systems. ***Project Date: May 2004 – May 2006***

Other Project Experience

USACE HTRW Contract at Aberdeen Proving Ground, Maryland; Tetra Tech FW, Inc. (Formally Foster Wheeler Environmental); November 1994 – January 2004; Program Manager—Project activities for this task order contract include the environmental restoration of 14 identified sites and 12 unidentified sites. Services include

RCRA, Toxic Substances Control Act, and Nuclear Regulatory Commission characteristic waste removal, MEC clearance, clean construction, designing and implementing multimedia sampling plans, site assessments, writing and implementing Occupational Safety and Health Administration Health and Safety plans, waste characterization, waste containerization, writing and implementing work plans, and cost estimating. Hazards of concern include RCRA Characteristic Wastes, Toxic Substances Control Act Characteristic Waste, Radioactive Wastes, MEC, and Chemical Warfare Materials, and Biological Agents. Managed field activities ensuring all aspects of the projects are completed in a safe, cost-effective, and compliment manner. Specific project tasks include the removal of up to 2,000 yd^3 of radioactive, MEC, and mixed waste soil. As well as being Program Manager, also served as a Project Manager and Quality Control Engineer on numerous removal action projects.

USACE, Lauderick Creek Chemical Warfare Materials/UXO Removal Action, Aberdeen Proving Ground, Maryland; May 2000 – January 2004; Project Manager—Responsible for the execution of the $11 million project which is to locate, access, identify, and remove chemical warfare material UXO from the Lauderick Creek Site of the Edgewood Area of Aberdeen Proving Ground. Site Safety Submission was approved by the Department of Defense Explosive Safety Board and Pre-Op Surveys were completed and approved prior to commencement of intrusive activities. Over 16,500 anomalies were investigated at the completion of the project (third year).

USACE, Ordnance and Explosive Removal Action, Fort Meade, Maryland; September 2001 – January 2004; Project Manager—Responsible for the execution of this $3.1 million, 332-acre geophysical investigation followed by UXO-like anomaly removal action. The work plan, explosive safety submission, geophysical prove out plan, and geophysical prove out report have been approved. The field efforts commenced in January 2003 and were completed in November 2003. Approximately 22,000 anomalies have been investigated at this site to date. In addition, designed and constructed a stream bank erosion repair at a MEC landfill.

Ei DuPont de Nemours and Company, Lake Success Business Park UXO Investigation and Removal Action, Bridgeport, Connecticut; January 2001 – January 2002; Project Manager—Responsible for the execution of this $400,000, 70-acre geophysical investigation and support of the MEC removal action.

Key Span Energy/Consolidated Edison Company of New York, Ravenswood Facility; September 1998 – August 2000; Project Manager—Responsible for all aspects of this $2 million Phase II facility investigation including work plan development, underground storage tank closure plans, underground storage tank closure certifications, site investigation reporting and overseeing the implementation of the plans in the field. Other responsibilities at this former manufactured gas plant site and the largest generating station in New York City included well point de-watering design and foundation design.

Naval Facilities Engineering Command – Northern Division; February 1998 – June 2000; Project Engineer— Responsible for field activities and Work Plan addendum development for closure/removal/remediation at Naval Station New York (numerous sites). Activities include waste manifesting and disposal, sampling, sump remediation and closure, and soil covers. Responsible for all coordination with client's numerous facility managers.

USACE; 26th Street Disposal Site, Aberdeen Proving Ground, Maryland; July 1995 – October 1998; Project Manager—Supervised the hand excavation of 800 yd^3 of soil and removal of material contaminated with radioactive material, potential chemical warfare material, MEC, and hazardous waste. The project cost approximately $3.6 million and employed 35 people from seven different subcontractors. This project involved excavation, characterization, and screening to define the nature and extent of contaminated materials prior to disposal. Intensive examination of the excavated waste was required to assure that all radioactive "hot spots," chemical agents, and UXO were removed. All activities were conducted using Level B and Level C personal protective equipment and real-time monitoring utilizing radiation detectors (Geiger counters), Chemical Warfare Materials monitors (MINICAMs), and flame ionization detector/photoionization detector/combustible gas indicator dust instrumentation. Excavated material was manifested and transported via truck and rail to Envirocare of Utah, Inc. During the removal activities, two concrete cylinders containing sealed metal containers were discovered. After construction of a vapor containment system, the concrete cylinders with encased sealed metal containers were chipped (to reduce the size) and placed in over pack steel drums. The task was accomplished in encapsulated Level A protection. The 26th Street Disposal Site project was completed (>45,000 man-hours) field portion without a lost time or an Occupational Safety and Health Administration recordable incident. The site has been de-listed by the Nuclear Regulatory Commission.

USACE, Adamsite Storage Vaults, Aberdeen Proving Ground, Maryland; May 1995 – December 1996; Project Manager**—**The Adamsite Vaults were originally used to store white phosphorus and drums of Adamsite (Chemical Warfare Materials). Responsible for a scope of work that included the removal of the vault contents, removal of the above ground structure; placement of non-salvageable material and rubble into the below ground portion of the vaults; backfilling the vaults with low density flowable filling to 1 ft below grade; and fill the remaining space to grade with crushed stone. The task first involved a preliminary radiological assessment of the area to determine the need for soil remediation. As a result of the radiological assessment, approximately 10 ft^3 of contaminated soil were removed. After the removal of radiological contaminated soil, approximately 15,000 gal of liquid waste and 30 yd^3 of sediments (both contaminated with arsenic, lead, copper, chromium, barium, and cyanide) were removed from the two storage vaults. The steel and concrete were demolished using a shear and a grappler. Foster Wheeler was able to recycle over 26,000 pounds of structural steel removed during demolition of the building through the base's Defense Reutilization and Marketing Office. In addition, by utilizing Aberdeen Proving Ground’s waste vendor and changing the sediment removal procedure, was able to reduce the project cost by approximately one-third ($150,000) of the original estimate ($450,000).

USACE, Pilot Plant Sumps, Aberdeen Proving Ground, Maryland; December 1994 – December 1995; Project Manager**—**Responsible for the sampling characterization of the contents and closure of seven sumps located in the Pilot Plant building of Edgewood Area on Aberdeen Proving Ground. The sump contents were analyzed for Chemical Warfare Materials and disposal characteristics. The sumps were characterized in Level B personal protective equipment. One sump contained mustard agent and required decontamination. Following characterization, Foster Wheeler removed the contents of the sumps via pump into holding trucks. Backfilled the sump pits with a controlled low-strength material within schedule and under the authorized budget by one quarter. The Pilot Plant Sumps project was completed without a lost time or an Occupational Safety and Health Administration recordable incident. Managed field activities and supported quality control, ensuring all aspects of the project were completed in a safe, cost-effective, and compliant manner. Project activities for this task order contract include the environmental restoration of 14 identified sites and 12 unidentified sites. Services included RCRA, Toxic Substances Control Act, and Nuclear Regulatory Commission characteristic waste removal, designing and implementing multimedia sampling plans, site assessments, writing and implementing Occupational Safety and Health Administration health and safety plans, waste characterization, waste containerization, writing and implementing work plans, and cost estimating. Hazards of concern include RCRA and Toxic Substances Control Act characteristic wastes, radioactive wastes, chemical surety material and biological agents.

USACE, Westwood Radioactive Material Disposal Facility, Aberdeen Proving Ground, Maryland; October 1995 – November 1998; Project Manager**—**Responsible for the removal action at the Westwood Radioactive Material Disposal Facility, which involved an initial field sampling and the removal, packaging, manifesting, and shipping of soil (approximately 1,100 yd^3), piping (450 linear ft), and underground septic equipment contaminated with radioactive (Cs-137) material. Waste was shipped via intermodal containers by truck to rail spur and then by train to Envirocare of Utah. Due to the high profile of the project, coordinated with numerous Aberdeen Proving Ground agencies, as well as the EPA, Maryland Department of the Environment, Nuclear Regulatory Commission, and public interest groups. The project cost approximately $1.8 million for the removal action and an additional $600,000 for disposal. Hazards of concern include gamma radiation, Chemical Warfare Materials, and riot control gas. Fieldwork was completed without a lost time injury. The site has been de-listed by the Nuclear Regulatory Commission.

USACE, Building E-1942 Abatement and Renovation, Aberdeen Proving Ground, Maryland; October 1996 – December 1998; Project Manager**—**Responsible for the environmental surveys of Building E-1942 for asbestos, lead-based paint, and polychlorinated biphenyls. Based on the results of the building inspections, and abatement measures, procedures were drafted, designed, and implemented. Building E-1942’s interior (20,000 ft^2) was demolished and renovated to provide office and administrative space for the Army’s Technical Escort Unit. This clean construction project cost approximately $2.3 million, employed up 85 people from five different subcontractors and included a complete renovation of this historic building. As project manager, was responsible for scope, schedule, budget, and level of quality.

EPA Region 2, Technical Assistance Team; October 1993 – October 1994, Project Manager**—**Primary responsibilities included providing technical support to EPA’s On-Scene Coordinators with respect to CERCLA, RCRA, and Department of Transportation regulations. Also conducted CERCLA-funded, intrusive site assessments under the direction of the EPA to determine potential hazards and actions to be taken. Tasks include assembling/reviewing work plans, conducting project scheduling and performing cost estimates to be used in CERCLA Removal Action Funding Requests. Typical duties have included health and safety management, design and implementation of multimedia, sampling plans, coordination with federal and state agencies, site cost tracking, hazard categorization of unknown substances, air monitoring, geophysical investigations, and engineering surveying. Specific site experience includes overseeing the ERCS analysis, removal, and disposal of 2,000 yd^3 of lead contaminated stream sediments at the NL Industries site in Pedricktown, New Jersey, where x-ray fluorescence spectroscopy was used in the determination of virgin soils; oversight of stabilization, inventory and drum sampling activities at the Standard Tank site in Bayonne, New Jersey; and hazard categorization of over 800 containers at an abandoned rail car facility in Dunkirk, New York. Additionally, served as Project Manager and Health and Safety Officer for the remediation of two illegal metal recycling facilities.

EPA Region 2, Standard Tank Cleaning, Bayonne, New Jersey; December 1993 – October 1994; Project Manager—Supervised the remediation of the Standard Tank Cleaning Corporation site, which consisted of the removal of 2.2 million gal of hazardous oil sludge. Duties include the preparation of the Health and Safety, Sampling, Analysis, and Monitoring Plans as well as the Community Relations Plan. In charge of remediation contractor oversight and review of project billings which were in excess of $3.5 million. Designed oil/water separator for treatment of 230,000 gal of contaminated wash and rainwater for an oil removal project. Completed the design of a flammable sludge stabilization treatment system utilizing pugmills and cement kiln dust.

Dames & Moore, Cranford, New Jersey; 1993; Staff Engineer—Completed numerous environmental documents as supplements to construction specifications and supervised field monitoring oversight for the multi-million-dollar New Jersey Turnpike Widening Project. Coordinated with New Jersey Department of Transportation and New Jersey Turnpike Authority personnel. Responsible for coordination/performance, Level B supervision of characterization, sampling, and removal of carbon disulfide dikes. Other responsibilities included onsite design modification of carbon disulfide removal system. Team leader during storm water sampling events at a pharmaceutical facility in New Jersey.

Blasland & Bouck Engineers, Cranbury, New Jersey; 1989-1993; Project Engineer—Primarily involved in providing consulting services to large industrial clients, including site investigations, report and document preparation, facility design, contract development, technical support, and construction review.

Blasland & Bouck Engineers, Edison, New Jersey/Syracuse University; 1988-1989; Engineer Intern—
Performed various engineering services in computer modeling, drafting, regulating review, and field sampling work on an intern and part-time status. Performed traffic studies of roadway and intersection level of service.

List of Technical Skills and Specializations

- Assessment of cleanup goals
- CERCLA
- Construction Quality Management for Contractors, USACE
- Data management
- Electromagnetic conductance and geophysics
- Evaluation of remedial alternatives for soil and groundwater
- Experienced with various sampling protocols—EPA, USACE, Multi- Increment, Aberdeen Proving Ground–Edgewood Area
- Familiar with CERCLA, RCRA, and Superfund Amendments and Reauthorization Act requirements
- Managed large RI/FS projects
- Managed several RIs of hazardous waste sites
- Project management including remediation, MEC/UXO removal and clean construction
- Project Manager on MEC/UXO site inspections, RI, digital geophysical mapping, small arms, and removal
- Public meetings
- RCRA
- Soil and groundwater remediation systems
- Underground storage tank management
- UXO, MEC, and ordnance and explosive design projects
- Visual Sample Plan development

FIRST AID, CPR, and BLOODBORNE PATHOGENS: PERSON ONE OF TWO

HEARTSAVER

Heartsaver®
First Aid CPR AED

American
Heart
Association.

Michael Wright

has successfully completed the cognitive and skills evaluations in accordance with the curriculum of the American Heart Association Heartsaver First Aid CPR AED Program.

Optional modules completed:

Heartsaver Total

Issue Date

1/4/2022

Training Center Name

American Medical Response (AMR) of Central New York

Training Center ID

NY04334

Training Center City, State

Syracuse, NY

Training Center Phone Number

(315) 701-7094

Renew By

01/2024

Instructor Name

Susan Burnett

Instructor ID

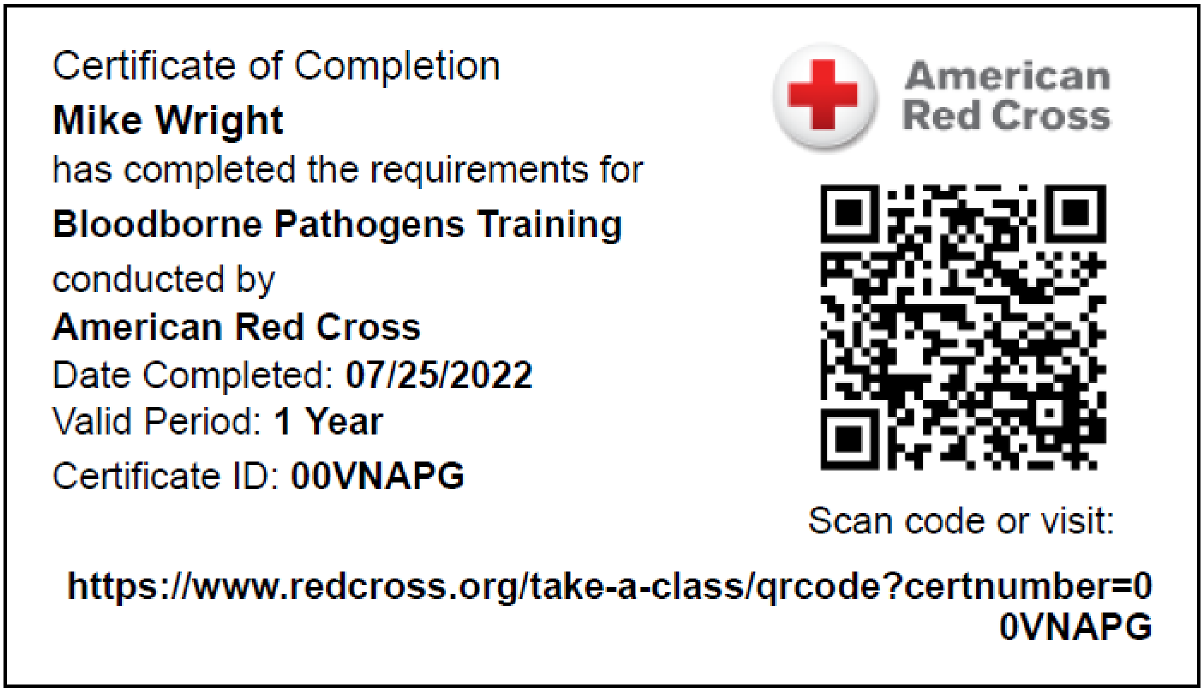
01170525452

eCard Code

226011585824

QR Code

To view or verify authenticity, students and employers should scan this QR code with their mobile device or go to www.heart.org/cpr/mycards.



Certificate of Completion

Mike Wright

has completed the requirements for

Bloodborne Pathogens Training

conducted by

American Red Cross

Date Completed: **07/25/2022**

Valid Period: **1 Year**

Certificate ID: **00VNAPG**

Scan code or visit:

https://www.redcross.org/take-a-class/qrcode?certnumber=00VNAPG

FIRST AID, CPR, and BLOODBORNE PATHOGENS: PERSON TWO OF TWO

HEARTSAVER

Heartsaver® First Aid CPR AED

American Heart Association.

Jacob Guy

has successfully completed the cognitive and skills evaluations in accordance with the curriculum of the American Heart Association Heartsaver First Aid CPR AED Program.

Optional modules completed:

Child CPR AED, Infant CPR

Issue Date

2/19/2021

Training Center Name

American Medical Response (AMR) of Central New York

Training Center ID

NY04334

Training Center City, State

Syracuse, NY

Training Center Phone Number

(315) 701-7094

Renew By

02/2023

Instructor Name

Susan Burnett

Instructor ID

01170525452

eCard Code

216009018653

QR Code

To view or verify authenticity, students and employers should scan this QR code with their mobile device or go to www.heart.org/cpr/mycards.

American Red Cross
Training Services

Certificate of Completion

Jacob Guy

has successfully completed requirements for

Bloodborne Pathogens Training

Date Completed: 6/23/2022
Validity Period: 1 Years

Conducted by: American Red Cross

To verify certificate, scan code or visit redcross.org/digitalcertificate and enter ID.

Learn and be inspired at LifesavingAwards.org

00V1FD7

Attachment D

Field and Inspection Forms

1. USACE Checklist Form A-02
2. USACE Safety Inspection Checklist – Deficiency Tracking Logs
3. Safety and Occupational Health Deficiency Tracking System Log
4. Daily Safety Meeting Form
5. Daily Safety Inspection Checklist
6. EA Employee/Visitor Register and Safety Brief
7. USACE Record of On Site First Aid Treatment
8. Environmental Monitoring Record
9. Health and Safety Activity Report
10. Initial Safety Inspection Checklist
11. USACE Accident Investigation Report

This page intentionally left blank

Form A-02
U.S. Army Corps of Engineers
Accident Prevention Plan Checklist

Date of Inspection

Location (Plant or Facility)

Contract Number

Contractor Name

Project Name

Inspector Name (Print)

Inspector Signature

This checklist serves as a guide only, it does not replace or eliminate the need to comply with the requirements set forth in Engineering Manual 385-1-1, Safety and Health Requirements Manual, dated 30 Nov 2014. The references included in this checklist correspond to the applicable sections of EM 385-1-1.

Item Description	**Yes**	**No**	**N/A**	**Remarks (Any NO or N/A item)**
a. Signature sheet				
1. Includes the name, title, signature, telephone number, and qualifications of the Plan Preparer (*Qualified person, i.e. corporate safety staff person, QC*)	☐	☐	☐	
2. Includes the name, title, signature, telephone number, and qualifications of the Plan Approver (*e.g. owner, company president, regional vice president*) (HTRW activities require approval of a Certified Industrial Hygienist, a Certified Safety Professional may approve the plan for operations involving UST removal where contaminants are known to be petroleum, oils, or lubricants).	☐	☐	☐	
3. Includes the name(s), title(s), signature(s), telephone number(s), and qualifications for Plan Concurrence (provide concurrence of other applicable corporate and project personnel (contractor)) (*e.g. Chief of Operations, Corporate Chief of Safety, Corporate Industrial Hygienist, project manager or superintendent, project safety professional, project QC.*)	☐	☐	☐	
b. Background information				
1. Includes the Contractor Name.	☐	☐	☐	
2. Includes the Contract Number.	☐	☐	☐	
3. Includes the Project Name.	☐	☐	☐	
4a. Includes the Brief Project Description.	☐	☐	☐	
4b. Includes a Discription of the Work to be Performed.	☐	☐	☐	
4c. Includes the Location of the Project (map).	☐	☐	☐	
4d. Includes the Equipment to be Used.	☐	☐	☐	
4e. Includes the Anticipated High Risk Activities.	☐	☐	☐	
5. Includes the Major Phases of Work Anticipated. *(Within these major phases of work identified, activities [includes Definable features of Work (DFOWs) and tasks] to be performed that will require an AHA shall be specifically highlighted. This information can then be used by QC, QA and Safety personnel to track AHA submittals. The AHAs for these activities, tasks of DFOWs are NOT submitted at this time (AHAs created/submitted at this time would not be activity-specific as they are intended to be). > See Sections 01.A.14 and 01.A.15.)*	☐	☐	☐	

Form A-02
U.S. Army Corps of Engineers
Accident Prevention Plan Checklist (cont'd)

Date of Inspection

Item Description	Yes	No	N/A	Remarks (Any NO or N/A item)
c. Statement of Safety and Health Policy.				
1. Provide a copy of current corporate/company Safety and Health Policy Statement, detailing commitment to providing a safe and healthful workplace for all employees. (*In addition to the corporate policy statement, a copy of the corporate safety program may provide a portion of the information required by the accident prevention plan.*)				
2. Includes Contractor's written safety program goals.				
3. Includes Contractor's written safety program objectives.				
4. Includes the Contractor Accident Experience (*Copy of OSHA 300 Forms, or equivalent documentation*).				
d. Responsibilities and Lines of Authority.				
1. Includes statement of the employer's ultimate responsibility for the implementation of his SOH program for his own employees, all sub-contractors and all others on the worksite (includes the strict enforcement of the program).				
2. Includes the identification and accountability of personnel responsible for safety and health at both the corporate and project level – including their resumes. Qualifications shall be in accordance with Section 01.A.17. *(Only official OSHA 30-Hour cards will be accepted or, if equivalent training is provided, appropriate instructor qualifications.)*				
3. Includes equivalent training to the OSHA 30-Hour classes is being presented as qualification, the training shall cover, as a minimum, the areas discussed in Appendix A, Section 3.d.3.(a-d).				
4. Includes the names of Competent (CP) and/or Qualified Person(s) (QP) and proof of competency/qualification to meet specific OSHA CP/QP requirements. *(Must include copies of proof of CP/QP).*				
5. Includes requirements and details of the employer's Risk Management Process. *(USACE uses the Activity Hazard Analysis (AHA) as part of a total risk management process. Contractors and other individual employer's may use the AHAs or their own version [Job Safety Analyses (JSAs), Job Hazard Analyses (JHAs), or similar Risk Management assessment tools]. These documents are considered equivalent to, and acceptable substitutes for, the USACE's AHA provided the data collected is the same as that required by the AHA.)*				
6. Includes requirements for initial activity-specific AHAs to be submitted and accepted at preparatory meetings, prior to work being performed;				
7. Includes requirements that no work by the Contractor shall be performed unless a designated Competent Person/SSHO is present on the job site.				
8. Includes policies and procedures regarding non-compliance with safety requirements (to include disciplinary actions for violation of safety requirements).				
9. Lines of authority.				
10. Includes written company procedures for holding managers and supervisors accountable for safety.				

Form A-02
U.S. Army Corps of Engineers
Accident Prevention Plan Checklist (cont’d)

Date of Inspection

Item Description	**Yes**	**No**	**N/A**	**Remarks (Any NO or N/A item)**
e. Subcontractors and Suppliers.				
1. Includes the list of subcontractors and suppliers. *(If not known at the time of initial APP submittal, the contractor shall include the following statement in their initial APP: “The subcontractors for the following DFOWs/activities are not known at this time, but additional information will be submitted to the APP for acceptance prior to the start of any activities listed”)*	☐	☐	☐	
2. Includes safety responsibilities of subcontractors and suppliers.	☐	☐	☐	
f. Training				
1. Includes requirements for new hire SOH orientation training at the time of initial hire of each new employee.	☐	☐	☐	
2. Includes requirements for mandatory training and certifications that are applicable to this project (*e.g., explosive actuated tools, confined space entry, crane operator, diver, vehicle operator, HAZWOPER training and certification, PPE*) and any requirements for periodic retraining / recertification.	☐	☐	☐	
3. Includes procedures for periodic safety and health training for supervisors and employees.	☐	☐	☐	
4. Includes the requirements for emergency response training.	☐	☐	☐	
g. Safety and Health Inspections				
1. Includes specific assignment of responsibilities for a minimum daily jobsite SOH inspection during periods of work activity.	☐	☐	☐	
1a. Includes the name(s) of individual(s) responsible for conducting safety inspections. (*e.g., PM, safety professional, QC, supervisors, employees*)	☐	☐	☐	
1b. Includes proof of inspector's training / qualifications.	☐	☐	☐	
1c. Indicates when inspections will be conducted.	☐	☐	☐	
1d. Indicates procedures for documentation. *(Furnished sample forms upon which inspections will be recorded.)*	☐	☐	☐	
1e. Indicates deficiency tracking system and follow-up procedures.	☐	☐	☐	
2. Includes any external inspections / certifications which may be required. (*e.g., US Coast Guard*)	☐	☐	☐	
h. Mishap Reporting and Investigation				
1. The plan identifies how, when, and who shall complete the Exposure data (man-hours worked).	☐	☐	☐	
2a. The plan identifies how, when, and who shall complete mishap investigations, reports, and logs. *(The contractor shall report, thoroughly investigate, and analyze all mishaps occurring incidentally to an operation, project or facility for which this manual is applicable.)*	☐	☐	☐	
2b. The plan identifies how, when, and who shall make immediate notification of major mishaps. *(Mishaps shall be reported as soon as possible but not more than 24 hours afterwards to the KO/COR.)*	☐	☐	☐	
2c. Includes how, when, and who will provide notice to the KO/COR when corrective actions are completed. *(Implement corrective actions as soon as reasonably possible.)*	☐	☐	☐	

Form A-02
U.S. Army Corps of Engineers
Accident Prevention Plan Checklist (cont'd)

Date of Inspection

Based on a risk assessment of contracted activities and on mandatory OSHA compliance programs, the Contractor shall address all applicable safety and occupational health risks and associated compliance plans. *Using the EM 385-1-1 as a guide, plans, programs, procedures (assessments and evaluations), may include but not be limited to:*

(1)Include a project-specific compliance plan, as applicable to the work being performed, and as identified below. The plans shall incorporate project-wide procedures to control hazards to which the employees of all project employers may be exposed.

(2) These procedures shall be coordinated with all project employers and shall include project-specific, project-wide emergency response and evacuation procedures, PPE requirements, recordkeeping and reporting requirements, and training requirements.

(3) The plans shall be prepared prior to the start of any work activities on the job site (as much as the information can be known at that point in time). The plans shall be updated throughout the life of the project to include changes in personnel, equipment, conditions, etc. Additional revisions shall be incorporated as necessary to reflect changing site conditions, construction methods, personnel roles and responsibilities and construction schedules.

(4) No activity (DFOW) shall be started on site until the APP is revised and submitted to the GDA for acceptance, with the site-specific plans, programs and procedures required to complete the project.

Item Description	**Yes**	**No**	**N/A**	Remarks (Any NO or N/A item)
i. Plans (Programs, Procedures, Assessments, and Evaluations) required by the Safety Manual				
1. Fatigue Management Plan (01.A.20)	☐	☐	☐	
2. Emergency Plans (01.E):	☐	☐	☐	
(a) Procedures & Test (01.E.01)	☐	☐	☐	
(b) Spill Plans (01.E.01, 06.A.02)	☐	☐	☐	
(c) Fire Fighting Plan (01.E.01; 19.A)	☐	☐	☐	
(d) Posting of Emergency Telephone Numbers (01.E.05)	☐	☐	☐	
(e) Man overboard/abandon ship (19.A.04)	☐	☐	☐	
(f) Plan for prevention of alcohol and drug abuse (01.C.02 & Specs)	☐	☐	☐	
3. Site Sanitation/Housekeeping Plan (02.B)	☐	☐	☐	
4. Medical Support Agreement. Outline on-site medical support and off-site medical arrangements including rescue and medical duties for those employees who are to perform them, and the name(s) of on-site Contractor personnel trained in first aid and CPR. A minimum of two employees shall be certified in CPR and first-aid per shift/site (03.A.01, 03.A.03)	☐	☐	☐	
5. Blood-borne Pathogen Program (03.A.05)	☐	☐	☐	
6. Exposure Control Plan (03.A.05)	☐	☐	☐	
7. Automatic External Defibrillator (AED) Program (03.B.04)	☐	☐	☐	
8. Site Layout Plan (04.A)	☐	☐	☐	
9. Access/Haul Road Plan (04.B)	☐	☐	☐	
10. Hearing Conservation Program (05.C)	☐	☐	☐	
11. Respiratory Protection Plan (05.G)	☐	☐	☐	
12. Health Hazard Control Program (06.A)	☐	☐	☐	
13. Hazard Communication Program (06.B.01)	☐	☐	☐	
14. Process Safety Management Plan (06.B.04)	☐	☐	☐	
15. Lead Compliance Plan (06.C.02 & Specifications)	☐	☐	☐	
16. Asbestos Abatement Plan (06.C.03 & Specifications)	☐	☐	☐	

Form A-02
U.S. Army Corps of Engineers
Accident Prevention Plan Checklist (cont’d)

Date of Inspection

Based on a risk assessment of contracted activities and on mandatory OSHA compliance programs, the Contractor shall address all applicable occupational risks and compliance plans. *Using the EM 385-1-1 as a guide, plans, programs, procedures (assessments and evaluations), may include but not be limited to:*

Item Description	Yes	No	N/A	Remarks (Any NO or N/A item)
i. Plans (Programs, Procedures) continued.				
17. Radiation Safety Program (06.F)	☐	☐	☐	
18. Abrasive Blasting Plan (06.I)	☐	☐	☐	
19. Heat Stress Monitoring Plan (HSMP) (06.J.02)	☐	☐	☐	
20. Cold Stress Monitoring Plan (CSMP) (06.J.04)	☐	☐	☐	
21. Indoor Air Quality Management Plan (06.L)	☐	☐	☐	
22. Mold Remediation Plan (06.L.04)	☐	☐	☐	
23. Chromium (VI) Exposure Evaluation (06.M)	☐	☐	☐	
24. Crystalline Silica Assessment (06.N.02)	☐	☐	☐	
25. Lighting Plan for Night Operations (07.A.06)	☐	☐	☐	
26. Traffic Control Plan (08.C.05)	☐	☐	☐	
27. Fire Prevention Plan (09.A.01)	☐	☐	☐	
28. Wild Land Fire Management Plan (09.L)	☐	☐	☐	
29. Arc Flash Hazard Analysis (11.B)	☐	☐	☐	
30. Assured Equipment Grounding Control Program (AEGCP), (11.D.05, Appendix E)	☐	☐	☐	
31. Hazardous Energy Control Program and Procedures (12.A.01)	☐	☐	☐	
32. Standard Pre-Lift Plan – LHE (16.A.03)	☐	☐	☐	
33. Critical Lift Plan – LHE (16.H)	☐	☐	☐	
34. Naval Architectural Analysis – LHE (Floating) (16.L)	☐	☐	☐	
35. Floating Plant Inspection and Certification (19.A.01)	☐	☐	☐	
36. Severe Weather Plan for Marine Activities (19.A.03)	☐	☐	☐	
37. Emergency Plan for Marine Activities (19.A.04)	☐	☐	☐	
38. Man Overboard/Abandon Ship Procedures (19.A.04)	☐	☐	☐	
39. Float Plan for Launches, Motorboats, Skiffs (19.F.04)	☐	☐	☐	
40. Fall Protection and Prevention Plan (21.D)	☐	☐	☐	
41. Demolition/Renovation Plan (to include engineering survey) (23.A)	☐	☐	☐	
42. Rope Access Work Plan (24.H)	☐	☐	☐	
43. Excavation/Trenching Plan (25.A.01)	☐	☐	☐	
44. Fire Prevention and Protection Plan for Underground Construction (26.D.01)	☐	☐	☐	
45. Compressed Air Work Plan for Underground Construction (26.I.01)	☐	☐	☐	
46. Erection and Removal Plan for Formwork and Shoring (27.C)	☐	☐	☐	
47. Precast Concrete Plan (27.D)	☐	☐	☐	

Form A-02
U.S. Army Corps of Engineers
Accident Prevention Plan Checklist (cont'd)

Date of Inspection

Based on a risk assessment of contracted activities and on mandatory OSHA compliance programs, the Contractor shall address all applicable occupational risks and compliance plans. *Using the EM 385-1-1 as a guide, plans, programs, procedures (assessments and evaluations), may include but not be limited to:*

Item Description	**Yes**	**No**	**N/A**	**Remarks (Any NO or N/A item)**
i. Plans (Programs, Procedures) continued.				
48. Lift-slab Plans (27.E)	☐	☐	☐	
49. Masonry Bracing Plan (27.F.01)	☐	☐	☐	
50. Steel Erection Plan (28.B)	☐	☐	☐	
51. Explosives Safety Site Plan (ESSP) (29.A)	☐	☐	☐	
52. Blasting Plan (29.A; 26.J)	☐	☐	☐	
53. Dive Operations Plan (30.A.14, 30.A.16)	☐	☐	☐	
54. Safe Practices Manual for Diving Activities (30.A.15)	☐	☐	☐	
55. Emergency Management Plan for Diving (30.A.18)	☐	☐	☐	
56. Tree Felling/Maintenance Program (31.A.01)	☐	☐	☐	
57. Aircraft/Airfield Construction Safety & Phasing Plan (CSPP) (32.A.02)	☐	☐	☐	
58. Aircraft/Airfield Safety Plan Compliance Document (SPCD) (32.A.02)	☐	☐	☐	
59. Site Safety and Health Plan (HTRW) (33.B)	☐	☐	☐	
60. Confined Space Entry Procedures (34.A.05)	☐	☐	☐	
61. Confined Space Program (34.A.06)	☐	☐	☐	
j. Risk Management Processes (AHAs). Detailed project-specific hazards and controls shall be provided by Activity Hazard Analysis for each activity (DFOW). No work will begin on an activity (DFOW) until the initial AHA has been accepted by the GDA addressing the project-specific hazards. (01.A.14 & 01.A.15) *Note: USACE uses the Activity Hazard Analysis (AHA) as part of a total risk management process. Contractors and other individual employer's may use the AHAs or their own version [Job Safety Analyses (JSAs), Job Hazard Analyses (JHAs), or similar Risk Management assessment tools]. These documents are considered equivalent to, and acceptable substitutes for, the USACE's AHA provided the data collected is the same as that required by the AHA.*	☐	☐	☐	

Remarks:

Form A-02 **U.S. Army Corps of Engineers** **Accident Prevention Plan Checklist (cont'd)**	Date of Inspection
Other Remarks:	

This page intentionally left blank

This page intentionally left blank

Safety and Occupational Health Deficiency Tracking System Log

This list will be posted on the Project Safety Bulletin Board and will be updated daily. EM-385 01.A.12d

Date Deficiency Identified	Description of Deficiency	Person Responsible for Correcting Deficiency	Projected Resolution Date	Date Actually Resolved

Safety and Occupational Health Deficiency Tracking System Log

This list will be posted on the Project Safety Bulletin Board and will be updated daily. EM-385 01.A.12d

Date Deficiency Identified	Description of Deficiency	Person Responsible for Correcting Deficiency	Projected Resolution Date	Date Actually Resolved

Safety and Occupational Health Deficiency Tracking System Log

This list will be posted on the Project Safety Bulletin Board and will be updated daily. EM-385 01.A.12d

Date Deficiency Identified	Description of Deficiency	Person Responsible for Correcting Deficiency	Projected Resolution Date	Date Actually Resolved

Safety and Occupational Health Deficiency Tracking System Log

This list will be posted on the Project Safety Bulletin Board and will be updated daily. EM-385 01.A.12d

Date Deficiency Identified	Description of Deficiency	Person Responsible for Correcting Deficiency	Projected Resolution Date	Date Actually Resolved

DAILY SAFETY MEETING FORM

Project/Site: ______________________________

Project No.: ______________________________

TIME:		**DATE:**	

Expected Weather Conditions & Extreme Temperature Precautions	Temperature (°F):	
	High Winds:	Y or N
	Precipitation:	Rain
	Notes:	
	Precautions:	

AHAs Reviewed & New Operations	*AHAs Reviewed (Check Applicable):*			
				Other
				Other
				Other
				Other
				Other
				Other
				Other

Daily Consideration	

Zones of Work	Cold Hot Warm	
General Hazards	Physical	
	Biological	
	Chemical	Contact with chlorinated solvents in environmental media.
	Radiological	Not Applicable.
	Ultraviolet	
PPE Level of Protection (From AHAs)	Level D	
	Modified D	
	Level C	
Emergency Evacuation	APP Section 9 (ER Plan)	Do not act as an emergency responder, with exception of those trained in First Aid. Dial 911. If necessary, evacuate to Rally Point.

Discussion Previous Day's Activities	
Notes	

DAILY SAFETY MEETING FORM

Notes and Discussion:

EA Engineering, Science,
and Technology, Inc.

DAILY SAFETY INSPECTION CHECKLIST
(TO BE COMPLETED EACH DAY OF CONSTRUCTION OR HTRW SITE ACTIVITIES)

Site: ______________________
Location: ______________________
Project No.: ______________________
Client: ______________________
Prepared by SSHO: ______________________
Project Manager: ______________________
Date : ______________________

Rating	**Y**	**N**	**N/A**	**Comments/Immediate Corrective Action[1]**
Accident Prevention Plan (APP) and Site Safety and Health Plan (SSHP) General Requirements				
Are there new onsite personnel? • Did they receive pre-entry briefing and are their names recorded in field logbook or daily log? • Was the USACE PM made aware of the new personnel. • Required training and medical surveillance documentation received (e.g., 40-hr, 8 hr, etc.)?				
Did personnel sign in/out of site?				
Daily tailgate safety meetings conducted and documented?				
Were new activities performed today? Were hazards identified, discussed during the daily safety tailgate, and incorporated into revised APP/SSHP?				
New materials brought on site? MSDSs available?				
Exclusion (EZ), Contamination Reduction (CRZ), and Support Zones (SZ) delineated and enforced?				
General housekeeping measures in place to prevent hazards?				
Emergency Planning				
Were there any changes to emergency contact names, telephone numbers, or hospital? If so, were site personnel made aware and was information distributed/reposted.				
Adequate safety equipment inventory available?				
Fire extinguisher available (monthly inspection of extinguisher will suffice)				
Eyewash station(s) functioning and in place (weekly inspection of eye wash station will suffice)?				
First aid supplies available (weekly inspection of first aid kit will suffice)?				
Communication equipment readily available for emergencies?				
Any reported accidents/incidents at this site? If so, were accident reporting procedures followed?				
Air Monitoring				
Monitoring equipment specified in SSHP available and in working order? Air monitoring instrumentation for this site includes – check each if required/on site, note deficiencies in comments: • Combustible gas meter • Organic vapor analyzer • Contaminant specific analyzer for benzene (if total organic vapor concentrations exceed 0.5 ppm)				
Monitoring equipment calibrated and calibration records				

Rating	Y	N	N/A	Comments/Immediate Corrective Action[1]
available?				
Environmental and personnel monitoring performed as specified in SSHP?				
PPE				
Proper dermal protection worn by EA and subcontracted employees when handling/ contacting hazardous chemicals or contaminated environmental media?				
Required PPE (hard hats, safety boots / shoes, eye protection with side shields, hearing protection) being worn by EA and subcontracted employees?				
PPE inspection completed by SSHO?				
Drill Rig Operations				
Daily rig inspection completed? Any equipment problems?				
Drill rigs/elevated equipment maintaining minimum 10-ft distance from energized (50 kV) overhead power lines?				
Investigation-derived Waste (IDW)				
Wastes properly staged, secured, and labeled at end of day?				

Additional Comments:

____
Site Safety and Health Officer’s Signature

____
Date

---

[1] If a deficiency is noted that cannot be immediately corrected, the SSHO will monitor the progress in correcting the deficiency and will document following:

- Date the deficiency was identified
- Description of the deficiency
- Name of the person responsible for correcting the deficiency
- Projected date of correction
- Actual date of correction.

Y = Satisfactory or Yes; N = Unsatisfactory or No, N/A = Not applicable

EA Engineering, Science, and Technology, Inc

Employee/Visitor Register and Safety Brief				
Date:				
Site Entry/Exit		**Name (Printed)**	**Signature**	**Company**
Time In	**Time Out**			

Record of On Site First Aid Treatment Corps of Engineers Employees	Office or Unit	Date
Name		Date & Time of Injury AM PM
Job Title	Supervisor	Location of First Aid Kit Used
Nature of Injury or Illness		
First Aid Supplies Used:		
Description of Incident and Location of Accident		
Treatment self administered ____ or administered by qualified FA provider ____Name of FA Provider:________________________________		
Referred to clinic/physician for further treatment? Yes __ No __ Form 3394 submitted? Yes __ No __		

MVN Form 360-R
Jan 04

Previous editions may not be used - Retain for one year

Proponent CEMVN-SS

ENVIRONMENTAL MONITORING RECORD

SITE: ______________________________

PROJECT NO.: ______________________________

INSTRUMENT: ______________________________

Time	Monitoring Location	Reading	Corrective Action Taken(a)

Comments: ______________________________

____

____

(a) Corrective actions taken must be documented whenever readings at or above action levels are reached. Monitoring equipment and action levels are specified in Section 9.33 of the Accident Prevention Plan.

Recorded By: ______________________________ Date: ______________

Site Health & Safety Officer

HEALTH AND SAFETY ACTIVITY REPORT

Site: ____ Location:____________________

Weather Cond.: ______________________ Onsite Hours: From _______ To _______

Changes in PPE Levels[1]	Work Operations	Reasons for Change

Site Safety and Health Plan Violations	Corrective Action Specified	Corrective Action Taken [2](yes/no)

Observations and Comments:

____

____

____

____

____

Completed by: ____ Date:
Site Health and Safety Supervisor

---

[1] Only SSHO may change PPE levels, using only criteria specified in APP/SSHP.

[2] If a deficiency is noted that cannot be immediately corrected, the SSHO will monitor the progress in correcting the deficiency and will document following:

- Date the deficiency was identified
- Description of the deficiency
- Name of the person responsible for correcting the deficiency
- Projected date of correction
- Actual date of correction.

EA Engineering, Science,
and Technology, Inc.

INITIAL SAFETY INSPECTION CHECKLIST
(TO BE COMPLETED FIRST DAY OF SITE ACTIVITIES)

Site: ______________________ Prepared by SSHO: ______________________
Location: ______________________
Project No.: ______________________ Project Manager: ______________________
Client: ______________________ Date : ______________________

Rating	**S**	**U**	**N/A**	**Comments/Immediate Corrective Action**[1]
Accident Prevention Plan (APP) and Site Safety and Health Plan (SSHP) General Requirements				
Was a pre-entry safety briefing conducted? If so, did it include the following: • Site personnel and roles and authority to stop work? • Competent person(s) for identifying hazards? • Disclosure of potential hazards? • Emergency response procedures including rally point, contacts, location and directions of nearest medical support (hospital)? • Use of fire extinguishers • Vehicle rules/regulations? • Equipment to be used and those personnel qualified to use the equipment? • Methods of decontamination? • Storing/staging of wastes and materials? • Location/use of Material Safety Data Sheets (MSDS)? • Site control, including requirements for documenting entry into the site and procedures for entry and exit into work zones? • Task specific personal protective equipment (PPE) requirements? • Applicable standard operating procedures? • Environmental monitoring requirements and action levels? • Responsibilities for safety of personnel/property? • Safe work practices? • Procedures for maintaining personnel and site sanitation?				
Approved APP/SSHP on site?				
APP/SSHP compliance agreement form signed by onsite personnel, including subcontractors?				
New activities or hazards identified and incorporated into revised APP/SSHP?				
Names of onsite personnel recorded on site sign in sheet?				
Applicable MSDSs on site or available?				
Hazard labeling practices currently being used?				
Records of daily inspections available for review?				
Daily tailgate safety meetings conducted and documented?				
Onsite personnel meet SSHP requirements for medical examinations, fit testing, and training (including subcontractors)?				
Documentation of training, medical examinations, and fit tests available from employer (as applicable)?				
Compliance with specified safe work practices?				
Exclusion (EZ), Contamination Reduction (CRZ), and Support				

S = Satisfactory; U = Unsatisfactory, N/A = Not applicable

Rating	**S**	**U**	**N/A**	**Comments/Immediate Corrective Action**[1]
Zones (SZ) delineated and enforced?				
Windsock, flag, or ribbons in place to indicate wind direction?				
SZ located upwind from EZ and CRZ, as practicable?				
Emergency Planning				
Emergency telephone numbers posted?				
Emergency telephone numbers up to date?				
Emergency route to hospital posted?				
Local emergency providers notified of site activities?				
Fire extinguisher on site, of adequate size, and inspected within past month?				
Review weather emergency procedures?				
Adequate safety equipment inventory available?				
First aid provider and first aid supplies available?				
Eyewash station(s) functioning and in place?				
Communication equipment readily available for emergencies?				
Any reported accidents/incidents at this site? If so, are the accident/incident reports available for review?				
Air Monitoring				
Monitoring equipment specified in SSHP available and in working order (See Instrumentation list below)?				
Monitoring equipment calibrated and calibration records available?				
Personnel know how to operate monitoring equipment and equipment manuals available on site?				
Environmental and personnel monitoring performed as specified in SSHP?				
Air monitoring instrumentation includes: • Combustible gas meter? • Organic vapor analyzer?				
PPE (SSHO to enforce PPE requirements for EA and subcontractor employess)				
Proper dermal protection worn when handling/ contacting hazardous chemicals or contaminated environmental media?				
Required PPE (hard hats, safety boots / shoes, eye protection with side shields) being worn?				
PPE inspection completed by SSHO?				
Hearing protection available? Worn when required?				
Heavy Equipment Operations				
Equipment operators experienced/properly trained?				
Dust control measures implemented in EZ, as necessary?				
Equipment regularly inspected and maintained?				
Utility lines located and marked prior to construction activities?				
Clearance/digging permits kept onsite and available for review?				
Drill rigs/elevated equipment maintaining minimum 10-ft distance from energized (50 kV) overhead power lines?				
When backing a vehicle up is a spotter used?				
Supplies				

S = Satisfactory; U = Unsatisfactory, N/A = Not applicable

Rating	**S**	**U**	**N/A**	**Comments/Immediate Corrective Action**[1]
Decontamination equipment and supplies on site?				
Fire extinguishers (functioning, inspected, and in field vehicles)?				
Spill cleanup supplies on site?				
Investigation-derived Waste (IDW)				
Wastes properly disposed of?				
Designated location for drummed IDW?				
IDW containers properly labeled?				
Additional Comments:				

____
Site Safety and Health Officer’s Signature

____
Date

---

[1] If a deficiency is noted that cannot be immediately corrected, the SSHO will monitor the progress in correcting the deficiency and will document following:
- Date the deficiency was identified
- Description of the deficiency
- Name of the person responsible for correcting the deficiency
- Projected date of correction
- Actual date of correction.

This page intentionally left blank

(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 Supplement to AR 385-40 The proponent agency is CESO	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 ☐ ON DUTY ☐ TDY ☐ OFF DUTY	h. EMPLOYMENT STATUS AT TIME OF ACCIDENT ☐ ARMY ACTIVE ☐ ARMY RESERVE ☐ VOLUNTEER ☐ PERMANENT ☐ FOREIGN NATIONAL ☐ SEASONAL ☐ TEMPORARY ☐ STUDENT ☐ OTHER *(Specify)* ____________

3. GENERAL INFORMATION

a. DATE OF ACCIDENT *(YYYYMMDD)*	b. TIME OF ACCIDENT *(Military Time)* hrs.	c. EXACT LOCATION OF ACCIDENT	d. CONTRACTOR'S NAME (1) PRIME
e. CONTRACT NUMBER ____________ ☐ CIVIL WORKS ☐ MILITARY ☐ OTHER *(Specify)* ____________	f. TYPE OF CONTRACT ☐ CONSTRUCTION ☐ SERVICE ☐ A/E ☐ DREDGE ☐ OTHER *(Specify)* ____________	g. HAZARDOUS/TOXIC WASTE ACTIVITY ☐ SUPERFUND ☐ DERP ☐ IRP ☐ OTHER *(Specify)*	(2) SUBCONTRACTOR

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 PRIMARY ____________ # (CODE) SECONDARY ____________ # (CODE)	g. TYPE AND SOURCE OF INJURY/ILLNESS TYPE ____________ # (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 FLOTATION 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 APPLICABLE
☐☐ 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. ACTIVITY AT TIME OF ACCIDENT ______________________________ (CODE) # ☐	a. ACTIVITY AT TIME OF ACCIDENT ______________________________ (CODE) # ☐

10. ACCIDENT DESCRIPTION *(Use additional paper, if necessary, see attached page 4.)*

11. CAUSAL FACTOR*(s)* *(Read instructions 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?	☐	☐
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? *(If yes, attach a copy.)*	☐	☐

12. TRAINING		
a. WAS PERSON TRAINED TO PERFORM ACTIVITY/TASK? ☐ YES ☐ NO	b. TYPE OF TRAINING ☐ CLASSROOM ☐ ON JOB	c. DATE OF MOST RECENT FORMAL TRAINING *(YYYYMMDD)*

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*(s)* *(Attach additional sheets as needed, See page 4)*

b. INDIRECT CAUSE*(s)* *(Attach additional sheets as needed, See page 5)*

14. ACTION*(s)* TAKEN, ANTICIPATED OR RECOMMENDED TO ELIMINATE CAUSE*(s)*		
DESCRIBE FULLY *(Attach additional sheets as necessary, See page 5)*		
15. DATES FOR ACTIONS IDENTIFIED IN BLOCK 14.		
a. BEGINNING *(YYYYMMDD)*	b. ANTICIPATED COMPLETION *(YYYYMMDD)*	
c. DATE SIGNED *(YYYYMMDD)*	d. TITLE OF SUPERVISOR COMPLETING REPORT	e. CORPS SIGNATURE, SUPERVISOR COMPLETING REPORT
c. DATE SIGNED *(YYYYMMDD)*	d. TITLE OF SUPERVISOR COMPLETING REPORT	e. CONTRACTOR SIGNATURE, SUPERVISOR COMPLETING REPORT
f. ORGANIZATION IDENTIFIER *(Division, Branch, Section, etc.,)*		g. OFFICE SYMBOL
16. MANAGEMENT REVIEW *(1st)*		
a. ☐ CONCUR b. ☐ NONCONCUR c. COMMENTS		
DATE *(YYYYMMDD)*	TITLE	SIGNATURE
17. MANAGEMENT REVIEW *(2nd - Chief Operations, Construction, Engineering, etc.,)*		
a. ☐ CONCUR b. ☐ NONCONCUR c. COMMENTS		
DATE *(YYYYMMDD)*	TITLE	SIGNATURE
18. SAFETY AND OCCUPATIONAL HEALTH OFFICE REVIEW		
a. ☐ CONCUR b. ☐ NONCONCUR c. ADDITIONAL ACTIONS/COMMENTS		
DATE *(YYYYMMDD)*	TITLE	SIGNATURE
19. COMMAND APPROVAL		
COMMENTS		
DATE *(YYYYMMDD)*	COMMANDER SIGNATURE	

10. ACCIDENT DESCRIPTION *(Continuation)*

13a. DIRECT CAUSE*(s) (Continuation)*

13b. INDIRECT CAUSE*(s) (Continuation)*

14. ACTION*(s)* TAKEN, ANTICIPATED, OR RECOMMENDED TO ELIMINATE CAUSE*(s) (Continuation)*

GENERAL. Complete a separate report for each person who was injured, caused, or contributed to the accident *(excluding uninjured personnel and witnesses)*. Use of this form for reporting USACE employee first-aid type injuries not submitted to the Office of Workers' Compensation Programs *(OWCP)* shall be at the discretion of the FOA commander. Please type or print legibly. Appropriate items shall be marked with an "X" in box(es). If additional space is needed, provide the information on a separate sheet and attach to the completed form. Ensure that these instructions are forwarded with the completed report to the designated management reviewers indicated in sections 16 and 17.

INSTRUCTIONS FOR SECTION 1 - ACCIDENT CLASSIFICATION

(Mark All Boxes That Are Applicable)

a. GOVERNMENT. Mark "CIVILIAN" box if accident involved government civilian employee; mark "MILITARY" box if accident involved U.S. military personnel.

(1) INJURY/ILLNESS/FATALITY - Mark if accident resulted in any government civilian employee injury, illness, or fatality that requires the submission of OWCP Forms CA-1 *(injury)*, CA-2 *(illness)* or CA-6 *(fatality)* to OWCP; mark if accident resulted in military personnel lost-time or fatal injury or illness.

(2) PROPERTY DAMAGE - Mark the appropriate box if accident resulted in any damage of $1000 or more to government property *(including motor vehicles)*.

(3) VEHICLE INVOLVED - Mark if accident involved a motor vehicle, regardless of whether "INJURY/ILLNESS/FATALITY" or "PROPERTY DAMAGE" are marked.

(4) DIVING ACTIVITY - Mark if the accident involved an in-house USACE diving activity.

b. CONTRACTOR.

(1) INJURY/ILLNESS/FATALITY - Mark if accident resulted in any contractor lost-time injury/illness or fatality.

(2) PROPERTY DAMAGE - Mark the appropriate box if accident resulted in any damage of $1000 or more to contractor property *(including motor vehicles)*.

(3) VEHICLE INVOLVED - Mark if accident involved a motor vehicle, regardless of whether "INJURY/ILLNESS/FATALITY" or "PROPERTY DAMAGE" are marked.

(4) DIVING ACTIVITY - Mark if the accident involved a USACE Contractor diving activity.

c. PUBLIC.

(1) INJURY/ILLNESS/FATALITY - Mark if accident resulted in public fatality or permanent total disability. *(The "OTHER" box will be marked when requested by the FOA to report an unusual non-fatal public accident that could result in claims against the government or as otherwise directed by the FOA Commander)*.

(2) VOID SPACE - Make no entry.

(3) VEHICLE INVOLVED - Mark if accident resulted in a fatality to a member of the public and involved a motor vehicle, regardless of whether "INJURY/ILLNESS/FATALITY" is marked.

(4) VOID SPACE - Make no entry.

INSTRUCTIONS FOR SECTION 2 - PERSONAL DATA

a. NAME - *(MANDATORY FOR GOVERNMENT ACCIDENTS. OPTIONAL AT THE DISCRETION OF THE FOA COMMANDER FOR CONTRACTOR AND PUBLIC ACCIDENTS)*. Enter last name, first name, middle initial of person involved.

b. AGE - Enter age.

c. SEX - Mark appropriate box.

d. SOCIAL SECURITY NUMBER - (*FOR GOVERNMENT PERSONNEL ONLY*) Enter the social security number *(or other personal identification number if no social security number issued)*.

e. GRADE - *(FOR GOVERNMENT PERSONNEL ONLY)* Enter pay grade. Example: 0-6; E-7; WG-8; WS-12; GS-11; etc.

f. JOB SERIES/TITLE - For government civilian employees enter the pay plan, full series number, and job title, e.g., GS-O810/Civil Engineer. For military personnel enter the primary military occupational specialty *(PMOS)*, e.g., 15A30 or 11G50. For contractor employees enter the job title assigned to the injured person, e.g., carpenter, laborer, surveyor, etc.

g. DUTY STATUS - Mark the appropriate box.

(1) ON DUTY - Person was at duty station during duty hours or person was away from duty station during duty hours but on official business at time of the accident.

(2) TDY - Person was on official business, away from the duty station and with travel orders at time of accident. Line-of-duty investigation required.

(3) OFF DUTY - Person was not on official business at time of accident.

h. EMPLOYMENT STATUS - *(FOR GOVERNMENT PERSONNEL ONLY)* Mark the most appropriate box. If "OTHER" is marked, specify the employment status of the person.

INSTRUCTION FOR SECTION 3 - GENERAL INFORMATION

a. DATE OF ACCIDENT - Enter the month, day, and year of accident.

b. TIME OF ACCIDENT - Enter the local time of accident in military time. Example: 1430 hrs *(not 2:30 p.m.)*.

c. EXACT LOCATION OF ACCIDENT - Enter facts needed to locate the accident scene, *(installation/project name, building number, street, direction and distance from closest landmark, etc.).*

d. CONTRACTOR NAME

(1) PRIME - Enter the exact name *(title of firm)* of the prime contractor.

(2) SUBCONTRACTOR - Enter the name of any subcontractor involved in the accident.

e. CONTRACT NUMBER - Mark the appropriate box to identify if contract is civil works, military, or other: if "OTHER" is marked, specify contract appropriation on line provided. Enter complete contract number of prime contract, e.g., DACW 09-85-C-0100.

f. TYPE OF CONTRACT - Mark appropriate box. A/E means architect/engineer. If "OTHER" is marked, specify type of contract on line provided.

g. HAZARDOUS/TOXIC WASTE ACTIVITY *(HTW)* - Mark the box to identify the HTW activity being performed at the time of the accident. For Superfund, DERP, and Installation Restoration Program *(IRP)* HTW activities include accidents that occurred during inventory, predesign, design, and construction. For the purpose of accident reporting, DERP Formerly Used DoD Site *(FUDS)* activities and IRP activities will be treated separately. For Civil Works O&M HTW activities mark the "OTHER" box.

INSTRUCTIONS FOR SECTION 4 - CONSTRUCTION ACTIVITIES

a. CONSTRUCTION ACTIVITY - Select the most appropriate construction activity being performed at time of accident from the list below. Enter the activity name and place the corresponding code number identified in the box.

CONSTRUCTION ACTIVITY LIST

1. MOBILIZATION
2. SITE PREPARATION
3. EXCAVATION/TRENCHING
4. GRADING (EARTHWORK)
5. PIPING/UTILITIES
6. FOUNDATION
7. FORMING
8. CONCRETE PLACEMENT
9. STEEL ERECTION
10. ROOFING
11. FRAMING
12. MASONRY
13. CARPENTRY
14. ELECTRICAL
15. SCAFFOLDING/ACCESS
16. MECHANICAL
17. PAINTING
18. EOUIPMENT/MAINTENANCE
19. TUNNELING
20. WAREHOUSING/STORAGE
21. PAVING
22. FENCING
23. SIGNING
24. LANDSCAPING/IRRIGATION
25. INSULATION
26. DEMOLITION

b. TYPE OF CONSTRUCTION EQUIPMENT - Select the equipment involved in the accident from the list below. Enter the name and place the corresponding code number identified in the box. If equipment is not included below, use code 24, "OTHER", and write in specific type of equipment.

CONSTRUCTION EQUIPMENT

1. GRADER
2. DRAGLINE
3. CRANE *(ON VESSEL/BARGE)*
4. CRANE *(TRACKED)*
5. CRANE *(RUBBER TIRE)*
6. CRANE *(VEHICLE MOUNTED)*
7. CRANE *(TOWER)*
8. SHOVEL
9. SCRAPER
10. PUMP TRUCK *(CONCRETE)*
11. TRUCK *(CONCRETE/TRANSIT MIXER)*
12. DUMP TRUCK *(HIGHWAY)*
13. DUMP TRUCK *(OFF HIGHWAY)*
14. TRUCK *(OTHER)*
15. FORKLIFT
16. BACKHOE
17. FRONT-END LOADER
18. PILE DRIVER
19. TRACTOR *(UTILITY)*
20. MANLIFT
21. DOZER
22. DRILL RIG
23. COMPACTOR/VIBRATORY ROLLER
24. OTHER

INSTRUCTIONS FOR SECTION 5 - INJURY/ILLNESS INFORMATION

a. SEVERITY OF INJURY/ILLNESS - Reference paragraph 2-10 of USACE Supplement 1 to AR 385-40 and enter code and description from list below.

NOI	NO INJURY
FAT	FATALITY
PTL	PERMANENT TOTAL DISABILITY
PPR	PERMANENT PARTIAL DISABILITY
LWD	LOST WORKDAY CASE INVOLVING DAYS AWAY FROM WORK
NLW	RECORDABLE CASE WITHOUT LOST WORKDAYS
RFA	RECORDABLE FIRST AID CASE
NRI	NON-RECORDABLE INJURY

b. ESTIMATED DAYS LOST - Enter the estimated number of workdays the person will lose from work.

c. ESTIMATED DAYS HOSPITALIZED - Enter the estimated number of workdays the person will be hospitalized.

d. ESTIMATED DAYS RESTRICTED DUTY - Enter the estimated number of workdays the person, as a result of the accident, will not be able to perform all of their regular duties.

e. BODY PART AFFECTED - Select the most appropriate primary and when applicable, secondary body part affected from the list below. Enter body part name on line and place the corresponding code letters identifying that body part in the box.

GENERAL BODY AREA	CODE	BODY PART NAME
ARM/WRIST	AB	ARM AND WRIST
	AS	ARM OR WRIST
TRUNK, EXTERNAL MUSCULATURE	B1	SINGLE BREAST
	B2	BOTH BREASTS
	B3	SINGLE TESTICLE
	B4	BOTH TESTICLES
	BA	ABDOMEN
	BC	CHEST
	BL	LOWER BACK
	BP	PENIS
	BS	SIDE
	BU	UPPER BACK
	BW	WAIST
	BZ	TRUNK OTHER
HEAD, INTERNAL	C1	SINGLE EAR INTERNAL
	C2	BOTH EARS INTERNAL
	C3	SINGLE EYE INTERNAL
	C4	BOTH EYES INTERNAL
	CB	BRAIN
	CC	CRANIAL BONES
	CD	TEETH
	CJ	JAW
	CL	THROAT, LARYNX
	CM	MOUTH
	CN	NOSE
	CR	THROAT, OTHER
	CT	TONGUE
	CZ	HEAD OTHER INTERNAL
ELBOW	EB	BOTH ELBOWS
	ES	SINGLE ELBOW
FINGER	F1	FIRST FINGER
	F2	BOTH FIRST FINGERS
	F3	SECOND FINGER
	F4	BOTH SECOND FINGERS
	F5	THIRD FINGER
	F6	BOTH THIRD FINGERS
	F7	FOURTH FINGER
	F8	BOTH FOURTH FINGERS
TOE	G1	GREAT TOE
	G2	BOTH GREAT TOES
	G3	TOE OTHER
	G4	TOES OTHER
HEAD, EXTERNAL	H1	EYE EXTERNAL
	H2	BOTH EYES EXTERNAL
	H3	EAR EXTERNAL
	H4	BOTH EARS EXTERNAL
	HC	CHIN
	HF	FACE
	HK	NECK/THROAT
	HM	MOUTH/LIPS
	HN	NOSE
	HS	SCALP
KNEE	KB	BOTH KNEES
	KS	KNEE
LEG, HIP, ANKLE, BUTTOCKS	LB	BOTH LEGS/HIPS/ ANKLES/
BUTTOCK	LS	SINGLE LEG/HIP/ ANKLE/BUTTOCK
HAND	MB	BOTH HANDS
	MS	SINGLE HAND
FOOT	PB	BOTH FEET
	PS	SINGLE FOOT
TRUNK, BONES	R1	SINGLE COLLAR BONE
	R2	BOTH COLLAR BONES
	R3	SHOULDER BLADE
	R4	BOTH SHOULDER BLADES
	RB	RIB
	RS	STERNUM *(BREAST BONE)*
	RV	VERTEBRAE *(SPINE; DISC)*
	RZ	TRUNK BONES OTHER
SHOULDER	SB	BOTH SHOULDERS
	SS	SINGLE SHOULDER
THUMB	TB	BOTH THUMBS
	TS	SINGLE THUMB
TRUNK, INTERNAL ORGANS	V1	LUNG, SINGLE
	V2	LUNGS, BOTH
	V3	KIDNEY, SINGLE
	V4	KIDNEYS, BOTH
	VH	HEART
	VL	LIVER
	VR	REPRODUCTIVE ORGANS
	VS	STOMACH
	VV	INTESTINES
	VZ	TRUNK, INTERNAL; OTHER

f. NATURE OF INJURY/ILLNESS - Select the most appropriate nature of injury/illness from the list below. This nature of injury/illness shall correspond to the primary body part selected in 5e, above. Enter the nature of injury/illness name on the line and place the corresponding CODE letters in the box provided.

* The injury or condition selected below must be caused by a specific incident or event which occurred during a single work day or shift.

GENERAL NATURE CATEGORY	CODE	NATURE OF INJURY NAME
*TRAUMATIC INJURY OR DISABILITY	TA	AMPUTATION
	TB	BACK STRAIN
	TC	CONTUSION; BRUISE; ABRASION
	TD	DISLOCATION
	TF	FRACTURE
	TH	HERNIA
GENERAL NATURE CATEGORY	CODE	NATURE OF INJURY NAME
	TK	CONCUSSION
	TL	LACERATION, CUT
	TP	PUNCTURE
	TS	STRAIN, MULTIPLE
	TU	BURN, SCALD, SUNBURN
	TI	TRAUMATIC SKIN DISEASES/ CONDITIONS INCLUDING DERMATITIS
	TR	TRAUMATIC RESPIRATORY DISEASE
	TQ	TRAUMATIC FOOD POISONING
	TW	TRAUMATIC TUBERCULOSIS
	TX	TRAUMATIC VIROLOGICAL/INFECTIVE/ PARASITIC DISEASE
	T1	TRAUMATIC CEREBRAL VASCULAR CONDITION/STROKE
	T2	TRAUMATIC HEARING LOSS
	T3	TRAUMATIC HEART CONDITION
	T4	TRAUMATIC MENTAL DISORDER, STRESS; NERVOUS CONDITION
	T8	TRAUMATIC INJURY - OTHER *(EXCEPT DISEASE, ILLNESS)*

** A nontraumatic physiological harm or loss of capacity produced by systemic infection; continued or repeated stress or strain; exposure to toxins, poisons, fumes, etc.; or other continued and repeated exposures to conditions of the work environment over a long period of time. For practical purposes, an occupational illness/disease or disability is any reported condition which does not meet the definition of traumatic injury or disability as described above.

**NON-TRAUMATIC ILLNESS/DISEASE OR DISABILITY

GENERAL NATURE CATEGORY	**CODE**	**NATURE OF INJURY NAME**
RESPIRATORY DISEASE	RA	ASBESTOSIS
	RB	BRONCHITIS
	RE	EMPHYSEMA
	RP	PNEUMOCONIOSIS
	RS	SILICOSIS
	R9	RESPIRATORY DISEASE, OTHER
VIROLOGICAL, INFECTIVE & PARASITIC DISEASES		
	VB	BRUCELLOSIS
	VC	COCCIDIOMYCOSIS
	VF	FOOD POISONING
	VH	HEPATITIS
	VM	MALARIA
	VS	STAPHYLOCOCCUS
	VT	TUBERCULOSIS
	V9	VIROLOGICAL/INFECTIVE/ PARASITIC - OTHER
DISABILITY, OCCUPATIONAL	DA	ARTHRITIS, BURSITIS
	DB	BACK STRAIN, BACK SPRAIN
	DC	CEREBRAL VASCULAR CONDITION; STROKE
	DD	ENDEMIC DISEASE *(OTHER THAN CODE TYPES R&S)*
	DE	EFFECT OF ENVIRONMENTAL CONDITION
	DH	HEARING LOSS
	DK	HEART CONDITION
	DM	MENTAL DISORDER, EMOTIONAL STRESS, NERVOUS CONDITION
	DR	RADIATION
	DS	STRAIN, MULTIPLE
	DU	ULCER
	DV	OTHER VASCULAR CONDITIONS
	D9	DISABILITY, OTHER
SKIN DISEASE OR CONDITION		
	SB	BIOLOGICAL
	SC	CHEMICAL
	S9	DERMATITIS, UNCLASSIFIED

g. TYPE AND SOURCE OF INJURY/ILLNESS *(CAUSE)* - Type and Source Codes are used to describe what caused the incident. The Type Code stands for an ACTION and the Source Code for an OBJECT or SUBSTANCE. Together, they form a brief description of how the incident occurred. Where there are two different sources, code the initiating source of the incident *(see example 1, below)*. Examples:

(1) An employee tripped on carpet and struck his head on a desk. TYPE: 210 *(fell on same level)* SOURCE: 0110 *(walking/working surface*).

NOTE: This example would NOT be coded 120 *(struck against)* and 0140 *(furniture)*.

(2) A Park Ranger contracted dermatitis from contact with poison ivy/oak.

TYPE: 510 *(contact)* SOURCE: 0920 *(plant)*

(3) A lock and dam mechanic punctured his finger with a metal sliver while grinding a turbine blade.

TYPE: 410 *(punctured by)* SOURCE: 0830 *(metal)*

(4) An employee was driving a government vehicle when it was struck by another vehicle.

TYPE: 800 *(traveling in)* SOURCE: 0421 *(government-owned vehicle, as driver)*

NOTE: The Type Code 800, "Traveling In" is different from the other type codes in that its function is not to identify factors contributing to the injury or fatality, but rather to collect data on the type of vehicle the employee was operating or traveling in at the time of the incident.

Select the most appropriate TYPE and SOURCE identifier from the list below and enter the name on the line and the corresponding code in the appropriate box.

CODE	**TYPE OF INJURY NAME**
	STRUCK
0110	STRUCK BY
0111	STRUCK BY FALLING OBJECT
0120	STRUCK AGAINST
	FELL, SLIPPED, TRIPPED
0210	FELL ON SAME LEVEL
0220	FELL ON DIFFERENT LEVEL
0230	SLIPPED, TRIPPED *(NO FALL)*
	CAUGHT
0310	CAUGHT ON
0320	CAUGHT IN
0330	CAUGHT BETWEEN
	PUNCTURED, LACERATED
0410	PUNCTURED BY
0420	CUT BY
0430	STUNG BY
0440	BITTEN BY
	CONTACTED
0510	CONTACTED WITH *(INJURED PERSON MOVING)*
0520	CONTACTED BY *(OBJECT WAS MOVING)*
	EXERTED
0610	LIFTED, STRAINED BY *(SINGLE ACTION)*
0620	STRESSED BY *(REPEATED ACTION)*
	EXPOSED
0710	INHALED
0720	INGESTED
0730	ABSORBED
0740	EXPOSED TO
0800	TRAVELING IN

CODE	**SOURCE OF INJURY NAME**
0100	BUILDING OR WORKING AREA
0110	WALKING/WORKING SURFACE *(FLOOR, STREET, SIDEWALKS, ETC.)*
0120	STAIRS, STEPS
0130	LADDER
0140	FURNITURE, FURNISHINGS, OFFICE EQUIPMENT
0150	BOILER, PRESSURE VESSEL
0160	EQUIPMENT LAYOUT *(ERGONOMIC)*
0170	WINDOWS, DOORS
0180	ELECTRICITY

0200	ENVIRONMENTAL CONDITION
0210	TEMPERATURE EXTREME *(INDOOR)*
0220	WEATHER *(ICE, RAIN, HEAT, ETC.)*
0230	FIRE, FLAME, SMOKE *(NOT TOBACCO)*
0240	NOISE
0250	RADIATION
0260	LIGHT
0270	VENTILATION
0271	TOBACCO SMOKE
0280	STRESS *(EMOTIONAL)*
0290	CONFINED SPACE
0300	MACHINE OR TOOL
0310	HAND TOOL *(POWERED; SAW, GRINDER, ETC.)*
0320	HAND TOOL *(NONPOWERED)*
0330	MECHANICAL POWER TRANSMISSION APPARATUS
0340	GUARD, SHIELD *(FIXED, MOVEABLE, INTERLOCK)*
0350	VIDEO DISPLAY TERMINAL
0360	PUMP, COMPRESSOR, AIR PRESSURE TOOL
0370	HEATING EQUIPMENT
0380	WELDING EQUIPMENT
0400	VEHICLE
0411	AS DRIVER OF PRIVATELY OWNED/RENTAL VEHICLE
0412	AS PASSENGER OF PRIVATELY OWNED/RENTAL VEHICLE
0421	DRIVER OF GOVERNMENT VEHICLE
0422	PASSENGER OF GOVERNMENT VEHICLE
0430	COMMON CARRIER *(AIRLINE, BUS, ETC.)*
0440	AIRCRAFT *(NOT COMMERCIAL)*
0450	BOAT, SHIP, BARGE
0500	MATERIAL HANDLING EQUIPMENT
0510	EARTHMOVER *(TRACTOR, BACKHOE, ETC.)*
0520	CONVEYOR *(FOR MATERIAL AND EQUIPMENT)*
0530	ELEVATOR, ESCALATOR, PERSONNEL HOIST
0540	HOIST, SLING CHAIN, JACK
0550	CRANE
0551	FORKLIFT
0560	HANDTRUCK, DOLLY
0600	DUST, VAPOR, ETC.
0610	DUST *(SILICA, COAL, ETC.)*
0620	FIBERS
0621	ASBESTOS
0630	GASES
0631	CARBON MONOXIDE
0640	MIST, STEAM, VAPOR, FUME
0641	WELDING FUMES
0650	PARTICLES *(UNIDENTIFIED)*
0700	CHEMICAL, PLASTIC, ETC.
0711	DRY CHEMICAL - CORROSIVE
0712	DRY CHEMICAL - TOXIC
0713	DRY CHEMICAL - EXPLOSIVE
0714	DRY CHEMICAL FLAMMABLE
0721	LIQUID CHEMICAL - CORROSIVE
0722	LIQUID CHEMICAL - TOXIC
0723	LIQUID CHEMICAL - EXPLOSIVE
0724	LIQUID CHEMICAL - FLAMMABLE
0730	PLASTIC
0740	WATER
0750	MEDICINE
0800	INAMINATE OBJECT
0810	BOX, BARREL, ETC.
0820	PAPER
0830	METAL ITEM, MINERAL
0831	NEEDLE
0840	GLASS
0850	SCRAP, TRASH
0860	WOOD
0870	FOOD
0880	CLOTHING, APPAREL, SHOES
0900	ANIMATE OBJECT
0911	DOG
0912	OTHER ANIMAL
0920	PLANT
0930	INSECT
0940	HUMAN *(VIOLENCE)*
0950	HUMAN *(COMMUNICABLE DISEASE)*
0960	BACTERIA, VIRUS *(NOT HUMAN CONTACT)*
1000	PERSONAL PROTECTIVE EQUIPMENT
1010	PROTECTIVE CLOTHING, SHOES, GLASSES, GOGGLES
1020	RESPIRATOR, MASK
1021	DIVING EQUIPMENT
1030	SAFETY BELT, HARNESS
1040	PARACHUTE

INSTRUCTIONS FOR SECTION 6 - PUBLIC FATALITY

a. ACTIVITY AT TIME OF ACCIDENT - Select the activity being performed at the time of the accident from the list below. Enter the activity name on the line and the corresponding number in the box. If the activity performed is not identified on the list, select from the most appropriate primary activity area *(water related, non-water related or other activity)*, the code number for "Other", and write in the activity being performed at the time of the accident.

WATER RELATED RECREATION

1. Sailing
2. Boating-powered
3. Boating-unpowered
4. Water skiing
5. Fishing from boat
6. Fishing from bank dock or pier
7. Fishing while wading
8. Swimming/supervised area
9. Swimming/designated area
10. Swimming/other area
11. Underwater activities *(skin diving, scuba, etc.)*
12. Wading
13. Attempted rescue
14. Hunting from boat
15. Other

NON-WATER RELATED RECREATION

16. Hiking and walking
17. Climbing *(general)*
18. Camping/picnicking authorized area
19. Camping/picnicking unauthorized area
20. Guided tours
21. Hunting
22. Playground equipment
23. Sports/summer *(baseball, football, etc.)*
24. Sports/winter *(skiing, sledding, snowmobiling etc.)*
25. Cycling *(bicycle, motorcycle, scooter)*
26. Gliding
27. Parachuting
28. Other non-water related

OTHER ACTIVITIES

29. Unlawful acts *(fights, riots, vandalism, etc.)*
30. Food preparation/serving
31. Food consumption
32. Housekeeping
33. Sleeping
34. Pedestrian struck by vehicle
35. Pedestrian other acts
36. Suicide
37. "Other" activities

b. PERSONAL FLOTATION DEVICE USED - If fatality was water-related was the victim wearing a person flotation device? Mark the appropriate box.

INSTRUCTIONS FOR SECTION 7 - MOTOR VEHICLE ACCIDENT

a. TYPE OF VEHICLE - Mark appropriate box for each vehicle involved. If more than one vehicle of the same type is involved, mark both halves of the appropriate box. USACE vehicle(s) involved shall be marked in left half of appropriate box.

b. TYPE OF COLLISION - Mark appropriate box.

c. SEAT BELT - Mark appropriate box.

INSTRUCTIONS FOR SECTION 8 - PROPERTY/MATERIAL INVOLVED

a. NAME OF ITEM - Describe all property involved in accident. Property/material involved means material which is damaged or whose use or misuse contributed to the accident. Include the name, type, model; also include the National Stock Number *(NSN)* whenever applicable.

b. OWNERSHIP - Enter ownership for each item listed. *(Enter one of the following: USACE; OTHER GOVERNMENT; CONTRACTOR; PRIVATE)*

c. $ AMOUNT OF DAMAGE - Enter the total estimated dollar amount of damage *(parts and labor)*, if any.

INSTRUCTIONS FOR SECTION 9 - VESSEL/FLOATING PLANT ACCIDENT

a. TYPE OF VESSEL/FLOATING PLANT - Select the most appropriate vessel/floating plant from list below. Enter name and place corresponding number in box. If item is not listed below, enter item number for "OTHER" and write in specific type of vessel floating plant.

VESSEL/FLOATING PLANTS

1. ROW BOAT
2. SAIL BOAT
3. MOTOR BOAT
4. BARGE
5. DREDGE/HOPPER
6. DREDGE/SIDE CASTING
7. DREDGE/DIPPER
8. DREDGE/CLAMSHELL, BUCKET
9. DREDGE/PIPE LINE
10. DREDGE/DUST PAN
11. TUG BOAT
12. OTHER

b. COLLISION/MISHAP - Select from the list below the object*(s)* that contributed to the accident or were damaged in the accident.

COLLISION/MISHAP

1. COLLISION W/OTHER VESSEL
2. UPPER GUIDE WALL
3. UPPER LOCK GATES
4. LOCK WALL
5. LOWER LOCK GATES
6. LOWER GUIDE WALL
7. HAULAGE UNIT
8. BREAKING TOW
9. TOW BREAKING UP
10. SWEPT DOWN 0N DAM
11. BUOY/DOLPHIN/CELL
12. WHARF OR DOCK
13. OTHER

INSTRUCTIONS FOR SECTION 10 - ACCIDENT DESCRIPTION

DESCRIBE ACCIDENT - Fully describe the accident. Give the sequence of events that describe what happened leading up to and including the accident. Fully identify personnel and equipment involved and their role*(s)* in the accident. Ensure that relationships between personnel and equipment are clearly specified. Continue on blank sheets if necessary and attach to this report.

INSTRUCTIONS FOR SECTION 11 - CAUSAL FACTORS

a. Review thoroughly. Answer each question by marking the appropriate block. If any answer is yes, explain in item 13 below. Consider, as a minimum, the following:

(1) DESIGN - Did inadequacies associated with the building or work site play a role? Would an improved design or layout of the equipment or facilities reduce the likelihood of similar accidents? Were the tools or other equipment designed and intended for the task at hand?

(2) INSPECTION/MAINTENANCE - Did inadequately or improperly maintained equipment, tools, workplace, etc. create or worsen any hazards that contributed to the accident? Would better equipment, facility, work site or work activity inspections have helped avoid the accident?

(3) PERSON'S PHYSICAL CONDITION - Do you feel that the accident would probably not have occurred if the employee was in "good" physical condition? If the person involved in the accident had been in better physical condition, would the accident have been less severe or avoided altogether? Was over exertion a factor?

(4) OPERATING PROCEDURES - Did a lack of or inadequacy within established operating procedures contribute to the accident? Did any aspect of the procedures introduce any hazard to, or increase the risk associated with the work process? Would establishment or improvement of operating procedures reduce the likelihood of similar accidents?

(5) JOB PRACTICES - Were any of the provisions of the Safety and Health Requirements Manual *(EM 385-1-1)* violated? Was the task being accomplished in a manner which was not in compliance with an established job hazard analysis or activity hazard analysis? Did any established job practice *(including EM 385-1-1)* fail to adequately address the task or work process? Would better job practices improve the safety of the task?

(6) HUMAN FACTORS - Was the person under undue stress *(either internal or external to the job)*? Did the task tend toward overloading the capabilities of the person; i.e., did the job require tracking and reacting to many external inputs such as displays, alarms, or signals? Did the arrangement of the workplace tend to interfere with efficient task performance? Did the task require reach, strength, endurance, agility, etc., at or beyond the capabilities of the employee? Was the work environment ill-adapted to the person? Did the person need more training, experience, or practice in doing the task? Was the person inadequately rested to perform safely?

(7) ENVIRONMENTAL FACTORS - Did any factors such as moisture, humidity, rain, snow, sleet, hail, ice, fog, cold, heat, sun, temperature changes, wind, tides, floods, currents, dust, mud, glare, pressure changes, lightning, etc., play a part in the accident?

(8) CHEMICAL AND PHYSICAL AGENT FACTORS - Did exposure to chemical agents *(either single shift exposure or long-term exposure)* such as dusts, fibers *(asbestos, etc.)*, silica, gases *(carbon monoxide, chlorine, etc.,)*, mists, steam, vapors, fumes, smoke, other particulates, liquid or dry chemicals that are corrosive, toxic, explosive or flammable, by products of combustion or physical agents such as noise, ionizing radiation, non-ionizing radiation *(UV radiation created during welding, etc.)* contribute to the accident/incident?

(9**)** OFFICE FACTORS **-** Did the fact that the accident occurred in an office setting or to an office worker have a bearing on its cause? For example, office workers tend to have less experience and training in performing tasks such as lifting office furniture. Did physical hazards within the office environment contribute to the hazard?

(10) SUPPORT FACTORS - Was the person using an improper tool for the job? Was inadequate time available or utilized to safely accomplish the task? Were less than adequate personnel resources *(in terms of employee skills, number of workers, and adequate supervision)* available to get the job done properly? Was funding available, utilized, and adequate to provide proper tools, equipment, personnel, site preparation, etc.?

(11) PERSONAL PROTECTIVE EQUIPMENT - Did the person fail to use appropriate personal protective equipment *(gloves, eye protection, hard-toed shoes, respirator, etc.)* for the task or environment? Did protective equipment provided or worn fail to provide adequate protection from the hazard*(s)*? Did lack of or inadequate maintenance of protective gear contribute to the accident?

(12) DRUGS/ALCOHOL - Is there any reason to believe the person's mental or physical capabilities, judgment, etc., were impaired or altered by the use of drugs or alcohol? Consider the effects of prescription medicine and over the counter medications as well as illicit drug use. Consider the effect of drug or alcohol induced "hangovers".

b. WRITTEN JOB/ACTIVITY HAZARD ANALYSIS - Was a written Job/Activity Hazard Analysis completed for the task being performed at the time of the accident? Mark the appropriate box. If one was performed, attach a copy of the analysis to the report.

INSTRUCTIONS FOR SECTION 12 - TRAINING

a. WAS PERSON TRAINED TO PERFORM ACTIVITY/TASK? - For the purpose of this section "trained" means the person has been provided the necessary information *(either formal and/or on-the-job (OJT) training)* to competently perform the activity/task in a safe and healthful manner.

b. TYPE OF TRAINING - Mark the appropriate box that best indicates the type of training; *(classroom or on-the-job)* that the injured person received, before the accident happened.

c. DATE OF MOST RECENT TRAINING - Enter YYYYMMDD of the last formal training completed that covered the activity task being performed at the time of the accident.

INSTRUCTIONS FOR SECTION 13 - CAUSES

a. DIRECT CAUSES - The direct cause is that single factor, which most directly lead to the accident. See examples below.

b. INDIRECT CAUSES - **I**ndirect causes are those factors which contributed to but did not directly initiate the occurrence of the accident.

Examples for section 13:

a. Employee was dismantling scaffold and fell 12 feet from unguarded opening.

Direct cause: failure to provide fall protection at elevation. Indirect causes: failure to enforce USACE safety requirements; improper training/motivation of employee *(possibility that employee was not knowledgeable of USACE fall protection requirements or was lax in his attitude towards safety)*; failure to ensure provision of positive fall protection whenever elevated; failure to address fall protection during scaffold dismantling in phase hazard analysis.

b. Private citizen had stopped his vehicle at intersection for red light when vehicle was struck in rear by USACE vehicle. *(Note: USACE vehicle was in proper/safe working condition).*

Direct cause: failure of USACE driver to maintain control of and stop USACE vehicle within safe distance.

Indirect cause: failure of employee to pay attention to driving *(defensive driving).*

INSTRUCTIONS FOR SECTION 14 - ACTION TO ELIMINATE CAUSE*(s)*

DESCRIPTION - Fully describe all the actions taken, anticipated, and recommended to eliminate the cause(s) and prevent reoccurrence of similar accidents/illnesses. Continue on blank sheets of paper if necessary to fully explain and attach to the completed report form.

INSTRUCTIONS FOR SECTION 15 - DATES FOR ACTION

a. **BEGIN DATE** - Enter the date YYYYMMDD when the corrective action(s) identified in section 14 will begin.

b. **COMPLETE DATE** - Enter the date YYYYMMDD when the corrective action(s) identified in section 14 will be completed.

c. **DATE SIGNED** - Enter YYYYMMDD that the report was signed by the responsible supervisor.

d.e.. **TITLE AND SIGNATURE -** Enter the title and signature of supervisor completing the accident report. For a GOVERNMENT employee accident/illness the immediate supervisor will complete and sign the report. For PUBLIC accidents the USACE Project Manager/Area Engineer responsible for the USACE property where the accident happened shall complete and sign the report. For CONTRACTOR accidents the Contractor's project manager shall complete and sign the report and provide to the USACE supervisor responsible for oversight of that contractor activity. This USACE supervisor shall also sign the report. Upon entering the information required in 15c., 15d., 15e., 15f. and 15g. below, the responsible USACE supervisor shall forward the report for management review as indicated in section 16.

f. **ORGANIZATION NAME** - For GOVERNMENT employee accidents enter the USACE organization name *(Division, Branch, Section, etc.)* of the injured employee. For PUBLIC accidents enter the USACE organization name for the person identified in block 15d. For CONTRACTOR accidents enter the USACE organization name for the USACE office responsible for providing contract administration oversight.

g. **OFFICE SYMBOL** - Enter the latest complete USACE Office Symbol for the USACE organization identified in block 15f.

INSTRUCTIONS FOR SECTION 16 - MANAGEMENT REVIEW (1st)

1ST REVIEW - Each USACE FOA shall determine who will provide 1st management review. The responsible USACE supervisor in section 15d. shall forward the completed report to the USACE office designated as the 1st Reviewer by the FOA. Upon receipt, the Chief of the Office shall review the completed report, mark the appropriate box, provide substantive comments, sign, date, and forward to the FOA Staff Chief *(2nd review)* for review and comment.

INSTRUCTIONS FOR SECTION 17 - MANAGEMENT REVIEW (2nd)

2ND REVIEW - The FOA Staff Chief *(i .e., FOA Chief of Construction, Operations, Engineering, Planning, etc.)* shall mark the appropriate box, review the completed report, provide substantive comments, sign, date, and return to the FOA Safety and Occupational Health Office.

INSTRUCTIONS FOR SECTION 18 - SAFETY AND OCCUPATIONAL HEALTH REVIEW

3RD REVIEW - The FOA Safety and Occupational Health Office shall review the completed report, mark the appropriate box, ensure that any inadequacies, discrepancies, etc. are rectified by the responsible supervisor and management reviewers, provide substantive comments, sign, date and forward to the FOA Commander for review, comment, and signature.

INSTRUCTION FOR SECTION 19 - COMMAND APPROVAL

4TH REVIEW - The FOA Commander shall *(to include the person designated Acting Commander in his absence)* review the completed report, comment if required, sign, date, and forward the report to the FOA Safety and Occupational Health Office. Signature authority shall not be delegated.

Attachment E

Site Safety and Health Plan

This page intentionally left blank

Attachment E
Site Safety and Health Plan

Long-Term Monitoring/Land Use Control Management
Former Seneca Army Depot
Romulus, New York

PREPARED FOR:

U.S. ARMY CORPS OF ENGINEERS,
ENGINEERING AND SUPPORT CENTER
HUNTSVILLE
5021 Bradford Drive East
Huntsville, Alabama 35805

CONTRACT NO. W912DY22D0131
TASK ORDER NO. W912DY22F0374

PREPARED BY:

EA Engineering, Science, and Technology, Inc., PBC

225 Schilling Circle, Suite 400
Hunt Valley, Maryland 21031

January 2023

---

* EA Engineering, P.C. is affiliated with EA Engineering, Science, and Technology, Inc., PBC (EAEST, Inc. PBC) who does business as EA Science and Technology in the State of New York. EAEST, Inc. PBC.

This page intentionally left blank

---

* EA Engineering, P.C. is affiliated with EA Engineering, Science, and Technology, Inc., PBC (EAEST, Inc. PBC) who does business as EA Science and Technology in the State of New York. EAEST, Inc. PBC.

TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF ACRONYMS AND ABBREVIATIONS

mg/m^3	Milligram(s) per cubic meter
AHA	Activity Hazard Analysis
AL	Action level
APP	Accident Prevention Plan
As	Arsenic
Ba	Barium
C	Ceiling limit
Ca	Potential occupational carcinogen
CDC	U.S. Center for Disease Control and Prevention
CFR	Code of Federal Regulations
COVID-19	Novel Coronavirus Disease 2019
CPR	Cardiopulmonary resuscitation
DEET	N,N-diethylmeta-toluamide
DOD	Department of Defense
EPA	U.S. Environmental Protection Agency
ft	Foot (feet)
IDLH	Immediately dangerous to life and death
LTM	Long-term monitoring
LUC	Land use control
MEC	Munitions and explosives of concern
NIOSH	National Institute for Occupational Safety and Health
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
OSHA	Occupational Safety and Health Administration
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PCE	Tetrachloroethene
PEL	Permissible exposure limit
PPE	Personal protective equipment
ppm	Part(s) per million
RMSF	Rocky Mountain Spotted Fever

LIST OF ACRONYMS AND ABBREVIATIONS (continued)

SEAD	Former Seneca Army Depot
SHM	Safety and Health Manager
SSHO	Site Safety and Health Officer
SSHP	Site Health and Safety Plan
STEL	Short-term exposure limit
SVOC	Semivolatile organic compound
TCE	Trichloroethene
TM	Technical Manager
TLV	Threshold Limit Value
USACE	U.S. Army Corp of Engineers
UXO	Unexploded ordinance
VOC	Volatile organic compound

1. SITE DESCRIPTION AND CONTAMINATION CHARACTERIZATION

1.1 This Site Safety and Health Plan (SSHP) has been prepared as an attachment to the Accident Prevention Plan (APP) for Former Seneca Army Depot (SEAD), Romulus, New York.

1.2 The scope of this project includes field activities related to groundwater sampling, sub-slab depressurization system monitoring, and associated reporting. Detailed information pertaining to the Scope of Work, equipment required, and definable features of work is presented in Chapter 2 of the APP.

1.3 SITE LOCATION AND BACKGROUND

1.3.1 General Description

1.3.1.1 Seneca Army Depot is a 10,587-acre former military facility located in Seneca County in the towns of Romulus and Varick, New York. SEAD is located between Seneca Lake and Cayuga Lake in Seneca County and is bordered by New York State (NYS) Highway 96 on the east, NYS Highway 96A on the west, and sparsely populated farmland to the north and south. The SEAD was owned by the U.S. Government and operated by the Department of the Army between 1941 and 2000. In 1999, SEAD's military mission was terminated, and the installation was closed in 2000 under Department of Defense's (DoD's) Base Realignment and Closure process. Since 2000, the Army has assumed a caretaker role at the SEAD, pending the close-out of environmental investigations, studies, and remedial activities that are required at the former facility. Environmental concerns at SEAD are being addressed through a Federal Facilities Agreement between the U.S. Army, U.S. Environmental Protection Agency (EPA) (EPA Site Identification [ID] NY0213820830), and the State of New York (Site ID 850006). As part of SEAD close-out activities, more than 8,250 acres of land within the SEAD was transferred to new owners for reuse.

1.3.1.2 To address employment and economic impacts associated with SEAD's closure, the Seneca County Board of Supervisors established the SEAD Local Redevelopment Authority in October 1995. The primary responsibility assigned to the Local Redevelopment Authority was to prepare a plan for redevelopment of the SEAD property. Following a comprehensive planning process, a Reuse Plan and Implementation Strategy for SEAD was completed and adopted by the Local Redevelopment Authority on 8 October 1996. The Seneca County Board of Supervisors subsequently approved this Reuse Plan on 22 October 1996. In 2005, after it had acquired portions of the SEAD from the U.S. Army, Seneca County Industrial Development Agency changed the planned use of land in many portions of the SEAD.

1.3.2 Site Background/History

1.3.2.1 SEAD was built in 1941 and was commissioned as a U.S. Army facility. It was utilized as a munitions storage and disposal facility by the U.S. Army from 1941 until the 1990s. In 1995, SEAD was listed in the Base Realignment and Closure Commission before its formal shut down in 2000. Since, the site has undergone site assessment and clean-up activities, and until 2019, U.S. Army personnel were stationed at the Base to allow access to Administrative Record and Permanent Record documents stored on the property (the Administrative Record is now web-based). The parcel originally consisted of approximately 10,600 acres. Since SEAD was decommissioned in 2000, the U.S. Army has served as a caretaker of the site throughout the processes of environmental assessments and remedial activities. Approximately 8,250 acres of the land has been transferred to new ownership. All the sites at SEAD have existing Records of Decision and are in either long-term monitoring (LTM) or land use control (LUC) (or both). EA will conduct a re-evaluation of each Record of Decision, as many are quite old and in need of revision with the current state of SEAD.

1.3.2.2 SEAD currently consists of 42 sites, each designated with respective SEAD identification numbers, in addition to several privately held parcels. This includes the following sites: SEAD 1, 2, 5, 12, 13, 16, 17, 23, 25, 26, 27, 39, 40, 41, 43, 44A, 44B, 46, 52, 56, 59, 62, 64A, 64B, 64C, 64D, 66, 67, 69, 71, 121C, 121I, 122B, 122E, 002-R-01, 003-R-01, 007-R-01, and the Ash Landfill Operable Unit (SEADs 3, 6, 8, 14, and 15).

1.4 CONTAMINANT CHARACTERIZATION

1.4.1 SEAD was listed as a National Priorities List site, in Group 14 on the Federal Section. Following this designation, EPA Region II, and the New York State Department of Environmental Conservation (NYSDEC) identified 72 solid waste management units (now considered individual sites, identified with the SEAD acronym and ID number). Evidence supported that hazardous substances or waste existed at these sites that may have been released into the environment, due to SEAD serving as a generator and treatment, storage, and disposal facility of hazardous wastes. Thus, SEAD was subject to regulation under the Resource Conservation and Recovery Act and the Comprehensive Environmental Response, Compensation and Liability Act regulation. Resource Conservation and Recovery Act requires that corrective/remedial action occur at each SEAD site as needed, which required that they be designated as requiring no action or as an area of concern.

1.4.2 Following remedial investigations and feasibility studies related to individual SEAD sites, multiple remedial activities have taken place on a site-specific basis to address environmental impacts at the sites. Environmental Risk Assessments have also been completed over time to assess and monitor ecological threats at the sites.

1.4.3 Generally, Contaminants of concern across the 42 sites include the following analytes found in soil and groundwater: metals, polycyclic aromatic hydrocarbons (PAHs), nitroaromatics, explosive compounds, phthalates, pesticides, semivolatile organic compounds (SVOCs), volatile organic compounds (VOCs), polychlorinated biphenyls (PCBs), alcohols, glycols, and alkanes (deicing components), and anions. Remedial actions that have historically taken place include excavation of soils impacted with contaminants of concern exceeding acceptable screening limits. Groundwater monitoring has occurred where applicable groundwater standards were exceeded. Some sites required monitoring of vegetated compacted soils cover placed over contaminated soils, and some required further qualitative assessments to visible surface water flow/transport of contaminants.

1.4.4 Sites: SEAD-23, SEAD-46, SEAD-002-R-01, SEAD-003-R-01, and SEAD-007-R-01 are known munitions and explosives of concern (MEC) sites and have a potential for encountering material potentially presenting an explosive hazard, which includes unexploded ordnance (UXO), and or discarded military munitions. Anomaly avoidance shall be implemented at all hazardous, toxic and radiological waste investigation sites.

This page intentionally left blank

2. HAZARD AND RISK ANALYSIS

2.1 The primary work phases are described in Chapter 2 of the APP. Each task has been analyzed to assess the potential safety, chemical, physical, radiological, ergonomic, and biological hazards that may be encountered by site personnel and prescribe the proper engineering and/or administrative controls and/or personal protective equipment (PPE). These controls will ensure that the risks to site personnel safety and health are reduced or eliminated while performing the project. The results of the task hazard analysis are documented using a task-specific Activity Hazard Analysis (AHA). An AHA has been developed for each task associated with this project. The AHAs are provided in Attachment A of the APP. The primary hazard groups of concern associated with this site are as follows:

- Chemical Hazards
- General Physical Hazards
- Fire/Explosion Hazards
- Vehicle and Pedestrian Hazards
- Utilities-Related Hazards
- Weather Hazards
- Material Handling/Moving/Lifting Hazards
- Biological Hazards
- Noise Hazards
- Potential MEC Hazards

2.2 CHEMICAL HAZARDS

2.2.1 The potential for exposure to chemical hazards may occur during site activities. Site chemicals discussed within the negative exposure assessment are identified in **Table 2-1**. Potential site chemicals based on the contaminant characterization presented in Section 1.2 and chemicals to be used on-site. Chapter 7 presents the exposure limits, routes of exposure, and symptoms of exposure for chemicals of potential concern that may be present at this site.

2.2.1 Evaluation of Site Contaminants of Concern

2.2.1.1 Contaminants of concern across the 42 sites include the following analytes found in soil and groundwater: metals, PAHs, nitroaromatics, explosive compounds, phthalates, pesticides, SVOCs, VOCs, PCBs, alcohols, glycols, and alkanes (deicing components), and anions.

Historical data were reviewed to determine the maximum possible concentration that could be expected for each potential site chemical, presented in **Table 2-1**.

For VOCs, PCBs, metals, anions, residual explosive compounds, pesticides, and SVOCs in soil and groundwater, no respiratory protection is warranted; however, the Site Safety and Health Officer (SSHO) in conjunction with the Technical Manager (TM) will conduct personal screenings with a PID for VOCs/SVOCs.

This page intentionally left blank

Table 2-1. Potential Site Chemical Hazards

Compound	PEL or TLV/STEL	IDLH	Route of Exposure	Symptoms
Other				
Portland Cement and nuisance dusts	1 mg/m^3	5000 mg/m^3	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, nose; cough, expectoration; exertional dyspnea (breathing difficulty), wheezing, chronic bronchitis; dermatitis.
Diesel Fuel *Skin*	100 mg/m^3 (Approximately 15 ppm)	—	Inhalation, Ingestion, Skin/Eye Contact	Dermatitis.
Gasoline	300 ppm/500 ppm	Ca	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, mucous membrane; dermatitis; headache, lassitude (weakness, exhaustion), blurred vision, dizziness, slurred speech, confusion, convulsions; chemical pneumonitis (aspiration liquid); possible liver, kidney damage; (potential occupational carcinogen).
VOCs				
Toluene	100 ppm	500 ppm	Inhalation, skin absorption, ingestion, skin and/or eye contact	Causes respiratory tract irritation. Inhalation of high concentrations (>200 ppm) of toluene are clearly associated with central nervous system encephalopathy, headache, depression, lassitude (weakness, exhaustion), impaired coordination, transient memory loss, and impaired reaction time.
p/m-xylene	100 ppm	1,000 ppm	Inhalation, skin absorption, ingestion, skin and/or eye contact	Dizziness, excitement, drowsiness, irritated eyes, nose and throat, nausea, vomiting, abdominal pain, and dermatitis.
o-xylene	100 ppm	1,000 ppm	Inhalation, skin absorption, ingestion, skin and/or eye contact	Dizziness, excitement, drowsiness, irritated eyes, nose and throat, nausea, vomiting, abdominal pain, and dermatitis
Benzene	1.0 ppm/5.0 ppm	Ca 500 ppm	Inhalation, Ingestion, Absorption, Skin/Eye Contact	Irritated eyes, nose, skin, respiratory system, nausea, headache, fatigue, dermatitis.
Ethylbenzene	20 ppm/125 ppm	800 ppm	Inhalation, Ingestion, Skin/Eye Contact	Irritated eyes, mucous membranes; headache, dermatitis, narcosis, coma.
Toluene *Skin*	20 ppm C 300 ppm	500 ppm	Inhalation, Ingestion, Absorption, Skin/Eye Contact	Irritated eyes, nose; fatigue, weakness, confusion, euphoria, dizziness, insomnia, nervousness, muscle fatigue, dermatitis.
Xylenes, total	100 ppm/150 ppm	900 ppm	Inhalation, Ingestion, Absorption, Skin/Eye Contact	Dizziness, excitement, drowsiness, irritated eyes, nose and throat, nausea, vomiting, abdominal pain, and dermatitis
TCE	10 ppm/25 ppm C 200 ppm	Ca 1,000 ppm	Inhalation, ingestion, absorption, skin/eye contact	Irritated eyes, skin; headache, dizziness, vertigo, visual distortion, fatigue, giddiness, vomiting, dermatitis, nausea.
PCE	25 ppm/100 ppm C 200 ppm	Ca 150 ppm	Inhalation, ingestion, absorption, skin/eye contact	Irritated eyes, nose, throat; nausea, flush face, dizziness, headache, liver damage.
PCBs				
Aroclor 1242	1.0 mg/m^3	5 mg/m^3 Ca	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, chloracne; liver damage; reproductive effects; [potential occupational carcinogen]
Aroclor 1254	0.5 mg/m^3	5 mg/m^3 Ca	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, chloracne; liver damage; reproductive effects; [potential occupational carcinogen]
SVOCs (PAH)				
Benzo(a)anthracene	0.2 mg/m^3	80 mg/m^3 Ca	Inhalation, Skin/Eye Contact	Dermatitis, bronchitis; suspected human carcinogen.

Table 2-1. Potential Site Chemical Hazards

Compound	PEL or TLV/STEL	IDLH	Route of Exposure	Symptoms
Benzo{a)pyrene	0.2 mg/m^3	80 mg/m^3 Ca	Inhalation, Skin/Eye Contact	Dermatitis, bronchitis; suspected human carcinogen.
Benzo(b)fluoranthene	0.2 mg/m^3	80 mg/m^3 Ca	Inhalation, Skin/Eye Contact	Dermatitis, bronchitis; suspected human carcinogen.
Chrysene	0.2 mg/m^3 (a)	80 mg/m^3 Ca	Inhalation, Skin/Eye Contact	Dermatitis, bronchitis; suspected human carcinogen.
Naphthalene	10 ppm/15 ppm	250 ppm	Inhalation, Ingestion, Absorption, Skin/Eye Contact	Eye irritation, headache, confusion, vomiting, profuse sweating, abdominal pain.
Pyrene	0.2 mg/m^3	80 mg/m^3 Ca	Inhalation, Skin/Eye Contact	Dermatitis, bronchitis; suspected human carcinogen.
Pesticides				
DDT	1.0 mg/m^3	500 mg/m^3 Ca	Inhalation, Ingestion, Absorption, Skin/Eye Contact	Irritation eyes, skin; paresthesia tongue, lips, face; tremor; anxiety, dizziness, confusion, malaise (vague feeling of discomfort), headache, lassitude (weakness, exhaustion); convulsions; paresis hands; and vomiting.
Dieldrin	0.25 mg/m^3	50 mg/m^3 Ca	Inhalation, Ingestion, Absorption, Skin/Eye Contact	Headache, dizziness; nausea, vomiting, malaise (vague feeling of discomfort), sweating; myoclonic limb jerks; clonic, tonic convulsions; coma. In Animals: liver, kidney damage.
Metals				
Arsenic (inorganic compounds as As)	0.01 mg/m^3 0.005 mg/m^3 AL	Ca 5 mg/m^3 (as As)	Inhalation and Ingestion via particulates, Skin/Eye Contact	Ulceration of nasal septum, dermatitis, gastrointestinal bleeding.
Barium (and soluble compounds as Ba)	0.5 mg/m^3	50 mg/m^3	Inhalation and Ingestion via particulates, Skin/Eye Contact	Upper respiratory irritation, muscle spasm, slow pulse, irritated eyes, skin.
Cadmium	0.005 mg/m^3	9.0 mg/m^3	Inhalation and Ingestion via particulates, Skin/Eye Contact	Pulmonary edema, dyspnea (breathing difficulty), cough, chest tightness, substernal (occurring beneath the sternum) pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; anosmia (loss of the sense of smell), emphysema, proteinuria, mild anemia.
Chromium	1.0 mg/m^3	250 mg/m^3	Inhalation and Ingestion via particulates, Skin/Eye Contact	Irritation eyes, skin; lung fibrosis (histologic).
Lead (and inorganic compounds as lead)	0.050 mg/m^3 0.030 mg/m^3 AL	100 mg/m^3 (as lead)	Inhalation and Ingestion via particulates, Skin/Eye Contact	Lassitude, insomnia, pallor, anoxia, weight loss, constipation, abdominal pain, colic, anemia, wrist paralysis.
Mercury	0.1 mg/m^3	10 mg/m^3	Inhalation and Ingestion via particulates, Skin/Eye Contact	Irritation eyes, skin; cough, chest pain, dyspnea (breathing difficulty), bronchitis, pneumonitis; tremor, insomnia, irritability, indecision, headache, lassitude (weakness, exhaustion); stomatitis, salivation; gastrointestinal disturbance, anorexia, weight loss; proteinuria.
Nickel	1.0 mg/m^3	Ca 10 mg/m^3 (as Ni)	Inhalation and Ingestion via particulates, Skin/Eye Contact	Sensitization dermatitis, allergic asthma, pneumonitis; (potential occupational carcinogen)

Table 2-1. Potential Site Chemical Hazards

Compound	PEL or TLV/STEL	IDLH	Route of Exposure	Symptoms
Selenium	0.2 mg/m^3	1.0 mg/m^3	Inhalation and Ingestion via particulates, Skin/Eye Contact	irritation eyes, skin, nose, throat; visual disturbance; headache; chills, fever; dyspnea (breathing difficulty), bronchitis; metallic taste, garlic breath, gastrointestinal disturbance; dermatitis; eye, skin burns; In Animals: anemia; liver necrosis, cirrhosis; kidney, spleen damage
Acids/Corrosives				
Hydrochloric acid	C 2 ppm	50 ppm	Inhalation, ingestion, skin/eye contact	Irritation nose, throat, larynx; cough, choking; dermatitis; solution; eye, skin burns; liquid; frostbite, in animals; laryngeal spasm; pulmonary edema.
Nitric acid	2 ppm/4 ppm	25 ppm	Inhalation, absorption, skin/eye contact	Corrosive to body tissue. Dental erosion, irritation, corrosive burns of skin, eyes, upper respiratory tract, delayed pulmonary edema, pneumonitis, and bronchitis.
Sulfuric acid	0.2 mg/m^3 thoracic fraction 1 mg/m^3	15 mg/m^3	Inhalation, absorption, skin/eye contact	Immediately damaging to any body tissue, it contacts at high concentrations. Severe or permanent damage to eyes, upper respiratory tract and lung damage.

Notes:

AL =	Action level
As =	Arsenic
Ba =	Barium
C =	Ceiling limit
Ca =	Potential occupational carcinogen
IDLH =	Immediately dangerous to life and death
PEL =	Permissible exposure limit
Skin =	Skin absorption can contribute to overall body dose
STEL =	Short-Term Exposure Limit (15 minutes)
TLV =	Threshold limit value

This page left intentionally blank

2.2.2 Dermal contact with these chemical hazards is possible. Many hazardous chemicals are readily absorbed through the skin. Therefore, dermal protection appropriate for the chemical will be worn when handling or contacting potentially contaminated environmental media (Chapter 5).

2.3 GENERAL PHYSICAL HAZARDS

2.3.1 Field operations at the site may include many general safety hazards, such as:

- Holes, ditches, etc.
- Precariously positioned objects, which may cause crushing or other injuries (e.g., hand tools, field equipment, safety equipment)
- Sharp objects (e.g., metal shards, debris or trash in the woods, hydraulic lines in vehicles) that may cause cuts, injection, or other injuries
- Slippery surfaces, posing slip and fall hazards (e.g., muddy areas or wet leaves)
- Uneven terrain, posing slip, trip, and fall hazards (all activities)
- Unstable surfaces that may pose fall, crushing, or other injuries

2.3.2 Site personnel will look constantly, closely, and carefully for these basic safety hazards and immediately inform the SSHO of previously-unidentified conditions that may present a hazard. If hazards are present, these hazards will be recorded by the SSHO, and precautionary measures will be taken to prevent injury. Materials handling at hazardous waste sites can vary from heavy equipment handling to manually moving/lifting items. Hazards associated with materials handling at SEAD will include physical injury.

2.3.3 Injuries to back and abdominal muscles from improperly lifting of loads are the most common occupational injuries reported. Such injuries can range from relatively mild strains to major, permanently disabling injuries. Before lifting a load (e.g., sample coolers, field equipment), personnel will consider the overall weight, distribution of weight, unwieldiness or awkwardness of the load, distance to be carried, obstacles to be negotiated, site conditions, and visibility. Workers will lift with their legs, keeping their back straight, keep the load close to their body, not twist while lifting, and not lift more than 50 pounds.

2.3.4 Fire/Explosion Hazards

2.3.4.1 The Fire Protection and Prevention Plan is presented in Section 9.27 of the APP.

2.3.5 Heavy Equipment Hazards

2.3.5.1 No heavy equipment will be required to complete this Scope of Work.

2.3.6 Vehicle and Pedestrian Hazards

2.3.6.1 Work is being conducted in an isolated area with no immediate external vehicle or pedestrian hazards.

2.3.7 Noise Hazards

2.3.7.1 Noise hazards are addressed within the Hearing Conservation Program (Section 9.10) of the APP.

2.3.8 Utilities

2.3.8.1 No known utilities are in the vicinity of the area where controls will be emplaced, nor will intrusive work occur.

2.3.9 Hand and Power Tools

2.3.9.1 Limited hand tools (wrenches, or similar tools) will be required to complete this investigation.

2.3.9.2 Use, Inspection, and Maintenance:

- Unsafe tools will not be used.
- Impact tools, such as chisels, will be kept free of mushroomed heads.
- Wooden handles will be kept free of splinters or cracks and will be kept tight in the tool.
- Hand and power tools will be used, inspected, and maintained in accordance with the manufacturer’s instructions and recommendations and will be used only for the purpose for which designed.
- Hand and power tools will be inspected, tested, and determined to be in safe operating condition before use: continued periodic inspections will be made to ensure safe operation condition and proper maintenance.
- Hand and power tools will be in good repair and with all required safety devices installed and properly adjusted: tools having defects that will impair their strength or render them unsafe will be removed from service.

2.3.9.3 Guarding

- Power tools designed to accommodate guards will be equipped with such guards.

- Portable power-driven circular saws will be equipped with guards above and below the base plate or shoe. When the tool is withdrawn from work, the lower guard will automatically and instantly return to the covering position.

2.3.9.4 Switches

- All hand-held powered drills, tappers, fastener drivers, horizontal, vertical, and angle grinders with wheels greater than 2 inches in diameter, disc sanders, belt sanders, reciprocating saws, saber saws, and other similar operating powered tools shall be equipped with a momentary contact "on-off" control and may have a lock-on control provided that turnoff can be accomplished by a single motion of the same finger or fingers that turn it on.

- All other hand-held powered tools, such as circular saws, chain saws, and percussion tools without positive accessory holding means, shall be equipped with a constant pressure switch that will shut-off the power when the pressure is released. This is a general safety precaution as these tools are not yet required to complete the investigation.

- Exception: This paragraph does not apply to concrete vibrators, concrete breakers, powered tampers, jack hammers, rock drills, and similar hand operated power tools.

2.3.9.5 Personal Protective Equipment

- Loose and frayed clothing, loose long hair, dangling jewelry (including dangling rings, chains, earrings, and wristwatches) will not be worn while working with power tools.

- Employees using hand and power tools and exposed to the hazard of falling, flying, abrasive, and splashing objects, or exposed to harmful dust, fumes, mists, vapors, or gases will be provided with the PPE necessary to protect them from the hazard.

2.3.9.6 Weather Hazards

2.3.9.6.1 Weather hazards and controls are presented in the Severe Weather Contingency Plan (Section 9.40 of the APP).

2.3.9.8 Material Handling/Moving/Lifting Hazards

2.3.9.8.1 Material handling at hazardous waste sites can vary from heavy equipment handling to manually moving/lifting items. Hazards associated with material handling include physical injury, detonation, fire, explosion, and vapor generation, among others. Injuries to back and abdominal muscles from improperly lifting of loads are the most common occupational injuries reported. Such injuries can range from relatively mild strains to major, permanently disabling injuries. Before lifting a load, personnel will consider the overall weight, distribution of weight, unwieldiness or awkwardness of the load, distance to be carried, obstacles to be negotiated, site conditions, and visibility. Loads anticipated to be moved during SEAD site activities include coolers, new drums, hand tools, and health and safety equipment. When using equipment to move materials, proper work practices will be followed, and equipment used will be designed for the task to be performed. Equipment will be inspected in accordance with the requirements presented in Chapter 7 of the APP. No repetitive motions are anticipated that would require further evaluation for this investigation.

2.4 BIOLOGICAL HAZARDS

2.4.1 A survey of the potential biological hazards (harmful plants, animals, and insects) was conducted for work areas. The results are summarized in the subsections below.

2.4.1 Bees, Hornets, and Wasps

 Carpenter Bee	 Honeybee	 Bumble Bee
 Paper Wasp	 Hornets (General)	 Yellow Jacket

Environment	Nests/hives are found in brush, grasses, and on the ground (especially for wasps). Habitat is more likely in drainages.
Health Hazards	Stinging of site personnel. Swelling and discomfort are typical; however, some people (rare) are hypersensitive to the injected toxins.
Symptoms	Swelling, itching, and minor pain are typical symptoms. Persons hypersensitive to the injected toxins may experience anaphylactic shock (violent and immediate response: intense swelling of body, life-threatening, potentially fatal).
Treatment	See First Aid Procedures below.
Protective Measures	*Awareness*: Note the presence of habitat or potential habitat and demarcate as appropriate (SSHO/TM will apply paint/tape/other to mark the location; employees will stay clear of the habitat). *PPE*: Level D PPE is required. See descriptions in the Chapter 5, and task-specific AHAs. Personnel will spray exposed skin with insect repellant containing n, n-diethyl meta-toluamide (DEET) A(approximately 33 percent solution) and clothing with insect repellant containing permethrin/permanone or DEET. Permethrin is for clothing only following manufacturer instructions. *Note*: Personnel with hypersensitivity to stings are required to carry an antidote pen on their person, instruct personnel on the use and location of the pen, and notify the SSHO/TM. If stung, personnel must notify the SSHO/TM immediately.
First Aid Procedures	General First Aid procedures in the event of a sting include washing the area with soap and water, removing the stinger (if present), applying a cold compress, and applying a topical antihistamine. In the event of excessive swelling (greater than 10 centimeters), swelling of the lips/throat, faintness, dizziness, confusion, rapid heartbeats, hives, or nausea/cramps/vomiting occurs notify the SSHO/TM and seek professional medical treatment. An antidote pen will be applied to address anaphylactic shock.
Inoculation	Not applicable.

2.4.2 Insects

 Mosquito	
Environment	Nests/hives are found in brush, grasses, and on the ground in wooded areas (most common) where there is standing water. This included non-natural pools like equipment tarps and site pooling of water.
Health Hazards	Stinging of site personnel and biting of site personnel. Swelling and discomfort are typical. In New York, mosquitoes may be a vector for West Nile Virus, Zika Virus, and Encephalitis.
Symptoms	Swelling, itching, and minor pain are typical symptoms. West Nile: bout 1 in 5 people who are infected will develop a fever and other symptoms. Less than 1 percent of those infected develop a serious, sometimes fatal, neurologic illness. Zika: If symptomatic, then typically fever, rash, joint pain, red eyes appearing 3–12 days after bite, lasts a few days, and most symptoms are mild.
Treatment	Refer to First Aid Procedures below.
Protective Measures	Awareness: Note the presence of habitat or potential habitat and demarcate as appropriate (SSHO will apply paint/tape/other to mark the location; employees will stay clear of the habitat). PPE: Level D PPE is required. See descriptions in Chapter 5. Personnel will spray exposed skin with insect repellant containing DEET (approximately 33 percent solution) and clothing with insect repellant containing permethrin/permanone or DEET.
First Aid Procedures	General First Aid procedures in the event of a sting include washing the area with soap and water, maintain proper hygiene of the sting area, as some personnel have been known to scratch the site until an open wound is present. Apply topical antihistamines to alleviate the symptoms and monitor for worsening of the above symptoms in the event of exposure to any infectious diseases. If symptoms worsen beyond mild, seek emergency medical care.
Inoculation	Not applicable for most of the above.

2.4.3 Arachnids (Spiders and Scorpions)

 Black Widow	 Brown Recluse Spider
Environment/ Habitat	**Black Widows**: Found in dark, out of the way places including storage sheds, brickwork, eaves, discarded building material, storm sewers, down spouts, outdoor lighting, and under outdoor furniture. These spiders are nocturnal and construct an irregular, unorganized, loosely woven web 1–6 feet (ft) above the ground with raisin-sized “cottony” egg sacs, grass clippings and often other debris. **Brown Recluse:** Found in dark, out of the way places including storage sheds, brickwork, eaves, discarded building material, storm sewers, down spouts, outdoor lighting, and under outdoor furniture. These spiders are nocturnal and construct an irregular, unorganized, loosely woven web 1–6 ft above the ground with raisin-sized “cottony” egg sacs, grass clippings and often other debris.
Health Hazards	The toxicity of the venom is inversely proportional to size. Systemic symptoms of the spiders are presented below.
Symptoms	**Black Widow:** Symptoms from bites are systemic, spreading through the lymphatic system and usually start about 1–3 hours post-bite, whereupon the patient seeks treatment. The most common symptoms are intense pain, rigid board-like stomach muscles, muscle cramping, malaise, local sweating, nausea, oliguria, vomiting, and hypertension. **Brown Recluse Spider:** Many bites are painful at inception and can produce slightly necrotic wounds that usually heal in a short duration without severe scarring. Other symptoms that may accompany the bite includes itching, shivering, vomiting, and a slight fever. The symptoms are usually short in duration and subside in several days.
Treatment	Refer First Aid procedures below.
Protective Measures	Awareness: Typically, a bite from this spider is not noticed until several hours later when the symptoms above become noticeable or severe. Look for disorderly webs; shake out clothing, boots, and gloves prior to wearing; and minimize disturbance of potential habitat. PPE: Level D PPE is required. See descriptions in Chapter 5 of the SSHP. Personnel will spray exposed skin with insect repellant containing DEET (approximately 33% solution) and clothing with insect repellant containing permethrin/permanone or DEET. If bitten, personnel must notify the SSHO immediately.
First Aid Procedures	Bites/Stings: Wash the area with soap and water; apply a cold compress and elevate the area above the level of the heart; then seek professional medical treatment. DO NOT apply heat or steroid creams, remove venom by suction, apply electricity, or apply a tourniquet.
Inoculation	Not applicable.

2.4.4 Ticks

 Black Legged	 Brown Dog	 Lone Star

Environment	Ticks are typically found along well-defined paths of grassy or transitional vegetation waiting for hosts to pass. Ticks cannot fly nor jump and wait on leaves or long grasses in a position called questing, holding two pairs of legs outstretched while two pairs of legs maintain a connection on the vegetation. Most people are infected by nymphal stages during the spring and summer. Nymphs are small enough to escape notice and can stay attached longer than adults, increasing risk of disease transmission.
Health Hazards	Transmission of Amblyomma (tularemia, ehrlichiosis, Rocky Mountain spotted fever [RMSF], boutonneuse fever); Dermacentor (RMSF, Colorado tick fever, tularemia, Siberian tick typhus, and Central European tick-borne encephalitis, as well as being an agent of tick paralysis); Hyalomma (Siberian tick typhus, Crimean-Congo hemorrhagic fever); Ixodes (Lyme disease, babesiosis , human granulocytic ehrlichiosis, Russian spring-summer encephalitis); and Rhipicephalus (RMSF and boutonneuse fever).
Symptoms	Symptoms of tick-borne diseases start within 2 weeks of being bitten. The most common symptoms for tick-borne disease are fever, headache, and muscle pain. There are disease-specific symptoms such the bull’s eye rash that can be seen in some cases of Lyme disease.
Treatment	See First Aid procedures below for acute actions. Treatment typically includes a complete dose of an antibiotic.
Protective Measures	*Awareness:* Wear light-colored clothing and perform tick checks in the morning, in the evening, after bathing, and intermittently throughout the day. During work hours, have other site personnel inspect clothing for the presence of ticks. *PPE:* Level D PPE is required. See PPE suites in AHAs and APP. Personnel will spray exposed skin with insect repellant containing DEET (approximately 33 percent solution) and clothing with insect repellant containing permethrin/permanone or DEET. Tuck and Tape for Ticks: tuck trouser legs into boots and tape boots to trouser legs. Also, tuck shirts into pants and wear a belt.
First Aid Procedures	If you find a tick attached to your skin, remove the tick as soon as possible. Use fine-tipped tweezers to grasp the tick as close to the skin’s surface as possible. Pull upward with steady, even pressure. If the mouthparts break off and remain in the skin, remove the mouthparts with tweezers. If you are unable to remove the mouth easily with clean tweezers, leave it alone and let the skin heal. After removing the tick, thoroughly clean the bite area and your hands with rubbing alcohol or soap and water. Never crush a tick with your fingers. Dispose of a live tick by putting it in alcohol, placing it in a sealed bag/container, wrapping it tightly in tape, or flushing it down the toilet. Monitor yourself and other site personnel for symptoms described above. Report all tick bites, suspected tick bites, and/or potential symptoms of tick-borne illness to the Unexploded Ordnance Safety Officer immediately and less than 24 hours from the incident.
Inoculation	Currently, there is no effective vaccine available for the illnesses listed above.

2.4.5 Poisonous Snakes

 Northern Copperhead	 Timber Rattlesnake
Environment	Copperheads live in a range of habitats, from terrestrial to semi-aquatic, including rocky, forested hillsides, and wetlands. They are also known to occupy abandoned and rotting wood or sawdust piles, construction sites, and sometimes suburban areas. They climb into low bushes or trees to hunt prey and will also bask in the sun and swim in the water. The timber rattlesnake occurs in a wide variety of terrestrial habitat including lowland cane thickets, high areas around swamps and river floodplains, hardwood and pine forests, mountainous areas, and rural habitats in farming areas. They typically become reduced in numbers in highly urbanized or areas of housing development.
Health Hazards	Snake bites often result in temporary tissue damage in the immediate area of bite. Their bite may be painful but is very rarely (almost never) fatal to humans.
Symptoms	A bite area may be tender and mildly swollen. Symptoms include redness and swelling around the bite, severe pain at the site of the bite, nausea and vomiting, labored breathing (in extreme cases, breathing may stop altogether), disturbed vision, increased salivation and sweating, numbness or tingling around your face and/or limbs.
Treatment	First Aid procedures are provided below for acute actions. Treatment is required by medical professionals and typically includes a complete dose of an antibiotic.
Protective Measures	*Awareness:* Avoid tall grass, be aware of snakes hanging from tree limbs, check before sticking hands into crevasses, holes, hollow logs. *PPE***:** Level D PPE is required. Descriptions are provided in Chapter 5 of the SSHP. Heavy pants and boots can protect against snake bites.
First Aid Procedures	Workers should take the following steps if they are bitten by a snake: seek medical attention as soon as possible (dial 911 or call local Emergency Medical Services); try to remember the color and shape of the snake, which can help with treatment of the snake bite; keep still and calm, this can slow down the spread of venom; inform your supervisor; apply First Aid if you cannot get to the hospital right away. First aid includes: lay or sit down with the bite below the level of the heart; wash the bite with soap and water; cover the bite with a clean, dry dressing.
Inoculation	Currently, there is no vaccine available for the illnesses listed above.

Notes:

Very little snake habitat is present on-site. Increased awareness should occur in areas with trees and around naturally running water.

2.4.6 Poisonous Plants

 Poison Ivy (Shrub)	 Poison Oak
Environment	The plants listed above are all regionally found.
Health Hazards	Poison Ivy (Urushiol Oil): Poison Ivy secretes urushiol oil, which causes contact dermatitis that can become severe if introduced into mucous membranes (i.e., eyes, nose).
Symptoms	Urushiol Oil: Swelling and itching; red rash within a few days of contact; bumps, streaking, and weeping blisters (blisters fluids not contagious). The rare potential exists for a severe allergic reaction including severe swelling or difficulty breathing.
Treatment	First Aid procedures are provided below.
Protective Measures	*Awareness:* Identify and avoid the plants listed above. Attempt to access the sampling locations using another route, or slightly relocate sampling locations, if the plants are present in the work area. Notify the SSHO if/when these plants are observed. Prevention: Clean tools used near known or suspected Poison Ivy with soap/water. PPE: Modified Level D PPE is required. Descriptions are provided in Chapter 5 of the SSHP.
First Aid Procedures	Urushiol Oil: Immediately rinse skin and wash with soap and water; apply a cold compress and hydrocortisone cream (do not apply to open blisters); and seek professional medical attention if severe swelling or difficulty breathing is observed. Generally, an oral antihistamine (e.g., diphenhydramine) may be taken to reduce the allergic response.
Inoculation	Not applicable.

2.4.7 Harmful Animals

2.4.7.1 Rodents, snakes, stray dogs, stray cats, raccoons, or other animals may be encountered on job sites. The only effective measure to preclude animal bites is avoidance. If wild animals are encountered, retreat to the support vehicle, and notify the SSHO immediately:

- Contact with wild animals will be avoided. Do not reach into an object such as a pipe that may contain a rodent or other animal or attempt to remove the animal. If possible, delay activity in this area until the animal leaves or has been removed by an animal control unit. If it is necessary to use or move an object where an animal is hiding, the SSHO may have to notify the local animal control agency to subdue an animal that may cause a risk to workers (e.g., a raccoon). Do not approach an animal under any circumstance, as this may cause the animal to be in an aggressive state. Persons bitten by an animal will seek medical assistance immediately, especially if it is suspected that the animal may be rabid. Aggressive or disoriented behavior, as well as foaming at the mouth, can be signs of rabid animals. Until medical assistance can be reached, persons will watch for symptoms of severe swelling, nausea, and shock. The local animal control agency will be contacted if a stray dog is observed on the property, especially if its presence will affect work activity or the animal’s safety. Do not attempt to leash a stray dog (no matter how harmless it may appear); doing so would greatly increase the risk of an animal bite.

2.4.8 Micro-organisms

2.4.8.1 The possibility of ingestion or exposure to micro-organisms may occur on-site within standing pools of water or any nearby water catchments. Personnel are prohibited from consuming non-potable water and will follow proper hygiene procedures prior to potential hand-to-mouth contact. Personnel will be required to follow hygiene procedures of handwashing and face washing each time exiting the primary work zone into the Support Zone. Discussions surrounding the novel coronavirus disease 2019 (COVID-19) infection are presented separately, below.

2.4.9 Coronavirus and Coronavirus Disease 2019

2.4.9.1 During an active outbreak of COVID-19, precautions need to be taken to prevent the spread of the virus. Federal and state travel and work restrictions will be followed as applicable. OSHA measures to prevent worker exposure will be followed at all times. A distance of 6 ft between employees will be maintained if more than two employees are required to be in the same general work area. If physical distancing is not possible due to the requirements of work, then personnel will follow guidance and don face masks.[1] All work should be completed in a way that severely limits timeframes with personnel within 6 ft of each other.

2.4.9.2 Symptoms of COVID-19 include, but are not limited to, fever, cough, shortness of breath or difficulty breathing, fatigue, muscle or body aches, headache, new loss of taste or smell, sore throat, congestion or runny nose, nausea or vomiting, and diarrhea that may appear 2 to 14 days after exposure. There is the potential for asymptomatic community transmission; therefore, preventive measures will be taken during all operations. In accordance with the contractor’s policy, employees that exhibit potential COVID-19 symptoms are not allowed on-site.

2.4.9.3 The questions below should be asked of each employee/subcontract employee and any potential site/office visitors to help us identify people that should be excluded from office/job sites:

- Do you currently have fever, cough, shortness of breath or difficulty breathing, fatigue, muscle or body aches, headache, new loss of taste or smell, sore throat, congestion or runny nose, nausea or vomiting, and diarrhea?

- Have you been in contact with someone who has been medically diagnosed with COVID-19?

- Have you traveled to states and countries with documented outbreaks within the last 14 days?

- Have you been in contact with anyone, including family members, who have traveled to countries or states with documented outbreaks with the last 14 days?

---

[1] Personnel are required to don face masks as per a Presidential Executive Order when working on areas receiving federal funding.

2.4.-.4 If an employee or subcontractor answers yes to any of the above questions, please ask them to leave the job site immediately and contact their supervisor, and the Safety and Health Manager (SHM) for further instruction.

2.4.9.5 The protocol for managing the transmission includes the requirement that all site personnel must:

- During the Daily Tailgate Safety Meeting, the personal screening process will be followed prior to site workers being allowed on-site.
- Employees will don a facial mask or face shield when working with others.
- Communications will be conducted via cell phone when possible when it is needed to contact personnel.
- A minimal distance of 6 ft will be maintained between all persons:
  - This includes tailgate safety meetings, decontamination areas, equipment operations, and the phases of work requiring surveys.
- During all operations, employees will remain aware of their surroundings and alert for any approaching site worker.
- When work is completed all commonly touched surfaces (equipment, cooler exteriors, etc.) will be decontaminated using a disinfectant capable of killing the virus on surfaces including:
  - Bleach – mix 5 tablespoons (1/3 cup) bleach per gallon of water or 4 teaspoons bleach per quart of water
  - Alcohol solutions with at least 70 percent alcohol
  - Other approved disinfectants listed at: https://www.epa.gov/pesticide-registration/list-n-disinfectants-use-against-sars-cov-2.
  - SSHO will purchase or provide disinfectants that require 30-second latency periods or less to increase viable use and compliance2.

2.4.9.6 The surface of each item will be wetted using a spray bottle or paper towel saturated with disinfectant. The item will be allowed to air dry, or disinfectant will be allowed on surface for at least 30 seconds before wiping with a clean paper towel.

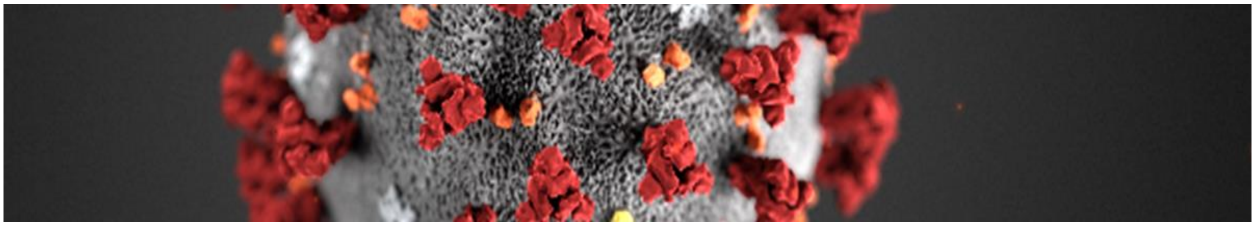
---

[2] Long latency periods occasionally result in non-compliant behavior regarding disinfection time.

2.4.9.7 In the event that personnel are screened with the potential to become positive, the SSHO will stop working, follow the notification procedure order of operations used in an emergency, and will immediately begin contact tracing protocols.

2.4.9.8 Additional guidance for workers in hot environments was presented by OSHA in September 2020. Acclimatized workers will be used to perform site activities and workers will only be required to don cloth face coverings when in close proximity. If site personnel experience issues with donning cloth face coverings, then face shields will be provided. Additionally, the SSHO will stagger work-rest periods to prevent interaction within communal areas. Workers will be encouraged to don breathable masks, light in color, and make an effort to keep the materials dry to maximize breathability.

2.4.10 COVID-19 Hazard Recognition via OSHA[3]



2.4.10.1 What is the risk to workers in the United States?

2.4.10.2 The risk of worker exposure to COVID-19, depends on numerous factors, including the extent of community transmission; the severity of resulting illness; existing medical conditions workers may have; environmental conditions that may affect exposure risk (e.g., working or living in close quarters); and the medical or other measures available to control the impact of the virus and the relative success of these measures. The U.S. Centers for Disease Control and Prevention (CDC) provides detailed information about this topic.

2.4.10.3 Certain people are at higher risk of developing more serious complications from COVID-19, including older adults and those with underlying medical conditions such as heart or lung disease, chronic kidney disease requiring dialysis, liver disease, diabetes, immune deficiencies, or obesity. See CDC's page for additional information about health conditions that put individuals at higher risk of serious illness from COVID-19.

2.4.10.4 For the most up-to-date information on OSHA’s guidance, see Protecting Workers: Guidance on Mitigating and Preventing the Spread of COVID-19 in the Workplace.

2.4.11.5 Classifying Risk of Worker Exposure to SARS-CoV-2

2.4.11.1 Worker risk of occupational exposure to SARS-CoV-2 during the pandemic may vary from community to community, depending on local conditions or outbreaks. Exposure risk depends in part on the physical environment of the workplace, the type of work activity, the health

---

[3] Accessed and revised on 30 June 2021.

status of the worker, the ability of workers to wear face coverings and abide by CDC guidelines, and the need for close contact (within 6 ft for a total of 15 minutes or more over a 24-hour period) with other people, including those known to have or suspected of having COVID-19, and those who may be infected with—and able to spread—SARS-CoV-2 without knowing it. Other factors, such as conditions in communities where employees live and work, their activities outside of work, and individual health conditions, may also affect workers' risk of getting COVID-19 and/or developing complications from the illness.

2.4.11.2 OSHA has divided job tasks into four potential risk exposure levels: very high, high, medium, and lower risk, as shown in the occupational risk pyramid.

2.4.11.3 As workers' job duties change or they perform different tasks in the course of their duties, they may move from one exposure risk level to another. Employers should always rely on current hazard assessments to identify workers' initial exposure risk to the virus on the job and changes to exposure risk if and when job duties change.

2.4.11.4 Note: The U.S. Department of Labor and U.S. Department of Health and Human Services originally published this risk pyramid as part of the Protecting Workers: Guidance on Mitigating and Preventing the Spread of COVID-19 in the Workplace (Spanish). EA's current understanding of how the SARS-CoV-2 virus spreads, combined with the risk of transmission by people who have the virus without knowing it, suggests that workers in areas with community transmission who have close contact with any other people, not just known or suspected COVID-19 cases, are at increased risk of exposure. Accordingly, OSHA has adjusted the risk categories and examples below to reflect this updated information.

2.4.11.10 Lower Exposure Risk (Caution)

2.4.11.10.1 Jobs that do not require close contact (within 6 ft for a total of 15 minutes or more over a 24-hour period) with other people. Workers in this category have minimal occupational contact with the public and other coworkers. Examples include:

- Remote workers (i.e., those working from home during the pandemic).
- Office workers who do not have frequent close contact with coworkers, customers, or the public.
- Healthcare workers providing only telemedicine services.

2.4.11.11 Medium and Very High Exposure Risk

- Not applicable for the Scope of Work.

2.4.11.12 How Does SARS-CoV-2 Spread?

- Although the pandemic possibly originated from humans exposed to infected animals, SARS-CoV-2, like other coronaviruses, spreads between people. The CDC acknowledges that at this time, there is no evidence that companion animals, including pets, play a significant role in spreading SARS-CoV-2 to people.

- According to the CDC, the virus that causes COVID-19 spreads most commonly through person-to-person contact (within about 6 ft), primarily through inhalation of respiratory particles (droplets and aerosols) produced when an infected person exhales, talks, sings, shouts, coughs, or sneezes. Less commonly, it is spread through airborne transmission over longer distances when smaller droplets and particles linger in air, particularly in enclosed spaces with inadequate ventilation.

- Another less common way that the virus spreads is when someone touches a contaminated surface, and then touches their nose, mouth, or eyes. Current evidence suggests that coronavirus may remain viable for hours to days on a variety of surfaces. Frequent cleaning of visibly dirty and high-touch surfaces, followed by disinfection, can help prevent SARS-CoV-2 and other respiratory pathogens (germs) from spreading in workplaces. Although touching contaminated surfaces or objects is not thought to be the main way the virus spreads, CDC is still learning more about various pathways of transmission.

- Person-to-person spread is likely to continue to occur in areas with community transmission and insufficient mitigation strategies.

- There is still more to learn about the transmissibility, severity, and other features associated with SARS-CoV-2.

2.4.11.13 Identifying Potential Risks and Sources of Exposure

- OSHA requires employers to provide a workplace free from recognized hazards that are causing or are likely to cause death or serious physical harm (29 U.S. Code § 654(a)(1)). To meet this obligation, it is important for employers to assess occupational hazards to which their workers may be exposed. Some OSHA standards, such as those for PPE (29 Code of Federal Regulations [CFR] 1910.132) and respiratory protection (29 CFR 1910.134), include requirements that will help protect workers from exposure to SARS-COV-2.

- In assessing potential hazards, employers should consider if and when their workers may be in close contact (within 6 ft) with someone who could have the virus and be able to spread it without knowing it. The extent of community spread, if any, is a key consideration in hazard assessment. Employers should also determine if workers could be exposed to environments (e.g., work sites) or materials (e.g., laboratory samples, waste) contaminated with the virus.

- Employers may also rely on the identification of infected individuals who have signs and/or symptoms of COVID-19 to help identify exposure risks for workers and implement appropriate control measures. It is also possible that someone may have been in close contact (within about 6 ft) with someone with COVID-19 in their community, and thus, may have had exposure that should prompt employer action (e.g., excluding the worker from the workplace during an appropriate self-monitoring quarantine period). The Control and Prevention page provides guidance for controlling risks for worker exposures.

2.4.11.14 Additional Information

- CDC provides data on COVID-19 cases and deaths in individual states, with links to additional data at the county level. These data can be used to help assess worker risk at specific work locations.

2.5 MUNITIONS AND EXPLOSIVES OF CONCERN HAZARDS

2.5.1 MEC may be encountered at the site. SEAD sites known to contain MEC are: SEAD-002-R-01, SEAD-003-R-01, SEAD-007-R-01, SEAD-23, and SEAD-46. All personnel should be alert for MEC at all times. Avoidance procedures and techniques will be utilized on all tasks. Personnel performing tasks related to MEC construction/avoidance support will follow the approved practices and procedures identified in the approved planning documents. A list of MEC-related tasks to be performed during this project is provided below:

- UXO escort of non-UXO qualified personnel (MEC avoidance)
- UXO Construction Support for any intrusive activities. Specifically at SEAD-23, which is known to contain MEC and in expected to have intrusive work performed.

2.5.1 General Work Practices

2.5.1.1 All project personnel will adhere to safe work procedures when working in an area with potential MEC. The following general precautions with regard to MEC will be observed at all times:

- DO NOT touch or move any ordnance item(s) regardless of the markings or apparent condition unless qualified to do so.

- DO NOT visit an ordnance site if an electrical storm is occurring or approaching. If a storm approaches during a site visit, leave the site immediately and seek shelter.

- DO NOT use radios or cellular phones in the vicinity of suspect ordnance items.

- DO NOT drive vehicles into a suspected MEC area; use clearly marked lanes.

- DO NOT carry matches, lighters, or other flame-producing devices onto a munitions response site.

- DO NOT rely on color code for positive identification of ordnance item(s) nor their contents.

- Approach ordnance items from the side; avoid approaching the front or rear areas.

- Always assume ordnance items contain a live charge until it can be ascertained otherwise by a qualified individual.

2.5.2 Specific Actions to be taken upon Locating Munitions Potentially Presenting an Explosive Hazard

2.5.2.1 Do not be misled by markings on the ordnance item stating practice or inert. Even practice items may have explosive charges that are used to mark/spot the point of impact; or the item could be incorrectly marked.

- Follow Engineer Manual 385-1-97 Explosive Safety (U.S. Army Corps of Engineers [USACE] 2008) general safety procedures when MEC encountered.

- Do not roll the item over or scrape the item to identify the markings.

- The location of any ordnance items found during sweep activities should be clearly marked so they can be easily located and avoided. Follow the procedures set forth in the Anomaly Avoidance Standard Operating Procedure located in the Quality Assurance Project Plan.

- Upon locating any munitions potentially presenting an explosive hazard, notify the SSHO so appropriate measures can be taken.

2.5.3 Specific Actions to be taken upon performing intrusive work in areas of know to have contained MEC

2.5.3.1 SEAD-23 is the only site identified as a MEC site, which will have intrusive work. All

- Any fieldwork associated sites identified as "MEC Sites" under this TO will be completed by personnel who are experienced with executing projects at military installations—including familiarity with MEC safety protocols and required coordination. Activities requiring anomaly avoidance will be conducted using DoD Explosives Safety Board Technical Paper-18 qualified UXO technicians who will clear an ingress/egress path and work area prior to entry by non-UXO qualified individuals. In addition, UXO technicians will clearly mark the cleared area utilizing techniques in full compliance with applicable federal, state, local, USACE, and Army policies, procedures, and regulations for military munitions response. This includes but is not limited to DoD Manual 6055.09-M, Ammunition and Explosive Safety Manual, Waste Military Munitions, and MPPEH; DoD 4145.26-M, DoD Contractor's Safety Manual for Ammunition and Explosives; Army Regulation 385-10, the Army Safety Program; Department of the Army Pamphlet 385-63, Range Safety; Department of the Army Pamphlet 385-64, Ammunition and Explosives

Safety Standards, DoD Instruction 4140.62. Sampling locations will be screened using a magnetometer and/or all metals detector prior to disturbance. If the UXO technician determines the selected area is clear, soil may be disturbed; however, if it cannot be determined that the area requiring subsurface disturbance is free of metallic anomalies, another location will be selected, and the process repeated until an acceptable area is found and communicated to USACE.

This page intentionally left blank

3. STAFF ORGANIZATION, QUALIFICATIONS, AND RESPONSIBILITIES

3.1 Chapter 4 of the APP shows the organization, qualifications, and responsibilities of staff. Attachment C of the APP present proofs-of-competency for key roles and key personnel for safety.

This page intentionally left blank

4. TRAINING

4.1 Training and certifications required for site personnel to complete this investigation are presented in Chapter 6 of the APP. Proofs-of-competency are presented in Attachment C of the APP.

This page intentionally left blank

5. PERSONAL PROTECTIVE EQUIPMENT

5.1 Based on the hazard assessment conducted by the SHM, and for tasks where engineering controls cannot eliminate the occupational hazards at the SEAD site, PPE is required. Employees have received OSHA-compliant PPE training as part of Hazardous Waste Operations and Emergency Response training.

5.2 SELECTION

5.2.1. The selection of the appropriate PPE was performed by the SHM. The type of PPE and level of protection will be re-evaluated periodically[4] by the SSHO, with feedback from site workers, in light of any new information about the site or site operations. Selection of the protective ensembles described below conforms to the levels of protection as described in the NIOSH Publication 85-115. Selection is based on an evaluation of the performance characteristics of the PPE relative to the site requirements/limitations, task-specific condition and duration, and hazards and potential hazards identified at the site.

5.3 PERSONAL PROTECTIVE EQUIPMENT USE

5.3.1 As previously stated, the contractor will provide PPE and the proper training on maintenance and use; however, the employees are required to use the PPE as provided and for the use of which it was intended.

5.4 TRAINING AND PROPER FITTING

5.4.1 Employees have received OSHA compliant PPE training as part of Hazardous Waste Operations and Emergency Response training. If the SSHO determines during site work that an employee needs to be re-trained, the SSHO will not allow the employee to perform the work activities until this re-training has occurred and will document the re-training as described in Table 6-1 of the APP.

5.5 INSPECTION AND IN-USE MONITORING

5.5.1 Inspection of PPE will be performed prior to use by the employee and is listed in Table 7-1 of the APP. PPE that does not pass inspection will be discarded and replaced.

5.6 MAINTENANCE AND STORAGE

5.6.1 Disposable PPE will be removed and disposed of in the Contamination Reduction Zone. Non-disposable PPE will be wiped clean for dust in the Contamination Reduction Zone. All PPE will be properly stored in site support vehicles.

---

[4] As required, but typically associated with a set of changing conditions requiring evaluation of PPE changes.

5.7 LEVELS OF PROTECTION AND REQUIREMENTS

5.7.1 Levels of protection at the site include Level D or Modified Level D. PPE required as part of first aid activities is not presented in this section; however, it will be provided for first aid/cardiopulmonary resuscitation (CPR) providers.

5.7.2 Level D Protection

5.7.2.1 Several work tasks at the SEAD site, except for drum management, contain no known atmospheric hazards and do not include splashes, immersion, or the potential for unexpected inhalation or contact with hazardous levels of any chemicals; therefore, Level D PPE includes:

- Work clothing consisting of long-sleeve shirts and work pants when working in heavily vegetated areas with potential for exposure to poisonous plants. Short-sleeve shirts are acceptable when outside of heavily vegetated areas or when worn in conjunction with over-the-counter barrier creams. Coveralls are also acceptable at all times.

- For work where a laceration hazard exists, heavy duty cloth, leather, or nylon cut-resistant gloves are recommended.

- Safety-toed boots (in accordance with American National Standards Institute Z41 and ASTM International Standards F2412 and F2413).

- Hearing protection (earplugs with a noise reduction ratio of 32 or muffs with a noise reduction ratio of 30) when in the Exclusion Zone and within 50 ft of heavy equipment in operation (including operators).

- Hard hats in accordance with American National Standards Institute/International Safety Equipment Association Z89.1.

- Chemical-resistant gloves (when contact with potentially contaminated media is expected or when working with applicable chemicals listed on Table 2-1). Based on the contaminant type(s) and concentration at this site and chemicals listed on Table 2-1, nitrile gloves will be utilized.

- High visibility apparel (e.g., blaze orange/yellow clothing and/or reflective safety vests) apparel is required when in the Exclusion Zone or when working near heavy equipment or traffic. It should be noted that that during hot work (e.g., welding), personnel either wear a flame-retardant safety vest or another employee (spotter) with a safety vest will be assigned to act as a lookout during the hot work.

- Safety glasses (Z87.1-rated) when within the Exclusion Zone or when conducting general site surveys.

- All disposable PPE will be bagged in plastic bags for non-hazardous disposal.

This page intentionally left blank

6. MEDICAL SURVEILLANCE

6.1 Site personnel for work to be completed at the SEAD site will be required to be enrolled in the medical surveillance program with their employer. Site workers that anticipate being exposed to contaminants at the PEL for 30 or more days a year or that may don respiratory protection will be enrolled in a medical surveillance program and will satisfactorily complete a comprehensive medical examination by or under the supervision of a licensed physician knowledgeable in occupational medicine prior to the initiation of field work. Contractor employees and subcontractors involved in those activities that may contact contaminated media (specifically, sampling activities and addressing investigation-derived waste) will be in the medical surveillance program. Medical examinations will be provided according to the following schedule:

- Prior to fieldwork assignment
- At least annually for employees covered by the program (biennially for those employees that do limit site work, with the approval of the occupational physician)
- At termination of employment or reassignment to an area where the employee had not been examined within the past 6 months
- As soon as possible after the development of signs or symptoms that may indicate an overexposure to hazardous substances or health hazards
- More frequently if the physician deems such examination necessary to maintain employee health.

6.2 Documentation for compliance with medical surveillance will be kept on-site. Further documentation is maintained in the contractor’s Office of Human Resources (410-584-7000). The records shall be complete and accurate and be kept on file for at least 30 years after termination of employment. A minimum of the following information shall be kept:

- Name and social security number
- Physician’s written opinions, recommendations, limitations, and test results
- Employee medical complaints related to hazardous waste operations
- Information provided to the physician by the employee concerning possible exposures, accidents, etc.

6.3 FIRST AID AND MEDICAL TREATMENT

6.3.1 At least two on-site workers will be currently certified in both first aid and CPR by the American Red Cross or equivalent organization. For this site, the Site Superintendent, and/or SSHO at a minimum are certified and will be on-site. Documentation of all personnel certifications will be kept on-site. The contractor has identified a hospital for emergency medical care for this project site. The hospital to be used during emergencies for this site is: Geneva General Hospital; 315-787-4000.

6.3.2 Employees will have the telephone number to the hospital during working hours should an occupational illness or injury occur. Individuals on-site currently certified in first aid will be called out at the start of each day's activities during the health and safety meeting. Certifications will be present on-site and will include separate Engineer Manual 385-1-1 (USACE 2014) 03.A.06a-c-compliant bloodborne pathogen training. For information on this training, refer to Chapter 6 of the APP. A site-specific Bloodborne Pathogen Exposure Control Plan is contained in Section 9.5 of the APP.

6.4 MEDICAL RESTRICTION

6.4.1 Should an occupational injury or illness occur that restricts or limits an employee's ability to function at full capacity, the contractor maintains a policy of providing these employees with restricted or modified duty assignments whenever possible to allow them to continue to be productive.

6.5 MEDICAL RECORDS

6.5.1 Medical and personal exposure monitoring records will be maintained according to the requirements of 29 CFR 1910.120 (f) and shall be kept for a minimum of 30 years beyond employment. Employee confidentiality shall be maintained.

7. EXPOSURE MONITORING

7.1 GENERAL

7.1.1 Exposure monitoring will be instituted during operations at the site. The monitoring program may be modified by the SHM with input from the SSHO if site conditions and monitoring results warrant. Monitoring will be accomplished under the direction of the SSHO, who will interpret the results. The SSHO will receive support by the Designated Representative and by site workers to ensure that monitoring is documented in a way to also reduce the risk associated with COVID-19. The results will be recorded on an environmental monitoring record (Attachment D of the APP).

7.2 AIR MONITORING PROGRAM

7.2.1 No air monitoring is required at this time as the VOC-contaminated groundwater is beneath land use controls. An addendum will be generated if site conditions change, and an Air Monitoring Plan is required.

7.2.1 General Area Monitoring

7.2.1.1 No air monitoring is required at this time as the VOC-contaminated groundwater is beneath land use controls. An addendum will be generated if site conditions change, and an Air Monitoring Plan is required.

7.2.1.2 Noise-generating monitoring and associated equipment is discussed in Section 9.10 of the APP and temperature-related monitoring is presented in Section 9.19 of the APP.

7.2.2 Real-Time Air Monitoring

7.2.2.1 No air monitoring is required at this time as the VOC-contaminated groundwater is beneath land use controls. An addendum will be generated if site conditions change, and an Air Monitoring Plan is required.

7.2.3 Perimeter Monitoring

7.2.3.1 Based on the above, perimeter monitoring is not required except for nuisance dust.

7.3 CALIBRATION AND MAINTENANCE

7.3.1 No air monitoring is required at this time as the VOC-contaminated groundwater is beneath land use controls. An addendum will be generated if site conditions change, and an Air Monitoring Plan is required.

This page intentionally left blank

8. TEMPERATURE RELATED STRESS

8.1 A Heat Stress Monitoring Plan is presented in Section 9.19 of the APP. A Cold Stress Monitoring Plan is not required due to the climate of the site.

This page intentionally left blank

9. STANDARD OPERATING PROCEDURES, ENGINEERING CONTROLS, AND WORK PRACTICES

9.1 SITE RULES

9.1.1 During field activities, personnel will remain in verbal, radio, or mobile phone contact with each other. The Site Superintendent and SSHO will use mobile telephones and will be responsible for handling communications during emergencies that may arise. Safe work practices that will be followed by site workers include, but are not limited to, the following rules:

- Working before or after daylight hours without special permission is prohibited.
- Eating and drinking, chewing gum or tobacco, and smoking in the Exclusion Zone is prohibited.
- Possessing, using, purchasing, distributing, or having controlled substances in their system throughout the day or during meal breaks is prohibited.
- Consuming or possessing alcoholic beverages is prohibited.
- Good housekeeping—The work area will be kept as clean as possible including frequent trash removal and efforts to keep floors dry and clean. Work areas will be kept clear of debris, tools, or other potential tripping hazards.
- Wash hands and face thoroughly upon leaving the Exclusion Zone.
- Immediately repair or replace defective PPE, but not while in the work area.
- Prescription drugs will not be taken by personnel unless specifically approved by a qualified occupational physician and then only within the Support Zone.
- Personnel on-site will use the buddy system; visual contact will be maintained between team members while in the work area.
- Dust suppression, such as wetting soil, shall be used to prevent dust generation as necessary on-site.

9.2 DAILY STARTUP AND SHUTDOWN PROCEDURES

9.2.1 The following general protocols will be followed daily prior to start of work activities and are a summarization of activities, training, and documentation covered in pertinent sections of the APP for the SEAD site:

- The SSHO will review site conditions to establish whether modification of work and safety plans is needed.

- Personnel will be briefed and updated on new safety procedures as appropriate.
- Safety equipment will be checked for proper function.
- The SSHO will ensure that first aid equipment is readily available.
- The SSHO will conduct monitoring activities and document accordingly.
- Personnel will proceed through appropriate decontamination procedures and facilities (e.g., hand washing, PPE removal) when exiting the Exclusion Zone, at the end of daily operations, and before breaks at the SEAD site.

9.3 SPILL CONTAINMENT

9.3.1 Emergency spill containment is presented in Section 9.2 of the APP.

9.4 SITE CONTROL MEASURES

9.4.1 Work zones are designed to prevent employees, visitors, and the surrounding environment from exposure to contamination during intrusive site activities. Site work zones will be established by the Site Superintendent/SSHO prior to initiating operations to control site access during site activities, as needed. Establishment of site work zones is based upon site conditions, activities, and exposure potentials.

9.5 EXCLUSION ZONE

9.5.1 There is no anticipated Exclusion Zone for the Former SEAD site. The establishment of an Exclusion Zone will be consistently refined as needed based on site conditions.

9.6 CONTAMINANT REDUCTION ZONE

9.6.1 There is no anticipated Contamination Reduction Zone for the Former SEAD site. The establishment of a Contamination Reduction Zone will be consistently refined as needed based on site conditions.

9.7 SUPPORT ZONE

9.7.1 The Support Zone shall consist of a staging area outside of the Contaminant Reduction Zone. It will contain the team vehicles, the site trailer, and other elements necessary to support site activities. PPE is not required in this area. A wide variety of work tasks at various locations is planned under the Performance Work Statement. The SSHO will determine the appropriate location of the Support Zone and ensure that it is demarcated properly.

9.8 SITE ENTRY AND EXIT

9.8.1 Persons entering the site, or treatment system will be required to wear the PPE assigned by the SSHO as specified in Section 5. Potentially contaminated PPE will be removed in the Contamination Reduction Zone.

9.9 EMERGENCY EQUIPMENT AND FIRST AID

9.9.1 Emergency equipment and first aid information are presented in Chapter 12.

This page left intentionally blank

10. PERSONNEL HYGIENE AND DECONTAMINATION

10.1 Fieldwork will be conducted in Level D or Modified Level D (when sampling) inside the treatment system building and when sampling wells. It will continue to be used until air sampling results confirm employee exposure is below the action level on Table 7-1 of the APP and allows for a downgrade to Modified Level D protection.

10.2 Site personnel will wash their hands, face, and exposed skin surfaces prior to ingestion of food, liquids or any other hand-to-mouth activities and when leaving the site. Decontamination units will be located in contamination reduction zones. Hand washing with potable water, soap, and paper towels will be available at the restroom facilities. The work trailer and site vehicles will also be furnished with hand sanitizer.

This page intentionally left blank

11. EQUIPMENT DECONTAMINATION

11.1 Decontamination will be supervised by the SSHO. The decontamination supplies and equipment will be maintained by the SSHO. Equipment decontamination will occur in Modified Level D PPE.

11.2 EQUIPMENT DECONTAMINATION

11.2.1 It is imperative that equipment and vehicles that come into contact with contaminated site media be decontaminated before allowing the items to leave the work area. It is anticipated that only sampling equipment and any other non-dedicated equipment and tools associated with geotechnical testing, groundwater sampling activities, and monitoring well abandonment will require decontamination.

11.2.2 Sampling equipment and small tools will be decontaminated using a non-phosphate detergent wash (Liquinox®/water) followed by a deionized water rinse contained in 5-gallon buckets. Decontamination fluid contained in the 5-gallon buckets will be properly disposed of at the end of the day or more frequently as needed.

11.3 WASTE DISPOSAL PROCEDURES

11.3.1 No hazardous waste is anticipated. PPE that cannot be decontaminated (i.e., chemical resistant suits, gloves, boot covers, respirator cartridges, etc.) will be placed in plastic trash bags. The disposal of any additional investigation-derived waste will be in accordance with EPA, state, and federal requirements.

This page intentionally left blank

12. EMERGENCY EQUIPMENT AND FIRST AID

12.1 A complete first aid kit (one per team or 25 personnel), meeting the requirements of a Type III, 16-unit or larger in a waterproof container will be readily available on-site and contain, at a minimum, a pocket mouthpiece for CPR, absorbent compresses, adhesive bandages, adhesive tape, antiseptic swabs, burn gel, sterile pads, and a triangular bandage. The contents of the kit(s) will be evaluated and possibly modified for this specific project. Kit(s) will be located not more than 300 ft from the work activity and may be transported in on-site vehicles.

12.2 The contents will be checked prior to their utilization for sterility and to replace expended items. The SSHO or other designated individual will inventory the kit(s) at least weekly and document the results in a log, an email to the SHM, or on the Daily Safety Inspection Checklist (provided in Attachment D of the APP). Expended or non-sterile contents will be replaced with serviceable items.

12.3 Prior to the start of work, the SSHO will discuss with site personnel the prevention steps, symptoms, and medical personnel available to assist with injuries or questions on diseases, plants, or animals that could be encountered while working on this project. Diseases, plants, and animals are discussed in Chapter 2.

12.4 A working cell phone or radio with adequate signal in this area will be maintained on-site and fully charged at the start of each workday.

12.5 Fire extinguisher sizes and placement are discussed in Section 9.27 of the APP and will be inspected at a frequency commensurate with Table 7-1 of the APP.

This page intentionally left blank

13. EMERGENCY RESPONSE AND CONTINGENCY PROCEDURES

13.1 Emergency response and contingency procedures are discussed in Section 9.2 of the APP including emergency contact telephone numbers. Directions and route to the nearest hospital are presented in Figure 9-1 (Section 9.2) of the APP.

This page intentionally left blank

14. REFERENCES

U.S. Army Corps of Engineers. 2008. *Engineer Manual 385-1-97Explosives Safety and Health Requirements Manual*. 17 May.

_______. 2014. *Engineer Manual 385-1-1 Safety and Health Requirements Manual*. 30 November.

This page intentionally left blank

Attachment F

Safety Data Sheets

This page intentionally left blank

Safety Data Sheet

Asphalt

Section 1. Identification

Product identifier:	Asphalt
Other means of identification:	Asphalt Asphaltum Bitumen Petroleum Petroleum Bitumen Road Asphalt Roofing Asphalt Blacktop Patch
Relevant Uses:	Basic component in Commercial Asphalt Paving and Construction.
Manufacturers Name:	CEMEX
Address:	929 Gessner Road, Suite 1900 Houston TX, 77024 T Customer Care 1-800-99-CEMEX
Emergency telephone number:	CHEMTREC: 1-800-424-9300

Section 2. Hazards Identification

OSHA/HCS status:	This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).
Category Classification(s):	SKIN CORROSION - Category 1 EYE DAMAGE - Category 1 MUTAGENICITY - Category 1B CARCINOGENICITY/INHALATION - Category 1 REPRODUCTIVE TOXICITY - Category 2 SINGLE TARGET ORGAN TOXICITY (REPEATED EXPOSURE) - Category 2

GHS label elements:

Hazard pictograms:

GHS05

GHS08

Signal word:	Danger
Hazard statements:	Causes severe skin burns and eye damage Causes serious eye damage May cause genetic defects (Inhalation) May cause cancer (Inhalation) Suspected of damaging fertility or the unborn child (Inhalation)
Precautionary Statements:	Obtain special instructions before use Do not handle until all safety precautions have been read and understood

Do not breathe dust, fume, mist
Wash clothing, hands, forearms and face thoroughly after handling
Wear eye protection, protective clothing, protective gloves
If swallowed: rinse mouth. Do NOT induce vomiting
If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower
If inhaled: Remove person to fresh air and keep comfortable for breathing
If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If exposed or concerned: Get medical advice/attention
Get medical advice/attention if you feel unwell and immediately call a POISON CENTER
Specific treatment (see Section 4 on this label)
Take off contaminated clothing and wash it before reuse
Dispose of contents/container to comply with local/regional/national/international regulations

Other Hazards: Not applicable.

Section 3. Composition / Information on Ingredients

Substance/mixture: Asphalt/Aggregate Product

Ingredient Name	% Content	CAS number
Aggregate	93	308075-07-2
Petroleum Asphalt	2 - 3	8052-42-4
Kerosene	1	8008-20-6
Naphtha, Coal Tar	1	8030-30-6
Quartz (crystalline silica)	> 0.1	14808-60-7

Any concentration shown as a range is to protect confidentiality or is due to process variation.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Section 4. First-Aid Measures

Description of necessary first aid measures:

General: Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.

Eye contact: Get medical attention immediately. Call a poison center or physician. Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 15 minutes.

Inhalation: Seek medical help if coughing or other symptoms persist. Seek medical attention and immediately and contact a poison center. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If the individual is not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth- to-mouth resuscitation. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Skin contact: Quickly and gently blot or brush away excess product. Immediately wash thoroughly with lukewarm, gently flowing water and non-abrasive pH neutral soap. Seek medical attention for burns, irritation, dermatitis and prolonged unprotected exposures. Get medical attention if irritation persists.

Ingestion: Seek medical attention and immediately contact a poison center. Have victim rinse mouth thoroughly with water. DO NOT INDUCE VOMITING unless directed to do so by medical personnel. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Have victim drink 60 to 240 mL (2 to 8 oz.) of water. Stop giving water if the exposed person feels sick as vomiting may be dangerous. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Chemical burns must be treated promptly by a physician. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and seek medical attention immediately. Maintain an open airway.

Potential symptoms and effects from acute exposures (delayed or immediate):

Eye contact:	Causes serious eye damage.
Inhalation:	May cause respiratory irritation.
Skin contact:	Causes severe burns. Discomfort or pain cannot be relied upon to alert a person to a serious injury. You may not feel pain or the severity of the burn until hours after the exposure. Chemical burns must be treated promptly by a physician.
Ingestion:	Not expected to be a significant route of entry. May cause burns to mouth, throat and stomach.

Potential symptoms and effects from over-exposures:

Eye contact:	Adverse symptoms may include the following: pain, watering and redness.
Inhalation:	Adverse symptoms may include the following: respiratory tract irritation and coughing. Prolonged breathing of vapors can be a central nervous system depressant.
Skin contact:	Adverse symptoms may include the following: pain or irritation, redness and blistering may occur, skin burns, ulceration and necrosis may occur
Ingestion:	Adverse symptoms may include the following: stomach pains

Recommendations for immediate medical attention / treatment:

If large quantities have been Ingested or inhaled:	Seek medical treatment and contact poison treatment specialist immediately.
Notes to physician:	Treat symptomatically.
Protection of first-aiders:	No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

Section 5. Fire-fighting Measures

Extinguishing media

Suitable extinguishing media:	Non-flammable. Use an extinguishing agent suitable for the surrounding fire.
Specific hazards arising from the chemical:	No specific fire or explosion hazard as packaged.
Hazardous thermal decomposition	Decomposition products may include the following materials: carbon monoxide, sulfur oxides (hydrogen sulfide), products: paraffins, naphthenes, aromatics and olefins. Hydrogen sulfide is an extremely flammable gas.
Special protective actions for firefighters:	Evacuate area. Fight fire with normal precautions from a reasonable distance. Move containers from fire area if this can be done without risk.
Special protective equipment for fire-fighters:	Positive pressure self-contained breathing apparatus (SCBA) and structural firefighters' protective clothing will provide adequate protection.

Section 6. Accidental Release Measures

Personal precautions, protective equipment and emergency procedures

No action shall be taken involving any personal risk or without suitable training. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment. For personal protective clothing requirements, please see Section 8.

For non-emergency personnel:	Evacuate area, if necessary. Contact emergency personnel, if needed. Do not breathe vapor, mist or dust. Stay upwind.
For emergency responders:	Evacuate surrounding areas if necessary. Keep unnecessary and unprotected personnel from entering. Do not breathe vapor, mist or dust. Provide adequate ventilation.
Environmental precautions:	Avoid release to the environment. Contain the spill to avoid the discharge of spilled material into drains, surface waters and/or groundwater. If the spilled material enters any drainage systems, surface waters and/or groundwater, follow all applicable local, state and federal laws and regulations for additional clean-up and/or reporting requirements.

Methods and materials for containment and cleaning up

Small and large spills:	Wear appropriate personal protective equipment as described in Section 8 for cleaning, containing and removing the spill. Solid Form: Minimize generation of dust. For small spills, clean with a vacuum with a filtration system sufficient to remove and prevent recirculation of dust (a vacuum equipped with a high-efficiency particulate air (HEPA) filter is recommended). For large spills, use control dust measures and carefully scoop or shovel into clean dry container for later reuse or disposal. DO NOT USE COMPRESSED AIR TO CLEAN SPILLS. Liquid Form: Eliminate all ignition sources in the vicinity of the spill. Hydrocarbons such as kerosene or mineral oil can be used to dissolve any remaining material. In turn, these hydrocarbons or oils can be absorbed with clay or diatomaceous earth. Place the material in disposable containers. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and Storage

Precautions for safe handling

Protective measures:	Put on appropriate personal protective equipment (see Section 8). Avoid exposure by obtaining and following special instructions before use. Do not handle until all safety precautions have been read and understood. Do not get in eyes or on skin or clothing. Do not breathe vapor, mist or dust. Do not ingest. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. At elevated temperatures, this product will cause thermal burns and may release toxic hydrogen sulfide. Hydrogen sulfide is a fatal and highly flammable gas. Explosion can occur if hydrogen sulfide is allowed to accumulate in the headspace of closed systems in the presence of an ignition source
Advice on general occupational hygiene:	Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking.
Conditions for safe storage:	Store and handle in accordance with all current regulations and standards. Keep separated from incompatible substances.

Section 8. Exposure Controls / Personal Protection

Occupational Exposure Limits

Ingredient name	Exposure limits
Quartz (crystalline silica)	ACGIH TLV (United States, 3/2012). TWA: 0.025 mg/m^3 8 hours. Form: Respirable NIOSH REL (United States, 6/2009). TWA: 0.05 mg/m^3 8 hours. Form: Respirable

	OSHA PEL Z-3 (United States, 9/2005). TWA: 10mg/m^3 divided by %SiO2 + 2: Respirable TWA: 30mg/m^3 divided by %SiO2 + 2: Total
Asphalt Fumes	ACGIH TLV (United States, 3/2013). TWA: NIOSH REL (United States, 6/2009). TWA: Ceiling 5 mg/m^3 [15-minute] See Appendix A, Appendix C OSHA PEL (United States, 6/2010). TWA: None
Kerosene (as total hydrocarbon vapor)	ACGIH TLV (United States, 3/2012). TWA: 200 mg/m^3 NIOSH REL (United States, 6/2009). TWA: 100 mg/m^3 OSHA PEL (United States, 6/2010). TWA: none
Naphtha, Coal Tar	NIOSH REL (United States, 6/2009). TWA: 100 ppm (400 mg/m^3) OSHA PEL (United States, 6/2010). TWA: 100 ppm (400 mg/m^3)
Particulates Not Otherwise Regulated (Total Dust)	ACGIH TLV (United States, 3/2012) TWA: 3 mg/m^3 8 hours. Form: Respirable TWA: 10 mg/m^3 8 hours. Form: Total dust OSHA PEL (United States, 6/2010). TWA: 5mg/m^3 8 hours. Form: Respirable TWA: 15 mg/m^3 8 hours. Form: Total dust

Controls

Appropriate engineering controls:	Use only with adequate ventilation. If user operations generate vapor/dusts, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.
Environmental exposure controls:	Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation.

Hygiene

Wash	Clean water should always be readily available for skin and (emergency) eye washing. Periodically wash areas contacted by Asphalt with a pH neutral soap and clean, uncontaminated water. Remove protective equipment and dusty clothing before entering eating areas.

PPE

Eye/face protection:	In case of vapor, mist or dust production: protective goggles. Wearing contact lenses when working with asphalt is not recommended.
Hand protection:	Wear gloves to prevent contact. Recommended material: Thermally insulated, Rubber (when handling hot asphalt).
Body protection:	Under dusty conditions or when excessive skin contact is likely, wear coveralls or other suitable work clothing.
Other skin protection:	Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved. Footwear and other gear to protect the skin should be approved by a specialist before handling this product.

Respiratory protection:	Use a properly fitted, particulate filter respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product, and assigned protection factor of the selected respirator.

Section 9. Physical and Chemical Properties

Physical State:	Liquid to Solid [granular]	Lower and upper explosive (flammable) limits:	Not applicable.
Color:	Black.	Vapor pressure:	Not applicable.
Odor:	Oily.	Vapor density:	Not applicable.
Odor threshold:	Not available.	Relative density:	0.95 to 1.1
pH (in water):	12 to 13.	Solubility:	Not applicable.
Melting point:	Not available.	Solubility In water:	0.16
Boiling point:	<243°C (<470°F)	Partition coefficient: n-octanol/water:	Not applicable.
Flash point:	>204°C (>400ºF)	Auto-ignition temperature:	485ºC (905ºF)
Burning time:	Not available.	Decomposition temperature:	Not available.
Burning rate:	Not available.	SADT:	Not available.
Evaporation rate:	Not applicable.	Viscosity:	Not applicable.
Flammability (solid, gas):	Not applicable.		

Section 10. Stability and Reactivity

Reactivity:	Not reactive under normal conditions of storage and use.
Chemical stability:	The product is stable.
Possibility of hazardous reactions:	Under normal conditions of storage and use, hazardous reactions will not occur.
Conditions to avoid:	Heat sources.
Incompatible materials:	Reactive or incompatible with the following materials: strong oxidizing agents. Silica reacts violently with powerful oxidizing agents such as fluorine, boron trifluoride, chlorine trifluoride, manganese trifluoride, and oxygen difluoride yielding possible fire and/or explosions. Silicates dissolve readily in hydrofluoric acid producing a corrosive gas — silicon tetrafluoride.
Hazardous decomposition products:	Under normal conditions of storage and use, hazardous decomposition products should not be produced. Combustion may produce carbon monoxide and sulfur oxides. paraffins, napthenes, aromatics, and olefins. At elevated temperatures, this product may release toxic hydrogen sulfide, an extremely flammable gas.

Section 11. Toxicological Information

Toxicological Effects

Acute toxicity:	Asphalt /LC50 = Not available
Irritation/Corrosion:	Skin: May cause skin irritation. Eyes: May cause eye irritation. Respiratory: May cause respiratory tract irritation.

Sensitization: Not classified

Mutagenicity: May cause genetic defects.

Ingredient	Category	Route of Exposure
Naphtha	Category 1B	Inhalation

Reproductive toxicity: Suspected of damaging fertility or the unborn child.

Ingredient	Category	Route of Exposure
Naphtha	Category 2	Inhalation

Teratogenicity: Not classified.

Aspiration hazard: Not classified.

Carcinogenicity Classification: The NIOSH “Hazard Review: Health Effects of Occupational Exposure to Asphalt” concludes that the collective data currently available from studies on paving asphalt provide insufficient evidence for an association between lung cancer and exposure to asphalt during paving; however, the collective health and exposure data provide sufficient evidence for NIOSH to conclude that roofing asphalt fumes are a potential occupational carcinogen.

Ingredient	OSHA	IARC	ACGIH	NTP
Quartz (crystalline silica)	–	1	A2	Known to be a human carcinogen.
Naphtha, Coal Tar	--	2B (road paving), 2A (roofing)	A2	Nominated; Status: Review Deferred

Specific target organ toxicity (single exposure): Product not classified

Ingredient	Category	Route of Exposure	Target Organs
Quartz (crystalline silica)	Category 3	Inhalation	Respiratory tract irritation
Kerosene	Category 3	Inhalation	Eyes, skin, respiratory system, central nervous system

Specific target organ toxicity (repeated exposure): Product not classified

Ingredient	Category	Route of Exposure	Target Organs
Quartz (crystalline silica)	Category 2	Inhalation	Respiratory tract and kidneys

Routes of exposure - Dermal contact, Eye contact, Inhalation, and Ingestion.

Potential acute health effects:

Eye contact: Causes serious eye damage.
Inhalation: May cause respiratory irritation.
Skin contact: Causes severe burns.
Ingestion: May cause burns to mouth, throat and stomach.

Symptoms related to the physical, chemical and toxicological characteristics:

Eye contact: Adverse symptoms may include the following: pain, watering, redness
Inhalation: Adverse symptoms may include the following: respiratory tract irritation, coughing
Skin contact: Adverse symptoms may include the following: pain or irritation, redness, blistering may occur, skin burns, ulcerations and necrosis may occur
Ingestion: Adverse symptoms may include the following: stomach pains

Delayed and immediate effects and also chronic effects from short and long term exposure:

Short term exposure
Potential immediate effects: No known significant effects or critical hazards.
Potential delayed effects: No known significant effects or critical hazards.

Long term exposure
Potential immediate effects: No known significant effects or critical hazards.

Potential delayed effects: No known significant effects or critical hazards.

Potential chronic health effects: **General**: Repeated or prolonged inhalation of vapor, mist or dust may lead to chronic respiratory irritation and central nervous system depression.

Carcinogenicity: Quartz (crystalline silica) is considered a hazard by inhalation. IARC has classified Quartz (crystalline silica) as a Group 1 substance, carcinogenic to humans. This classification is based on the findings of laboratory animal studies (inhalation and implantation) and epidemiology studies that were considered sufficient for carcinogenicity. Excessive exposure to Quartz (crystalline silica) can cause silicosis, a non-cancerous lung disease.

Mutagenicity: Exposed road workers and roofers exhibited DNA damage in the peripheral lymphocytes, which were assessed as an indication of the potential genotoxicity of bitumen-borne substances.

Teratogenicity: No known significant effects or critical hazards.

Developmental effects: No known significant effects or critical hazards.

Fertility effects: May cause a disturbance in ovarian function and menstrual cycle.

Numerical measures of toxicity: There are no data available - acute toxicity estimates.

Section 12. Ecological

Toxicity

Persistence and degradability: There are no data available.

Bioaccumulation potential: There are no data available.

Mobility in soil: Soil/water partition coefficient (Koc): Not available.

Other adverse effects: No known significant effects or critical hazards.

Ecotoxicity: Not classified.

Ingredient	Category	LC50 Fish	LC50 Daphnia	EC50 Algae
Naphtha, Coal Tar	Acute Category 2 Chronic Category 2	9 mg/l	3.7 mg/l	--
Kerosene	Acute Category 2 Chronic Category 2	1 - 10 mg/l	1 - 10 mg/l	1 - 10 mg/l

Section 13. Disposal Considerations

Disposal methods: Salvage spilled asphalt where possible. Uncontaminated asphalt may be reused. Dispose of waste material in accordance with local, state and federal laws and regulations.

Section 14. Transport Information

Special precautions for user: Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to Annex II of MARPOL 73/ 78 and the IBC Code: Not Regulated.

Transport Parameters	DOT Classification	IMDG	IATA
UN Number	Not Regulated	Not Regulated	Not Regulated
UN Proper Shipping Name	-	-	-
Transport Hazard Class	-	-	-
Packing Group	-	-	-
Environmental Hazard	None	None	None
Additional Information	-	-	-

Section 15. Regulatory Information

Status under USDOL-OSHA Hazard Communication Rule, 29 CFR 1910.1200
This product is considered a "hazardous chemical" under this regulation, and should be part of any hazard communication program.

Status under CERCLA/SUPERFUND 40 CFR 117 and 302
Not listed.

Hazard Category under SARA(Title III), Sections 311 and 312
This product qualifies as a "hazardous substance" with delayed health effects.

Status under SARA (Title III), Section 313
This product does not contain Emergency Planning and Community Right to Know (EPCRA") Section 313 chemicals in excess of the applicable de minimis concentration specified in EPCRA Section 313 Section 372.38(a). Trace amounts of naturally occurring chemicals might be detected during chemical analysis.

Status under TSCA (as of May 1997)
The ingredients of this product are listed on the TSCA inventory or are exempt.

Status under the Federal Hazardous Substances Act
This product is a "hazardous substance" subject to statutes promulgated under the subject act.

Status under California Proposition 65
This product contains up to 0.05 percent of chemicals (trace elements) known to the State of California to cause cancer, birth defects or other reproductive harm. California law requires the manufacturer to give the above warning in the absence of definitive testing to prove that the defined risks do not exist.

State Right to Know:
Kerosene (8008-20-6)
U.S. - New Jersey - Right to Know Hazardous Substance List
U.S. - New York - Reporting of Releases Part 597 - List of Hazardous Substances

Quartz (crystalline silica) (14808-60-7)
U.S. - Idaho - Non-Carcinogenic Toxic Air Pollutants - Acceptable Ambient Concentrations
U.S. - New Jersey - Right to Know Hazardous Substance List
U.S. - Washington - Permissible Exposure Limits - TWAs

Section 16. Other Information

Approval or Revision History

Revision:	Jun 2015 - Revised Section(s) per HCS-GHS

Notice to reader

While the information provided in this safety data sheet is believed to provide a useful summary of the hazards of Asphalt as it is commonly used, the sheet cannot anticipate and provide all of the information that might be needed in every situation. Inexperienced product users should obtain proper training before using this product. In particular, the data furnished in this sheet do not address hazards that may be posed by other materials mixed with Asphalt. Users should review other relevant material safety data sheets before working with Asphalt.

SELLER MAKES NO WARRANTY, EXPRESS OR IMPLIED, CONCERNING THE PRODUCT OR THE MERCHANTABILITY OR FITNESS THEREOF FOR ANY PURPOSE OR CONCERNING THE ACCURACY OF ANY INFORMATION PROVIDED BY CEMEX, Inc. except that the product shall conform to contracted specifications. The information provided herein was believed by CEMEX to be accurate at the time of preparation or prepared from sources believed to be reliable, but it is the responsibility of the user to investigate and understand other pertinent sources of information to comply with all laws and procedures applicable to the safe handling and use of product and to determine the suitability of the product for its intended use. Buyer's exclusive remedy shall be for damages and no claim of any kind, whether as to product delivered or for non-delivery of product, and whether based on contract, breach of warranty, negligence, or otherwise shall be greater in amount than the purchase price of the quantity of product in respect of which damages are claimed. In no event shall Seller be liable for incidental or consequential damages, whether Buyer's claim is based on contract, breach of warranty, negligence or otherwise. In particular, the data furnished in this sheet do not address hazards that may be posed by other materials mixed with Asphalt. Users should review other relevant safety data sheets before working with Asphalt.

Abbreviations

ACGIH — American Conference of Governmental Industrial Hygienists
CAS — Chemical Abstract Service
CERCLA — Comprehensive Emergency Response and Comprehensive Liability Act
CFR — Code of Federal Regulations DOT — Department of Transportation
GHS – Globally Harmonized System Globally Harmonized System
HEPA - High Efficiency Particulate Air
IATA — International Air Transport Association
IARC — International Agency for Research on Cancer
IMDG — International Maritime Dangerous Goods
NIOSH — National Institute of Occupational Safety and Health
NOEC — No Observed Effect Concentration
NTP — National Toxicology Program
OSHA — Occupational Safety and Health Administration
PEL — Permissible Exposure Limit
REL — Recommended Exposure Limit RQ — Reportable Quantity
SARA — Superfund Amendments and Reauthorization Act
SDS — Safety Data Sheet
TLV — Threshold Limit Value
TPQ — Threshold Planning Quantity
TSCA — Toxic Substances Control Act
TWA — Time-Weighted Average
UN — United Nations

SAFETY DATA SHEET

Conforms to OSHA HazCom 2012, CPR, NOM-018-STPS-2000 Standards & GHS

SECTION 1: PRODUCT AND COMPANY IDENTIFICATION

Product Name: Bentonite

Product Identities: Sodium bentonite, bentonite clay, Prime Gel, Pond Seal, High Yield, SlikGel, Swell Plug, PS-8, montmorillonite

Supplier/Manufacture:
Diversified Minerals Inc.
1135 E. Wooley Road
Oxnard CA, 93030
(888) 364-9595

Poison Control System:
(800) 222-1222

Recommended Uses: It is mostly used in drilling mud in the oil and gas well drilling industries. The property of swelling also makes sodium bentonite useful as a sealant, especially targeted for the sealing of subsurface disposal systems for spent nuclear fuel and for quarantining metal pollutants of groundwater. Similar uses include making slurry walls, waterproofing of below grade walls and forming other impermeable barriers (e.g. to plug old wells or as a liner in the base of landfills to prevent migration of leachate into the soil. Sodium bentonite is also used in a variety of pet care items such as cat litter to absorb odors.

Restrictions on Use: N/A

SECTION 2: HAZARD IDENTIFICATION

WARNING

Irritant: Causes eye, skin and inhalation irritation

Use proper engineering controls, work practices, and personal protective equipment to prevent exposure to wet or dry product.

Read SDS for details.

GHS Classification: (Please see GHS Classifications on our website under Resources)

Carcinogenicity - Category 1A
Specific Target Organ Toxicity Repeat Exposure - Category 2

GHS LABEL ELEMENTS Symbol(s)

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

Component	CAS RN	ACGIH TLV (mg/m^3)	OSHA-PEL (mg/m^3)
Bentonite	1302-78-9	10	NA
Silica	14808-60-7	0.1	10(R) 30(T)
Inert or nuisance dust	- - -	10	5(R) 15(T)

Bentonite is absorbent aluminum phyllosilicate clay, consisting mostly of montmorillonite. Trace amount of elements may be detected due to the naturally variable chemical compositions of earth materials.

SECTION 4: FIRST-AID MEASURES

Eye Contact:	Rinse eyes thoroughly with water for at least 15 minutes, including under lids to remove all particles. Seek medical attention for discomfort or if irritation or other symptoms do not subside.
Skin Contact:	Wash with cool water and pH neutral soap or a mild skin detergent Seek medical attention for rash, irritation and dermatitis.
Inhalation:	Move person to fresh air. Seek medical attention for discomfort or if coughing or other symptoms do not subside.
Ingestion:	Treat symptomatically. If bowel obstruction is suspected, seek immediate medical attention**.**

SECTION 5: FIRE-FIGHTING MEASURES

Flashpoint & Method:	Non-combustible
General Hazard:	Avoid breathing dust.
Extinguishing Media:	Use extinguishing media appropriate for surrounding fire.
Firefighting Equipment:	Bentonite poses no fire-related hazard.
Combustion Products:	In excess of 1000°C compounds will break down into their constituent oxides.

SECTION 6: ACCIDENTAL RELEASE MEASURES

General:	Place spilled material into a container. Avoid actions that cause the bentonite to become airborne. Avoid inhalation of bentonite and direct contact with skin. Wear appropriate Personal Protective Equipment (PPE) as described in Section 8 below.
Waste Disposal:	Dispose of bentonite according to Federal, State, Provincial and local regulations.

SECTION 7: HANDLING AND STORAGE

General:	Handle with care and use appropriate control measures. Keep dry until used. Properly ground all pneumatic conveyance systems. The potential exists for static build-up and static discharge when moving cement powders through a plastic, non- conductive, or non-grounded pneumatic conveyance system. The static discharge may result in damage to equipment and injury to workers.
Engulfment hazard:	To prevent burial or suffocation, do not enter a confined space, such as a silo, bin, bulk truck or other storage container or vessel that stores or contains bentonite. Bentonite can build up or adhere to the walls of a confined space. The bentonite can suddenly release, collapse, or fall unexpectedly.
Housekeeping:	Avoid actions that cause bentonite to become airborne during clean-up such as dry sweeping or using compressed air. Use HEPA vacuum or thoroughly wet with water to clean-up dust. Use PPE described in Section 8 below.
Storage Temperature:	Unlimited.
Storage Pressure:	Unlimited.
Storage Moisture:	Keep dry.
Clothing:	Promptly remove and launder clothing that is dusty or wet with bentonite. Thoroughly wash skin after exposure to bentonite.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls:	Use local exhaust and general dilution ventilation or other suppression methods to maintain dust levels below exposure limits.
Personal Protective Equipment (PPE):	
Respiratory Protection:	Under ordinary circumstances no respiratory protection is required. Wear a NIOSH approved respirator that is properly fitted and is in good condition when exposed to dust above exposure limits.
Eye Protection:	Wear ANSI approved glasses or safety goggles when handling dust or wet bentonite to prevent contact with eyes. Wearing contact lenses when using bentonite, under dusty conditions, is not recommended.
Skin protection:	Wear gloves, boot covers and protective clothing impervious to water to prevent skin contact. Do not rely on barrier creams, in place of impervious gloves. Remove clothing and PPE that become saturated with wet bentonite and immediately wash exposed areas.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Solid	**Evaporation Rate:**	NA
Appearance:	Beige	**pH (in water):**	10
Odor:	Odorless	**Boiling Point:**	NA
Vapor Pressure:	NA	**Freezing Point:**	None, solid
Vapor Density:	NA	**Viscosity:**	None, solid
Specific Gravity	2.4-2.6	**Solubility in water:**	Negligible

SECTION 10: STABILITY AND REACTIVITY

Stability:	Stable. Keep dry until use.
Incompatibility:	NA
Hazardous Polymerization:	None.
Hazardous Decompositions:	Will not spontaneously occur.

SECTION 11 AND 12: TOXICOLOGICAL AND ECOLOGICAL INFORMATION

For questions regarding toxicological and ecological information refer to contact information in Section 1.

SECTION 13: DISPOSAL CONSIDERATIONS

Dispose of waste and containers in compliance with Federal, State, Provincial and Local regulations.

SECTION 14: TRANSPORT INFORMATION

This product is not classified as a Hazardous material under US D.O.T or Canadian TDG regulations.

SECTION 15: REGULATORY INFORMATION

OSHA/MSHA Hazard Communication:

This product is considered by OSHA/MSHA to be a hazardous chemical and should be included in the employer’s hazard communication program.

CERCLA/Superfund: This product is not listed as a CERCLA hazardous substance.

EPCRA
SARA Title III:

This product has been reviewed according to the EPA Hazard Categories promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 and is considered a “hazardous substance” a delayed health hazard.

EPRCA
SARA Section 313:

This product does not contain any of the substance subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372

California Proposition 65:

WARNING: This material may contain chemicals known to the State of California to cause cancer, birth defects or other reproductive harm

SECTION 16: OTHER INFORMATION

General Abbreviations:

>	Greater than	NIOSH	National Institute for Occupational Safety and Health
<	Lesser than	NTP	National Toxicology Program
ACGIH	American Conference of Governmental Industrial Hygienists	OSHA	Occupational Safety and Health Administration
CAS RN	Chemical Abstracts Reference Number	PEL	Permissible Exposure Limit
CERCLA	Comprehensive Environmental Response, Compensations and Liability Act	pH	Negative log of hydrogen ion
CFR	Code of Federal Regulations	PPE	Personal Protective Equipment
CL	Ceiling Limit	R	Respirable Particulate
DOT	Department of Transportation	RCRA	Resource Conservation and Reauthorization Act
g/cm^3	Grams per cubic centimeter	SARA	Superfund Amendments and Reauthorization Act
HEPA	High-Efficiency Particulate Air	SDS	Safety Data Sheet
HMIS	Hazardous Materials Identification Systems	T	Total Particulate
IARC	International Agency for Research on Cancer	TDG	Transportation of Dangerous Goods
mg/m^3	Milligrams per cubic meter	TLV	Threshold Limit Value
MSHA	Mine Safety and Health Administration	TWA	Time Weighted Average (8 hour)
NA	Not Applicable	WHMIS	Workplace Hazardous Materials Information System
NFPA	National Fire Protection Association	---	-----

This SDS (Section 1-16) was revised on May 21, 2015.

An electronic version of this SDS is available at: www.dmicement.com

The data in the Safety Data Sheet related only to the specific material designated herein and does not relate to use in combination with any other material on or in any process. Diversified Minerals Inc. (DMI) believes the information contained herein is accurate; however, DMI makes no guarantees with respect to such accuracy and assumes no liability in connection with the use of the information contained herein which is not intended to be and should not be construed as legal advice or as insuring compliance with any federal, state or local laws or regulations. Any party using this product should review all such laws, rules, or regulations prior to use, including but not limited to Federal, Provincial, State and Local regulations.

NO WARRANTY IS MADE, EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR OTHERWISE.

SAFETY DATA SHEET

Issuing Date January 5, 2015 **Revision Date** June 12, 2015 **Revision Number** 1

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Product identifier

Product Name **Clorox® Regular-Bleach$_1$**

Other means of identification

EPA Registration Number 5813-100

Recommended use of the chemical and restrictions on use

Recommended use	Household disinfecting, sanitizing, and laundry bleach
Uses advised against	No information available

Details of the supplier of the safety data sheet

Supplier Address
The Clorox Company
1221 Broadway
Oakland, CA 94612

Phone: 1-510-271-7000

Emergency telephone number

Emergency Phone Numbers For Medical Emergencies, call: 1-800-446-1014
For Transportation Emergencies, call Chemtrec: 1-800-424-9300

2. HAZARDS IDENTIFICATION

Classification

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200).

Skin corrosion/irritation	Category 1
Serious eye damage/eye irritation	Category 1

GHS Label elements, including precautionary statements

Emergency Overview

Signal word **Danger**

Hazard Statements
Causes severe skin burns and eye damage
Causes serious eye damage

Appearance Clear, pale yellow **Physical State** Thin liquid **Odor** Bleach

Precautionary Statements - Prevention

Wash face, hands and any exposed skin thoroughly after handling.
Wear protective gloves, protective clothing, face protection, and eye protection such as safety glasses.

Precautionary Statements - Response

Immediately call a poison center or doctor.
If swallowed: Rinse mouth. Do NOT induce vomiting.
If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water.
Wash contaminated clothing before reuse.
If inhaled: Remove person to fresh air and keep comfortable for breathing.
Specific treatment (see supplemental first aid instructions on this label).
If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

Precautionary Statements - Storage

Store locked up.

Precautionary Statements - Disposal

Dispose of contents in accordance with all applicable federal, state, and local regulations.

Hazards not otherwise classified (HNOC)

Although not expected, heart conditions or chronic respiratory problems such as asthma, chronic bronchitis, or obstructive lung disease may be aggravated by exposure to high concentrations of vapor or mist.

Product contains a strong oxidizer. Always flush drains before and after use.

Unknown Toxicity
Not applicable.

Other information
Very toxic to aquatic life with long lasting effects.

Interactions with Other Chemicals
Reacts with other household chemicals such as toilet bowl cleaners, rust removers, acids, or products containing ammonia to produce hazardous irritating gases, such as chlorine and other chlorinated compounds.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	CAS-No	Weight %	Trade Secret
Sodium hypochlorite	7681-52-9	5 - 10	*

* The exact percentage (concentration) of composition has been withheld as a trade secret.

4. FIRST AID MEASURES

First aid measures

General Advice	Call a poison control center or doctor immediately for treatment advice. Show this safety data sheet to the doctor in attendance.
Eye Contact	Hold eye open and rinse slowly and gently with water for 15 - 20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice.
Skin Contact	Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice.
Inhalation	Move to fresh air. If breathing is affected, call a doctor.
Ingestion	Have person sip a glassful of water if able to swallow. Do not induce vomiting unless told to do so by a poison control center or doctor. Do not give anything by mouth to an unconscious person. Call a poison control center or doctor immediately for treatment advice.
Protection of First-aiders	Avoid contact with skin, eyes, and clothing. Use personal protective equipment as required. Wear personal protective clothing (see section 8).

Most important symptoms and effects, both acute and delayed

Most Important Symptoms and Effects	Burning of eyes and skin.

Indication of any immediate medical attention and special treatment needed

Notes to Physician	Treat symptomatically. Probable mucosal damage may contraindicate the use of gastric lavage.

5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media
Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable Extinguishing Media
CAUTION: Use of water spray when fighting fire may be inefficient.

Specific Hazards Arising from the Chemical
This product causes burns to eyes, skin, and mucous membranes. Thermal decomposition can release sodium chlorate and irritating gases and vapors.

Explosion Data

Sensitivity to Mechanical Impact	None.
Sensitivity to Static Discharge	None.

Protective equipment and precautions for firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal Precautions	Avoid contact with eyes, skin, and clothing. Ensure adequate ventilation. Use personal protective equipment as required. For spills of multiple products, responders should evaluate the MSDSs of the products for incompatibility with sodium hypochlorite. Breathing protection should be worn in enclosed and/or poorly-ventilated areas until hazard assessment is complete.
Other Information	Refer to protective measures listed in Sections 7 and 8.

Environmental precautions

Environmental Precautions	This product is toxic to fish, aquatic invertebrates, oysters, and shrimp. Do not allow product to enter storm drains, lakes, or streams. See Section 12 for ecological Information.

Methods and material for containment and cleaning up

Methods for Containment	Prevent further leakage or spillage if safe to do so.
Methods for Cleaning Up	Absorb and containerize. Wash residual down to sanitary sewer. Contact the sanitary treatment facility in advance to assure ability to process washed-down material.

7. HANDLING AND STORAGE

Precautions for safe handling

Handling	Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes, and clothing. Do not eat, drink, or smoke when using this product.

Conditions for safe storage, including any incompatibilities

Storage	Store away from children. Reclose cap tightly after each use. Store this product upright in a cool, dry area, away from direct sunlight and heat to avoid deterioration. Do not contaminate food or feed by storage of this product.
Incompatible Products	Toilet bowl cleaners, rust removers, acids, and products containing ammonia.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Guidelines

Chemical Name	ACGIH TLV	OSHA PEL	NIOSH IDLH
Sodium hypochlorite 7681-52-9	None	None	None

ACGIH TLV: American Conference of Governmental Industrial Hygienists - Threshold Limit Value. OSHA PEL: Occupational Safety and Health Administration - Permissible Exposure Limits. NIOSH IDLH: Immediately Dangerous to Life or Health.

Appropriate engineering controls

Engineering Measures	Showers Eyewash stations Ventilation systems

Individual protection measures, such as personal protective equipment

Eye/Face Protection	If splashes are likely to occur: Wear safety glasses with side shields (or goggles) or face shield.
Skin and Body Protection	Wear rubber or neoprene gloves and protective clothing such as long-sleeved shirt.
Respiratory Protection	If irritation is experienced, NIOSH/MSHA approved respiratory protection should be worn. Positive-pressure supplied air respirators may be required for high airborne contaminant concentrations. Respiratory protection must be provided in accordance with current local regulations.
Hygiene Measures	Handle in accordance with good industrial hygiene and safety practice. Wash hands after direct contact. Do not wear product-contaminated clothing for prolonged periods. Remove and wash contaminated clothing before re-use. Do not eat, drink, or smoke when using this product.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical and Chemical Properties

Physical State	Thin liquid		
Appearance	Clear	**Odor**	Bleach
Color	Pale yellow	**Odor Threshold**	No information available

Property	**Values**	**Remarks/ Method**
pH	~12	None known
Melting/freezing point	No data available	None known
Boiling point / boiling range	No data available	None known
Flash Point	Not flammable	None known
Evaporation rate	No data available	None known
Flammability (solid, gas)	No data available	None known
Flammability Limits in Air		
Upper flammability limit	No data available	None known
Lower flammability limit	No data available	None known
Vapor pressure	No data available	None known
Vapor density	No data available	None known
Specific Gravity	~1.1	None known
Water Solubility	Soluble	None known
Solubility in other solvents	No data available	None known
Partition coefficient: n-octanol/water	No data available	None known
Autoignition temperature	No data available	None known
Decomposition temperature	No data available	None known
Kinematic viscosity	No data available	None known
Dynamic viscosity	No data available	None known
Explosive Properties	Not explosive	
Oxidizing Properties	No data available	

Other Information

Softening Point	No data available
VOC Content (%)	No data available
Particle Size	No data available
Particle Size Distribution	No data available

10. STABILITY AND REACTIVITY

Reactivity
Reacts with other household chemicals such as toilet bowl cleaners, rust removers, acids, or products containing ammonia to produce hazardous irritating gases, such as chlorine and other chlorinated compounds.

Chemical stability
Stable under recommended storage conditions.

Possibility of Hazardous Reactions
None under normal processing.

Conditions to avoid
None known based on information supplied.

Incompatible materials
Toilet bowl cleaners, rust removers, acids, and products containing ammonia.

Hazardous Decomposition Products
None known based on information supplied.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Product Information .

Inhalation Exposure to vapor or mist may irritate respiratory tract and cause coughing. Inhalation of high concentrations may cause pulmonary edema.

Eye Contact Corrosive. May cause severe damage to eyes.

Skin Contact May cause severe irritation to skin. Prolonged contact may cause burns to skin.

Ingestion Ingestion may cause burns to gastrointestinal tract and respiratory tract, nausea, vomiting, and diarrhea.

Component Information

Chemical Name	LD50 Oral	LD50 Dermal	LC50 Inhalation
Sodium hypochlorite 7681-52-9	8200 mg/kg (Rat)	>10000 mg/kg (Rabbit)	-

Information on toxicological effects

Symptoms May cause redness and tearing of the eyes. May cause burns to eyes. May cause redness or burns to skin. Inhalation may cause coughing.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Sensitization No information available.

Mutagenic Effects No information available.

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Chemical Name	ACGIH	IARC	NTP	OSHA
Sodium hypochlorite 7681-52-9	-	Group 3	-	-

IARC (International Agency for Research on Cancer)
Group 3 - Not Classifiable as to Carcinogenicity in Humans

Reproductive Toxicity No information available.

STOT - single exposure No information available.

STOT - repeated exposure No information available.
Chronic Toxicity Carcinogenic potential is unknown.
Target Organ Effects Respiratory system, eyes, skin, gastrointestinal tract (GI).

Aspiration Hazard No information available.

Numerical measures of toxicity - Product Information

The following values are calculated based on chapter 3.1 of the GHS document

ATEmix (oral)
54 g/kg
ATEmix (inhalation-dust/mist)
58 mg/L

12. ECOLOGICAL INFORMATION

Ecotoxicity
Very toxic to aquatic life with long lasting effects.

This product is toxic to fish, aquatic invertebrates, oysters, and shrimp. Do not allow product to enter storm drains, lakes, or streams.

Persistence and Degradability
No information available.

Bioaccumulation
No information available.

Other adverse effects
No information available.

13. DISPOSAL CONSIDERATIONS

Disposal methods
Dispose of in accordance with all applicable federal, state, and local regulations. Do not contaminate food or feed by disposal of this product.

Contaminated Packaging
Do not reuse empty containers. Dispose of in accordance with all applicable federal, state, and local regulations.

14. TRANSPORT INFORMATION

DOT	Not restricted.
TDG	Not restricted for road or rail.
ICAO	Not restricted, as per Special Provision A197, Environmentally Hazardous Substance exception.
IATA	Not restricted, as per Special Provision A197, Environmentally Hazardous Substance exception.
IMDG/IMO	Not restricted, as per IMDG Code 2.10.2.7, Marine Pollutant exception.

15. REGULATORY INFORMATION

Chemical Inventories

TSCA	All components of this product are either on the TSCA 8(b) Inventory or otherwise exempt from listing.
DSL/NDSL	All components are on the DSL or NDSL.

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List

U.S. Federal Regulations

SARA 313
Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372

SARA 311/312 Hazard Categories

Acute Health Hazard	Yes
Chronic Health Hazard	No
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	No

Clean Water Act
This product contains the following substances which are regulated pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

Chemical Name	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants	CWA - Hazardous Substances
Sodium hypochlorite 7681-52-9	100 lb			X

CERCLA
This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Chemical Name	Hazardous Substances RQs	Extremely Hazardous Substances RQs	RQ
Sodium hypochlorite 7681-52-9	100 lb	-	RQ 100 lb final RQ RQ 45.4 kg final RQ

EPA Statement
This chemical is a pesticide product registered by the Environmental Protection Agency and is subject to certain labeling requirements under federal pesticide law. These requirements differ from the classification criteria and hazard information required for safety data sheets and for workplace labels of non-pesticide chemicals. Following is the hazard information as required on the pesticide label:

> **DANGER: CORROSIVE.** Causes irreversible eye damage and skin burns. Harmful if swallowed. Do not get in eyes, on skin, or on clothing. Wear protective eyewear and rubber gloves when handling this product. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco, or using the restroom. Avoid breathing vapors and use only in a well-ventilated area.

US State Regulations

California Proposition 65
This product does not contain any Proposition 65 chemicals.

U.S. State Right-to-Know Regulations

Chemical Name	New Jersey	Massachusetts	Pennsylvania	Rhode Island	Illinois
Sodium hypochlorite 7681-52-9	X	X	X	X	
Sodium chlorate 7775-09-9	X	X	X		

International Regulations

Canada
WHMIS Hazard Class
E - Corrosive material

16. OTHER INFORMATION

NFPA	**Health Hazard**	3	**Flammability**	0	**Instability**	0	**Physical and Chemical Hazards**	-
HMIS	**Health Hazard**	3	**Flammability**	0	**Physical Hazard**	0	**Personal Protection**	B

Prepared By
Product Stewardship
23 British American Blvd.
Latham, NY 12110
1-800-572-6501

Revision Date June 12, 2015

Revision Note Revision Section 14.

Reference 1096036/164964.159

End of Safety Data Sheet

Safety Data Sheet

according to 29CFR1910/1200 and GHS Rev. 3

Effective date : 01.08.2015

Hydrochloric Acid,ACS

SECTION 1 : Identification of the substance/mixture and of the supplier

Product name :	**Hydrochloric Acid,ACS**
Manufacturer/Supplier Trade name:	
Manufacturer/Supplier Article number:	**S25358**

Recommended uses of the product and uses restrictions on use:

Manufacturer Details:

AquaPhoenix Scientific
9 Barnhart Drive, Hanover, PA 17331

Supplier Details:

Fisher Science Education
15 Jet View Drive, Rochester, NY 14624

Emergency telephone number:

Fisher Science Education Emergency Telephone No.: 800-535-5053

SECTION 2 : Hazards identification

Classification of the substance or mixture:

Corrosive
Serious eye damage, category 1
Corrosive to metals, category 1
Skin corrosion, category 1B

Irritant
Specific target organ toxicity following single exposure, category 3

Corr. Metals 1
Corr. Skin 1B
Eye Damage 1
STOT. SE 3

Signal word :Danger

Hazard statements:
May be corrosive to metals
Causes severe skin burns and eye damage
May cause respiratory irritation
Precautionary statements:
If medical advice is needed, have product container or label at hand
Keep out of reach of children
Read label before use
Use only outdoors or in a well-ventilated area
Wear protective gloves/protective clothing/eye protection/face protection
Keep only in original container
Do not get in eyes, on skin, or on clothing
Wash skin thoroughly after handling
IF SWALLOWED: Rinse mouth. Do NOT induce vomiting

IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing
Immediately call a POISON CENTER or doctor/physician
Specific treatment (see supplemental first aid instructions on this label)
Wash contaminated clothing before reuse
Absorb spillage to prevent material damage
Store in a well ventilated place. Keep container tightly closed
Store locked up
Store in corrosive resistant stainless steel container with a resistant inner liner
Dispose of contents and container to an approved waste disposal plant

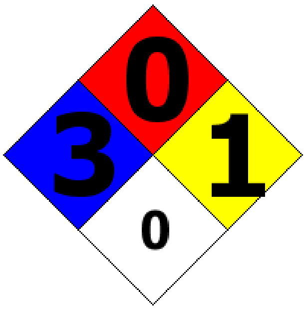
Other Non-GHS Classification:

WHMIS

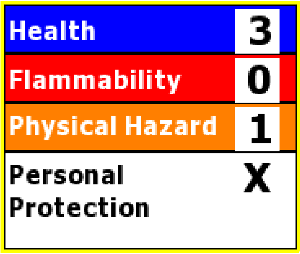
D1A

E

NFPA/HMIS



NFPA SCALE (0-4)



Health	3
Flammability	0
Physical Hazard	1
Personal Protection	X

HMIS RATINGS (0-4)

SECTION 3 : Composition/information on ingredients

Ingredients:		
CAS 7647-01-0	Hydrochloric Acid, ACS	30-50 %
CAS 7732-18-5	Water	50-70 %
		Percentages are by weight

SECTION 4 : First aid measures

Description of first aid measures

After inhalation: Move exposed individual to fresh air. Loosen clothing as necessary and position individual in a comfortable position.Seek medical attention if irritation or coughing persists.

After skin contact: Wash affected area with soap and water. Immediately remove contaminated clothing and shoes.Rinse thoroughly with plenty of water for at least 15 minutes.Immediately seek medical attention.

After eye contact: Protect unexposed eye. Flush thoroughly with plenty of water for at least 15 minutes.Remove contact lenses while rinsing.Continue rinsing eyes during transport to hospital.

After swallowing: Rinse mouth thoroughly. Do not induce vomiting. Have exposed individual drink sips of water. Immediately seek medical attention.

Most important symptoms and effects, both acute and delayed:

Inhalation may cause irritation to nose and upper respiratory tract, ulceration, coughing, chest tightness and shortness of breath. Higher concentrations cause tachypnoea, pulmonary oedema and suffocation . Ingestion may cause corrosion of lips, mouth, oesophagus and stomach, dysphagia and vomiting.Pain, eye ulceration, conjunctival irritation, cataracts and glaucoma may occur following eye exposure.Erythema and skin irritation, as well as chemical burns to skin and mucous membranes may arise following skin exposure.;Potential sequelae following ingestion of hydrochloric acid include perforation, scarring of the oesophagus or stomach and stricture formation causing dysphagia or gastric outlet obstruction. In some cases, RADS may develop. Respiratory symptoms may take up to 36 hours to develop.Symptoms of burning sensation, cough, wheezing, laryngitis, shortness of breath, spasm, inflammation, edema of the larynx, spasm, inflammation and edema of the bronchi, pneumonitis, pulmonary edema. Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin.

Indication of any immediate medical attention and special treatment needed:

Provide SDS to Physician.Physician should treat symptomatically.

SECTION 5 : Firefighting measures

Extinguishing media

Suitable extinguishing agents: Use water, dry chemical, chemical foam, carbon dioxide, or alcohol-resistant foam.

For safety reasons unsuitable extinguishing agents:

Special hazards arising from the substance or mixture:

Combustion products may include carbon oxides or other toxic vapors.If in contact with metals toxic fumes may be released.

Advice for firefighters:

Protective equipment: Wear protective eyeware, gloves, and clothing. Refer to Section 8. Wear respiratory protection.

Additional information (precautions): Thermal decomposition can produce poisoning chlorine. Hydrochloric acid reacts also with many organic materials with liberation of heat.Avoid inhaling gases, fumes, dust, mist, vapor, and aerosols. Avoid contact with skin, eyes, and clothing.

SECTION 6 : Accidental release measures

Personal precautions, protective equipment and emergency procedures:

Ensure adequate ventilation. Ensure that air-handling systems are operational.

Environmental precautions:

Should not be released into environment. Prevent from reaching drains, sewer, or waterway.

Methods and material for containment and cleaning up:

Always obey local regulations. If necessary use trained response staff or contractor. Evacuate personnel to safe areas. Containerize for disposal. Refer to Section 13. Keep in suitable closed containers for disposal. Soak up with inert absorbent material and dispose of as hazardous waste. Cover spill with soda ash or calcium carbonate. Mix and add water to form slurry.Wear protective eyeware, gloves, and clothing. Refer to Section 8.

Reference to other sections:

SECTION 7 : Handling and storage

Precautions for safe handling:

Prevent formation of aerosols. Never use hot water and never add water to the acid.Do not allow contact between hydrochloric acid, metal, and organics.Follow good hygiene procedures when handling chemical materials. Refer to Section 8. Prevent contact with skin, eyes, and clothing. Follow proper disposal methods. Refer to Section 13. Do not eat, drink, smoke, or use personal products when handling chemical substances. Use only in well ventilated areas.Avoid splashes or spray in enclosed areas.

Conditions for safe storage, including any incompatibilities:

Store in a cool location. Keep away from food and beverages. Protect from freezing and physical damage. Store away from incompatible materials. Provide ventilation for containers. Keep container tightly sealed.Containers for hydrochloric acid must be made from corrosion resistant materials: glass, polyethylene, polypropylene, polyvinyl chloride, carbon steel lined with rubber or ebonite.

SECTION 8 : Exposure controls/personal protection




Control Parameters:	7647-01-0, Hydrochloric Acid, ACGIH: 2 ppm Ceiling 7647-01-0, Hydrochloric Acid, NIOSH: 5 ppm Ceiling; 7 mg/m3 Ceiling
Appropriate Engineering controls:	Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor and mists below the applicable workplace exposure limits (Occupational Exposure Limits-OELs) indicated above. Emergency eye wash fountains and safety showers should be available in the immediate vicinity of handling.
Respiratory protection:	Not required under normal conditions of use. Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. When necessary use NIOSH approved breathing equipment.
Protection of skin:	Select glove material impermeable and resistant to the substance. Select glove material based on rates of diffusion and degradation. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Use proper glove removal technique without touching outer surface. Avoid skin contact with used gloves. Wear protective clothing.
Eye protection:	Faceshield (8-inch minimum).Tightly fitting safety goggles.
General hygienic measures:	Perform routine housekeeping. Wash hands before breaks and immediately after handling the product. Avoid contact with skin, eyes, and clothing. Before rewearing wash contaminated clothing.

SECTION 9 : Physical and chemical properties

Appearance (physical state,color):	Clear, colorless liquid.	**Explosion limit lower**: **Explosion limit upper**:	Non Explosive Non Explosive
Odor:	Pungent odor	**Vapor pressure**:	5.7mmHg @ 0C
Odor threshold:	0.3 – 14.9 mg/m3	**Vapor density**:	1.27 (Air=1)
pH-value:	< 1	**Relative density**:	1.0 - 1.2

Melting/Freezing point:	- 74 C	**Solubilities**:	Miscible
Boiling point/Boiling range:	81.5 - 110 C	**Partition coefficient (n-octanol/water)**:	Not Determined
Flash point (closed cup):	Not Applicable	**Auto/Self-ignition temperature**:	Not Determined
Evaporation rate:	>1.00	**Decomposition temperature**:	Not Determined
Flammability (solid,gaseous):	non combustible	**Viscosity**:	a. Kinematic:Not Determined b. Dynamic: Not Determined
Density: Not Determined **Hydrochloric Acid:**MW is36.46			

SECTION 10 : Stability and reactivity

Reactivity: Reacts violently with bases and is corrosive.
Chemical stability: No decomposition if used and stored according to specifications.
Possible hazardous reactions: Attacks many metals in the presence of water forming flammable explosive gas (hydrogen).Reacts violently with oxidants forming toxic gas (chlorine).
Conditions to avoid: Incompatible materials.
Incompatible materials: Bases, Amines, Alkali metals, Metals, permanganates (potassium permanganate), Fluorine, Metal acetylides, Hexalithium disilicide.
Hazardous decomposition products: Hydrogen chloride gas.Carbon oxides.

SECTION 11 : Toxicological information

Acute Toxicity:		
Inhalation:	7647-01-0	LD50 Rat 3124 ppm/hour
Oral:	7647-01-0	LD50 Rat 238 - 277 mg/kg
Dermal:	7647-01-0	LD50 Rabbit >5010 mg/kg
Chronic Toxicity: No additional information.		
Corrosion Irritation:		
Dermal:	7647-01-0	Skin - rabbit Result: Causes burns.
Ocular:	7647-01-0	Eyes - rabbit Result: Corrosive to eyes
Sensitization:		No additional information.
Single Target Organ (STOT):		7647-01-0: The substance or mixture is classified as specific target organ toxicant, single exposure, category 3 with respiratory tract irritation.
Numerical Measures:		No additional information.
Carcinogenicity:		No additional information.
Mutagenicity:		No additional information.

Reproductive Toxicity:	No additional information.

SECTION 12 : Ecological information

Ecotoxicity

7647-01-0: Toxicity to fish LC50 - Gambusia affinis (Mosquito fish) - 282 mg/l - 96 h (Hydrochloric acid)

Persistence and degradability:
Bioaccumulative potential:
Mobility in soil:
Other adverse effects:

SECTION 13 : Disposal considerations

Waste disposal recommendations:

Do not allow product to reach sewage system or open water.It is the responsibility of the waste generator to properly characterize all waste materials according to applicable regulatory entities (US 40CFR262.11). Contact a licensed professional waste disposal service to dispose of this material. Dispose of empty containers as unused product. Product or containers must not be disposed together with household garbage. Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations. Ensure complete and accurate classification.

SECTION 14 : Transport information

UN-Number

1789

UN proper shipping name

HYDROCHLORIC ACID

Transport hazard class(es)

Class:
8 Corrosive substances

Packing group:II
Environmental hazard:
Transport in bulk:
Special precautions for user:

SECTION 15 : Regulatory information

United States (USA)

SARA Section 311/312 (Specific toxic chemical listings):

Acute

SARA Section 313 (Specific toxic chemical listings):

7647-01-0 Hydrochloric Acid

RCRA (hazardous waste code):

None of the ingredients is listed

TSCA (Toxic Substances Control Act):

All ingredients are listed.

CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act):

7647-01-0 Hydrochloric Acid 5000 lbs

Proposition 65 (California):

Chemicals known to cause cancer:

None of the ingredients is listed

Chemicals known to cause reproductive toxicity for females:

None of the ingredients is listed

Chemicals known to cause reproductive toxicity for males:

None of the ingredients is listed

Chemicals known to cause developmental toxicity:

None of the ingredients is listed

Canada

Canadian Domestic Substances List (DSL):

All ingredients are listed.

Canadian NPRI Ingredient Disclosure list (limit 0.1%):

None of the ingredients is listed

Canadian NPRI Ingredient Disclosure list (limit 1%):

7647-01-0 Hydrochloric Acid

SECTION 16 : Other information

This product has been classified in accordance with hazard criteria of the Controlled Products Regulations and the SDS contains all the information required by the Controlled Products Regulations.Note:. The responsibility to provide a safe workplace remains with the user.The user should consider the health hazards and safety information contained herein as a guide and should take those precautions required in an individual operation to instruct employees and develop work practice procedures for a safe work environment.The information contained herein is, to the best of our knowledge and belief, accurate.However, since the conditions of handling and use are beyond our control, we make no guarantee of results, and assume no liability for damages incurred by the use of this material.It is the responsibility of the user to comply with all applicable laws and regulations applicable to this material.

GHS Full Text Phrases:

Abbreviations and acronyms:

IMDG: International Maritime Code for Dangerous Goods
PNEC: Predicted No-Effect Concentration (REACH)
CFR: Code of Federal Regulations (USA)
SARA: Superfund Amendments and Reauthorization Act (USA)
RCRA: Resource Conservation and Recovery Act (USA)
TSCA: Toxic Substances Control Act (USA)
NPRI: National Pollutant Release Inventory (Canada)
DOT: US Department of Transportation
IATA: International Air Transport Association
GHS: Globally Harmonized System of Classification and Labelling of Chemicals
ACGIH: American Conference of Governmental Industrial Hygienists
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)

HMIS: Hazardous Materials Identification System (USA)
WHMIS: Workplace Hazardous Materials Information System (Canada)
DNEL: Derived No-Effect Level (REACH)

Effective date : 01.08.2015
Last updated : 03.20.2015

SCIENCE Company

SDS

Safety Data Sheet

1. IDENTIFICATION

Product Identifier:	**Sodium Hydroxide**
Product Code(s):	NC-0874, NC-2091, S1013, S1101, CF1131
Synonyms:	Caustic Soda; Soda Lye; White Caustic.
Recommended Use:	For manufacturing, industrial, and laboratory use only.
Uses Advised Against:	Not for household use.
Supplier:	The Science Company 7625 W Hampden Ave #14, Lakewood CO 80227 Phone: (303) 777-3777 Fax: (303) 777-3331
Emergency Phone Number:	(800) 255-3924 (CHEM-TEL)

2. HAZARDS IDENTIFICATION

Hazard Classifications:	Acute Toxicity – Dermal:	Category 4
	Skin Corrosion/Irritation:	Category 1A
	Eye Damage/Irritation:	Category 1
	Corrosive to Metals:	Category 1
Signal Word:	DANGER	
Hazard Statements:	Harmful in contact with skin. Causes severe skin burns and serious eye damage. May be corrosive to metals.	
Pictograms:		

Precautionary Statements:

Prevention:	Wear protective gloves, protective clothing, eye protection, and face protection. Do not breathe dusts. Wash thoroughly after handling. Keep only in original container.

Response: Immediately call a poison center or doctor.
If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water. Wash contaminated clothing before reuse.
If swallowed: Rinse mouth. Do NOT induce vomiting.
If inhaled: Remove person to fresh air and keep comfortable for breathing.
If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
Absorb spillage to prevent material damage.

Storage: Store locked up.
Store in a corrosive resistant container with a resistant inner liner.

Disposal: Dispose of contents and container in accordance with local, regional, national, and international regulations.

Hazards Not Otherwise Classified: This product is harmful to aquatic life. Avoid release to the environment.

Toxicity Statement: Not applicable.

3. COMPOSITION AND INFORMATION ON INGREDIENTS

Component	Common Name / Synonyms	CAS#	Chemical Formula	% by Weight
Sodium Hydroxide	Caustic Soda; Soda Lye	1310-73-2	NaOH	≥ 96.0

Trade Secret Statement: Not applicable.

4. FIRST AID MEASURES

First Aid Procedures:

Inhalation: Move to fresh air. If breathing is difficult, give oxygen. If not breathing, give artificial respiration. Immediately call a poison center or doctor.

Ingestion: Do not induce vomiting unless directed to do so by medical personnel. Rinse mouth with water. If vomiting occurs, keep head low so that vomit does not enter lungs. Never give anything by mouth to an unconscious person. Immediately call a poison center or doctor.

Skin Contact: Remove contaminated clothing and shoes immediately. Wash skin with plenty of water for at least 15 minutes. Wash clothing before reuse. Immediately call a poison center or doctor.

Eye Contact: Check for and remove contact lenses, if present and easy to do. Immediately flush eyes with gentle but large stream of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Immediately call a poison center or doctor.

General Advice: Poison information centers in each state can provide additional assistance for scheduled poisons. Ensure that those providing first aid and medical personnel are aware of the material(s) involved and take precautions to protect themselves.

Symptoms and Effects: Irritation, burning, coughing, sneezing, choking sensation, hoarseness, difficulty breathing, shock, nausea, vomiting, diarrhea. Causes burns to the eyes, skin, respiratory tract, and gastrointestinal tract. May cause tissue damage. Prolonged or repeated exposure may cause tissue destruction and mutagenic effects.

Immediate Medical Care/ Special Treatment: Immediate medical attention is required. Call a poison center or physician immediately. Treat symptomatically.

5. FIREFIGHTING MEASURES

Suitable Extinguishing Media: Water spray, dry powder, alcohol resistant foam, carbon dioxide.

Unsuitable Extinguishing Media: Do not use a solid (straight) water stream, as it may scatter and spread fire.

Hazardous Combustion Products: Sodium oxides, hydrogen.

Specific Hazards: Highly caustic. Excessive thermal conditions may cause decomposition and yield sodium oxides. Contact with metals may yield hazardous hydrogen gas. Contact with water may cause violent exothermic reaction.

Special Protective Equipment/ Precautions for Firefighters: As in any fire, wear MSHA/NIOSH-approved (or equivalent) self-contained, positive-pressure or pressure-demand breathing apparatus and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions and Protective Equipment: Isolate hazard area and keep unnecessary and unprotected personnel away from the area of the leak or spill. Keep upwind. Wear appropriate personal protective equipment (see Section 8). Avoid contact with eyes, skin, and clothing.

Emergency Procedures: In case of chemical emergency, or if unsure how to address an accidental release, consult a professional (see Section 1).

Methods for Containment: Stop the flow of material, if this is without risk. Prevent entry into waterways, sewer, basements, or confined areas. Dike the spilled material, where this is possible. Product should not be released to the environment. Contain and recover solid when possible.

Methods for Cleanup: Absorb spill with an inert material (e.g. vermiculite, dry sand, earth, cloth, or fleece) and place in a non-combustible container for reclamation or disposal. Do not flush to sewer. Clean contaminated surface thoroughly. Residues from spills can be diluted with water and neutralized with a dilute acidic material. Never return spills in original containers for reuse. Clean up in accordance with all applicable regulations.

7. HANDLING AND STORAGE

Handling: Wear personal protective equipment (see Section 8). Provide sufficient air exchange and/or exhaust in work rooms. Avoid contact with skin, eyes, and clothing. Limit exposure to air and moisture. Avoid generation of product dust. Do not ingest. When using, do not eat, drink, or smoke. Keep away from incompatible materials (see Section 10). Handle in accordance with good industrial hygiene and safety practice. Wash thoroughly after handling. Containers of this material may be hazardous when empty, as they retain product residues. Observe all warnings and precautions listed for this product. As with all bases, never add water directly to this product. Instead, add bases to water to prevent violent eruption of the solution.

Storage: Store in a cool, dry, ventilated area. Store in a segregated and approved area away from heat and incompatible materials (see section 10). Store in original container. Do not store in metallic containers. Keep containers tightly closed and upright. Keep away from food, drink, and animal foodstuffs. Keep out of the reach of children. Comply with all national, state, and local codes pertaining to the storage, handling, dispensing, and disposal of this product.

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Exposure Limits: OSHA (PEL): 2 mg/m^3
ACGIH (TLV): 2 mg/m^3

Engineering Controls: Ensure adequate ventilation. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.

Personal Protective Measures:

Eye/Face Protection: Wear safety glasses with side shields or goggles and a face shield. Maintain approved eye wash station and accessible rinse facilities in work area.

Skin Protection: Wear appropriate chemical resistant clothing (with long sleeves) and appropriate chemical resistant gloves.

Respiratory Protection: An air-purifying, NIOSH-approved respirator with appropriate cartridge or canister may be permissible under certain circumstances where airborne concentrations are expected to exceed exposure limits. Use a positive-pressure, air-supplied respirator if there is any potential for an uncontrolled release, if exposure levels are unknown, or if any other circumstances exist where air-purifying respirators may not provide adequate protection.

Specific Requirements for Personal Protective Equipment: Ensure that glove material is compatible with this product. This information is available from glove manufacturers. If respiratory protection is required, use full face protection as well.

9. PHYSICAL AND CHEMICAL PROPERTIES

Unless otherwise indicated, all properties are given at 25 °C and standard pressure.

Appearance: Colorless to white, translucent solid.

Odor: Odorless.

Odor Threshold: No information found.

Formula Weight: 40.00

pH: 13 (0.5% w/v aqueous)

Melting/Freezing Point: 323 °C

Boiling Point/Range: 1388 °C

Decomposition Temperature: No information found.

Flash Point: Not applicable.

Auto-ignition Temperature: Not applicable.

Flammability: Not flammable.

Flammability/Explosive Limits: Not applicable.

Solubility: 1110 g/L aqueous; soluble in alcohol.

Vapor Pressure: 3 mmHg at 37 °C

Vapor Density: 1.38 (Air = 1)

Specific Gravity: 2.13 (Water = 1)

Evaporation Rate: No information found.

Viscosity:	No information found.
Partition Coefficient (n-octanol/water):	No information found.

10. STABILITY AND REACTIVITY

Reactivity Data:	Corrosive. See Section 11.
Chemical Stability:	Stable under normal conditions. Sensitive to air. Hygroscopic.
Conditions to Avoid:	Heat, excessive ambient moisture, exposure to air, incompatible materials.
Incompatible Materials:	Acids, oxidizers, metals.
Hazardous Decomposition Products:	Sodium oxides, hydrogen.
Possibility of Hazardous Reactions:	May react vigorously or violently with the incompatible materials listed above. Excessive thermal conditions may cause decomposition and yield sodium oxides. Contact with metals may yield hazardous hydrogen gas. Contact with moisture may cause violent exothermic reaction.
Hazardous Polymerization:	Will not occur.

11. TOXICOLOGICAL INFORMATION

Routes of Exposure:	Inhalation, ingestion, skin contact, eye contact.
Acute Effects:	Causes burns to the eyes, skin, respiratory tract, and gastrointestinal tract. May cause tissue damage.
Chronic Effects:	Prolonged or repeated exposure may cause tissue destruction and mutagenic effects.
Toxicological Data:	LD_{50} Dermal, Rabbit: 1350 mg/kg Corrosive. Causes severe burns to eyes and skin based on animal data.
Symptoms of Exposure:	Irritation, burning, coughing, sneezing, choking sensation, hoarseness, difficulty breathing, shock, nausea, vomiting, diarrhea.
Carcinogenic Effects:	This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.

12. ECOLOGICAL INFORMATION

Ecotoxicological Data:	LC_{50}, Western Mosquitofish (Gambusia affinis): 125 mg/L 96 h EC_{50}, Water Flea (Ceriodaphnia dubia): 34.59 - 47.13 mg/L 48 h
Persistence and Degradability:	Expected to be readily biodegradable.
Environmental Effects:	Harmful to aquatic organisms. May adversely affect pH of aquatic ecosystems. Avoid exposure to the environment.

13. DISPOSAL INFORMATION

Disposal Instructions: All wastes must be handled in accordance with local, state, and federal regulations. Minimize exposure to product waste (see Section 8). Do not dispose unused waste down drains or into sewers.

Contaminated Packaging: Because emptied containers may retain product residue, follow label warnings even after container is emptied. Offer rinsed packaging material to local recycling facilities.

Waste Codes: D002: Waste Corrosive Material (pH ≤ 2 or pH ≥12.5 or corrosive to steel)

14. TRANSPORT INFORMATION

DOT:

UN Number:	UN1823
Proper Shipping Name:	Sodium hydroxide, solid
Hazard Class:	8
Packing Group:	II
ERG Number:	154

Environmental Hazard Regulations: No information found.

Other Transport Precautions: DOT Reportable Quantity: 1000 lb

15. REGULATORY INFORMATION

U.S. Federal Regulations:

OSHA: This product is considered a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

TSCA Inventory: All components of this product are on the U.S. TSCA Inventory.

U.S. EPCRA (SARA Title III):

Section 302: No information found.

Sections 311/312:

Hazard Category	List (Yes/No)
Section 311 – Hazardous Chemical	Yes
Immediate Hazard	Yes
Delayed Hazard	No
Fire Hazard	No
Pressure Hazard	No
Reactivity Hazard	No

Section 313: No information found.

CERCLA Reportable Quantities: Sodium Hydroxide: 1000 lb

International Inventories:

Country or Region	Inventory Name	On Inventory (Yes/No)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes

*A "Yes" indicates that the listed component(s) of this product comply with the inventory requirements administered by the governing country(s).

16. OTHER INFORMATION

Disclaimer: The Science Company provides the information in this Safety Data Sheet in the belief that it is reliable but assumes no responsibility for its completeness or accuracy. The physical properties reported in this SDS are obtained from literature and do not constitute product specifications. The Science Company makes and gives no representations or warranties with respect to the information contained herein or the product to which it refers, whether express, implied, or statutory, including without limitation, warranties of accuracy, completeness, merchantability, non-infringement, performance, safety, suitability, stability, and fitness for a particular purpose. No warranty against infringement of any patent, copyright or trademark is made or implied. This SDS is intended only as a guide to the appropriate handling of the material by a properly trained person. It shall be the user's responsibility to develop proper methods of handling and personal protection based on the actual conditions of use. Accordingly, The Science Company assumes no liability whatsoever for the use of or reliance upon this information including results obtained, incidental or consequential damages, or lost profits.

Issue Date: May 19, 2016

Reason for Revision: Update of Section 9 over 05/28/2015 version.

Safety Data Sheet
according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and GHS

Effective date: 05/12/2015 **Revision:** 05/12/2015

LIQUINOX

1 Identification of the Substance/mixture and of the Company/Undertaking

1.1 Product identifier

Trade name: **LIQUINOX**

Application of the substance / the preparation: Hand detergent.

1.2 Relevant identified uses of the substance or mixture and uses advised against:

No additional information available.

1.3 Details of the supplier of the Safety Data Sheet

Manufacturer/Supplier:

Alconox, Inc.
30 Glenn St., Suite 309
White Plains, NY 10603
Phone: 914-948-4040

Further information obtainable from: Product Safety Department.

1.4 Emergency telephone number:

ChemTel Inc.: (800)255-3924, +1 (813)248-0585

2 Hazards Identification

2.1 Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008:

Classification according to Directive 67/548/EEC or Directive 1999/45/EC:

GHS07

Skin Irrit. 2, H315: Causes skin irritation.

Information concerning particular hazards for human and environment:

The product has to be labelled due to the calculation procedure of the "General Classification guideline for preparations of the EU" in the latest valid version.

Classification system:

The classification is according to the latest editions of the EU-lists, and extended by company and literature data

2.2 Label elements

Labelling according to Regulation (EC) No 1272/2008:

The product is classified and labelled according to the CLP regulation.

Hazard pictograms:

GHS07

Signal word: Warning

Hazard-determining components of labelling:

Alkyl benzene sulfonic acid, sodium salt.

Hazard statements:

H315: Causes skin irritation.

Precautionary statements:

P332+P313: If skin irritation occurs: Get medical advice/attention.

P302+P352: IF ON SKIN: Wash with plenty of soap and water.

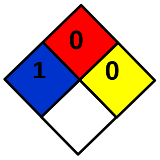
P501: Dispose of contents/container in accordance with local/regional/national/international regulations.

Other Hazard description:

WHMIS-classification and symbols:

D2B - Toxic material causing other toxic effects

NFPA ratings (scale 0 - 4)



Health = 1
Fire = 0
Reactivity = 0

HMIS-ratings (scale 0 - 4)

HEALTH	1	🟦
FIRE	0	🟥
REACTIVITY	0	🟨

Health = 1
Fire = 0
Reactivity = 0

2.3 Other hazards

Results of PBT and vPvB assessment

PBT: Not applicable.
vPvB: Not applicable.

3 Composition/Information on Ingredients

3.2 Chemical characterization: Mixture

Description: Hazardous ingredients of mixture listed below.

Identifying Nos.	Description	Wt. %
CAS: 68081-81-2	Alkyl benzene sulfonic acid, sodium salt	10 - 25%
CAS: 1300-72-7 EINECS: 215-090-9	Sodium xylene sulphonate	2.5 - 10%
CAS: 84133-50-6	Alcohol Ethoxylate	2.5 - 10%
CAS: 68603-42-9 EINECS: 271-657-0	Coconut diethanolamide	2.5 - 10%
CAS: 17572-97-3 EINECS: 241-543-5	Ethylenediaminetetraacetic acid, tripotassium salt	2.5 - 10%

Additional information: For the wording of the listed risk phrases refer to section 16.

4 First Aid Measures

4.1 Description of first aid measures

General information:

Take affected persons out into the fresh air.

After inhalation:

Supply fresh air; consult doctor in case of complaints.

After skin contact:

Immediately wash with water and soap and rinse thoroughly for 30 minutes. If skin irritation continues, consult a doctor.

After eye contact:

Remove contact lenses if worn.

Rinse opened eye for at least 30 minutes under running water, lifting upper and lower lids occasionally. Immediately consult a doctor.

After swallowing:

Do not induce vomiting; call for medical help immediately. Rinse out mouth and then drink plenty of water.

A person vomiting while laying on their back should be turned onto their side.

4.2 Most important symptoms and effects, both acute and delayed:

Irritating, all routes of exposure.

4.3 Indication of any immediate medical attention and special treatment needed:

No additional information available.

5 Firefighting Measures

5.1 Extinguishing media:

Suitable extinguishing agents:

CO2, powder or water spray. Fight larger fires with water spray or alcohol resistant foam.

5.2 Special hazards arising from the substance or mixture:

No additional information available.

5.3 Advice for firefighters:

Protective equipment:

Wear self-contained respiratory protective device.

Wear fully protective suit.

6 Accidental Release Measures

6.1 Personal precautions, protective equipment and emergency procedures:

Ensure adequate ventilation.

Particular danger of slipping on leaked/spilled product.

6.2 Environmental precautions:

Dilute with plenty of water.

Do not allow to enter sewers/ surface or ground water.

6.3 Methods and material for containment and cleaning up:

Absorb with liquid-binding material (sand, diatomite, acid binders, universal binders, sawdust).

Clean the affected area carefully; suitable cleaners are: Warm water

Dispose contaminated material as waste according to item 13. Ensure adequate ventilation.

6.4 Reference to other sections:

See Section 7 for information on safe handling.

See Section 8 for information on personal protection equipment.

See Section 13 for disposal information

7 Handling and Storage

7.1 Precautions for safe handling:

No special precautions are necessary if used correctly.

Information about fire - and explosion protection:

No special measures required.

7.2 Conditions for safe storage, including any incompatibilities:

Storage:

Requirements to be met by storerooms and receptacles: No special requirements.

Information about storage in one common storage facility: No special requirements.

Further information about storage conditions: None

7.3 Specific end use(s): No additional information available.

8 Exposure Controls/Personal Protection

8.1 Control parameters

Ingredients with limit values that require monitoring at the workplace:

The product does not contain any relevant quantities of materials with critical values that have to be monitored at the workplace.

Additional information: The lists valid during the making were used as basis.

8.2 Exposure controls:

Personal protective equipment:

General protective and hygienic measures:

Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing.
Wash hands before breaks and at the end of work.
Avoid contact with the eyes and skin.

Respiratory protection:

Not required under normal conditions of use.

Protection of hands:

Protective gloves

The glove material has to be impermeable and resistant to the product. Selection of the glove material should be based on the penetration time, rates of diffusion and the degradation of the glove material.

Material of gloves:

The selection of a suitable gloves does not only depend on the material, but also on the quality, and varies from manufacturer to manufacturer.

Penetration time of glove material:

The exact break through time has to be determined by the manufacturer of the protective gloves. DO NOT exceed the breakthrough time set by the Manufacturer.

For long term contact, gloves made of the following materials are considered suitable:

Butyl rubber, BR
Nitrile rubber, NBR
Natural rubber (NR)
Neoprene gloves

Eye protection:

Safety glasses
Goggles recommended during refilling.

Body protection: Protective work clothing

9 Physical and Chemical Properties

9.1 Information on basic physical and chemical properties:

General Information:	
Appearance:	
Form:	Liquid
Color:	Light Yellow
Odor:	Odorless
Odor threshold:	Not determined.
pH-value:	8.5
Change in condition:	
Melting point/Melting range:	Not determined.
Boiling point/Boiling range:	100°C
Flash point:	Not applicable.
Flammability (solid, gaseous):	Not applicable.
Ignition temperature:	Not applicable.
Decomposition temperature:	Not determined.
Self-igniting:	Product is not selfigniting.
Danger of explosion:	Product does not present an explosion hazard.
Explosion limits:	
Lower:	Not determined.
Upper:	Not determined.
Vapor pressure at 20°C:	23 hPa
Density:	1.08 g/cm³
Relative density:	Not determined.
Vapor density:	Not determined.
Evaporation rate:	Not determined.
Solubility in / Miscibility with water:	Fully miscible.
Segregation coefficient (n-octanol/water):	Not determined.
Viscosity:	
Dynamic:	Not determined.
Kinematic:	Not determined.
Solvent content:	
Organic solvents:	Not determined.
Solids content:	Not determined.
9.2 Other information:	No additional information available.

10 Stability and Reactivity

10.1 Reactivity:

10.2 Chemical stability:

Thermal decomposition / conditions to be avoided:

No decomposition if used according to specifications.

10.3 Possibility of hazardous reactions:

Reacts with strong oxidizing agents. Reacts with strong acids.

10.4 Conditions to avoid:

No additional information available.

10.5 Incompatible materials:

No additional information available.

10.6 Hazardous decomposition products:

Carbon monoxide and carbon dioxide
Sulphur oxides (SOx)
Nitrogen oxides

11 Toxicological Information

11.1 Information on toxicological effects:

Toxicity data: Toxicity data is available for mixture:

Primary irritant effect:

On the skin: Irritating to skin and mucous membranes.

On the eye: Strong irritant with the danger of severe eye injury.

Sensitization: No sensitizing effects known.

Additional toxicological information:

The product shows the following dangers according to the calculation method of the General EU Classification Guidelines for Preparations as issued in the latest version: Irritant

12 Ecological Information

12.1 Toxicity:

Aquatic toxicity: No additional information available.

12.2 Persistence and degradability: Biodegradable.

12.3 Bioaccumulative potential: Does not accumulate in organisms.

12.4 Mobility in soil: No additional information available.

Additional ecological information:

General notes:

Water hazard class 1 (German Regulation) (Self-assessment): slightly hazardous for water.
Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system.
Must not reach sewage water or drainage ditch undiluted or un-neutralized.

12.5 Results of PBT and vPvB assessment:

PBT: Not applicable.

vPvB: Not applicable.

12.6 Other adverse effects: No additional information available.

13 Disposal Considerations

13.1 Waste treatment methods:

Recommendation:

Smaller quantities can be disposed of with household waste.

Small amounts may be diluted with plenty of water and washed away. Dispose of bigger amounts in accordance with Local Authority requirements.

The surfactant used in this product complies with the biodegradability criteria as laid down in Regulation (EC) No. 648/2004 on detergents. Data to support this assertion are held at the disposal of the competent authorities of the Member States and will be made available to them, at their direct request or at the request of a detergent manufacturer.

Uncleaned packaging:

Recommendation: Disposal must be made according to official regulations.

Recommended cleansing agents: Water, together with cleansing agents, if necessary.

14 Transport Information

14.1 UN-Number:

DOT, ADR, ADN, IMDG, IATA:	Not Regulated

14.2 UN proper shipping name:

DOT, ADR, IMDG, IATA:	Not Regulated

14.3 Transport hazard class(es):

DOT, ADR, IMDG, IATA:

Class:	Not Regulated
Label:	-

14.4 Packing group:

DOT, ADR, IMDG, IATA:	Not Regulated

14.5 Environmental hazards:

Marine pollutant:	No

14.6 Special precautions for user:	Not applicable.

14.7 Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code: Not applicable.

UN "Model Regulation":	Not Regulated

15 Regulatory Information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture:

United States (USA):

SARA:

Section 355 (extremely hazardous substances): None of the ingredient is listed.

Section 313 (Specific toxic chemical listings): None of the ingredient is listed.

TSCA (Toxic Substances Control Act): All ingredients are listed.

Proposition 65 (California):

Chemicals known to cause cancer: None of the ingredient is listed.

Chemicals known to cause reproductive toxicity for females: None of the ingredient is listed.

Chemicals known to cause reproductive toxicity for males: None of the ingredient is listed.

Chemicals known to cause developmental toxicity: None of the ingredient is listed.

Carcinogenic Categories:

EPA (Environmental Protection Agency): None of the ingredient is listed.

TLV (Threshold Limit Value established by ACGIH): None of the ingredient is listed.

NIOSH-Ca (National Institute for Occupational Safety and Health): None of the ingredient is listed.

OSHA-Ca (Occupational Safety & Health Administration): None of the ingredient is listed.

Canadá:

Canadian Domestic Substances List (DSL): All ingredients are listed.

Canadian Ingredient Disclosure list (limit 0.1%): None of the ingredient is listed.

Canadian Ingredient Disclosure list (limit 1%): None of the ingredient is listed.

15.2 Chemical safety assessment: A Chemical Safety Assessment has not been carried out.

16 Other Information

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

Relevant phrases:

H315: Causes skin irritation.

Abbreviations and Acronyms:

ADR: European Agreement concerning the International Carriage of Dangerous Goods by Road.
IMDG: International Maritime Code for Dangerous Goods.
DOT: US Department of Transportation.
IATA: International Air Transport Association.
GHS: Globally Harmonized System of Classification and Labelling of Chemicals.
ACGIH: American Conference of Governmental Industrial Hygienists.
NFPA: National Fire Protection Association (USA).
HMIS: Hazardous Materials Identification System (USA).
WHMIS: Workplace Hazardous Materials Information System (Canada).
VOC: Volatile Organic Compounds (USA, EU).
LC50: Lethal concentration, 50 percent.
LD50: Lethal dose, 50 percent.

SDS Created by:

Global Safety Management, Inc.
10006 Cross Creek Blvd
Tampa, FL, 33647
Tel: 1-844-GSM-INFO (1-844-476-4636)
Website: www.GSMSDS.com

Safety Data Sheet

Material Name: Gasoline All Grades

SDS No. 9950
US GHS

Synonyms: Hess Conventional (Oxygenated and Non-oxygenated) Gasoline; Reformulated Gasoline (RFG); Reformulated Gasoline Blendstock for Oxygenate Blending (RBOB); Unleaded Motor or Automotive Gasoline

* * * Section 1 - Product and Company Identification * * *

Manufacturer Information

Hess Corporation
1 Hess Plaza
Woodbridge, NJ 07095-0961

Phone: 732-750-6000 Corporate EHS
Emergency # 800-424-9300 CHEMTREC
www.hess.com (Environment, Health, Safety Internet Website)

* * * Section 2 - Hazards Identification * * *

GHS Classification:

Flammable Liquid - Category 2
Skin Corrosion/Irritation - Category 2
Germ Cell Mutagenicity - Category 1B
Carcinogenicity - Category 1B
Toxic to Reproduction - Category 1A
Specific Target Organ Toxicity (Single Exposure) - Category 3 (respiratory irritation, narcosis)
Specific Target Organ Toxicity (Repeat Exposure) - Category 1 (liver, kidneys, bladder, blood, bone marrow, nervous system)
Aspiration Hazard - Category 1
Hazardous to the Aquatic Environment – Acute Hazard - Category 3

GHS LABEL ELEMENTS

Symbol(s)

Signal Word

DANGER

Hazard Statements

Highly flammable liquid and vapour.
Causes skin irritation.
May cause genetic defects.
May cause cancer.
May damage fertility or the unborn child.
May cause respiratory irritation.
May cause drowsiness or dizziness.
Causes damage to organs (liver, kidneys, bladder, blood, bone marrow, nervous system) through prolonged or repeated exposure.
May be fatal if swallowed and enters airways.
Harmful to aquatic life.

Precautionary Statements

Prevention

Keep away from heat/sparks/open flames/hot surfaces. No smoking
Keep container tightly closed.
Ground/bond container and receiving equipment.
Use explosion-proof electrical/ventilating/lighting/equipment.
Use only non-sparking tools.
Take precautionary measures against static discharge.
Wear protective gloves/protective clothing/eye protection/face protection.
Wash hands and forearms thoroughly after handling.
Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Do not breathe mist/vapours/spray.
Use only outdoors or in well-ventilated area.
Do not eat, drink or smoke when using this product.
Avoid release to the environment.

Response

In case of fire: Use water spray, fog, dry chemical fire extinguishers or hand held fire extinguisher.
IF ON SKIN (or hair): Wash with plenty of soap and water. Remove/Take off immediately all contaminated clothing and wash before reuse. If skin irritation occurs, get medical advice/attention.
IF exposed or concerned: Get medical advice/attention.
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a poison center or doctor/physician if you feel unwell.
Get medical advice/attention if you feel unwell.
IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician. Do not induce vomiting.

Storage

Store in a well-ventilated place.
Keep cool. Keep container tightly closed.
Store locked up.

Disposal

Dispose of contents/container in accordance with local/regional/national/international regulations.

* * * Section 3 - Composition / Information on Ingredients * * *

CAS #	Component	Percent
86290-81-5	Gasoline, motor fuel	100
108-88-3	Toluene	1-25
106-97-8	Butane	<10
1330-20-7	Xylenes (o-, m-, p- isomers)	1-15
95-63-6	Benzene, 1,2,4-trimethyl-	<6
64-17-5	Ethyl alcohol	0-10
100-41-4	Ethylbenzene	<3
71-43-2	Benzene	0.1-4.9

110-54-3	Hexane	0.5-4

A complex blend of petroleum-derived normal and branched-chain alkane, cycloalkane, alkene, and aromatic hydrocarbons. May contain antioxidant and multifunctional additives. Non-oxygenated Conventional Gasoline and RBOB do not have oxygenates (Ethanol). Oxygenated Conventional and Reformulated Gasoline will have oxygenates for octane enhancement or as legally required.

* * * Section 4 - First Aid Measures * * *

First Aid: Eyes

In case of contact with eyes, immediately flush with clean, low-pressure water for at least 15 min. Hold eyelids open to ensure adequate flushing. Seek medical attention.

First Aid: Skin

Remove contaminated clothing. Wash contaminated areas thoroughly with soap and water or with waterless hand cleanser. Obtain medical attention if irritation or redness develops.

First Aid: Ingestion

DO NOT INDUCE VOMITING. Do not give liquids. Obtain immediate medical attention. If spontaneous vomiting occurs, lean victim forward to reduce the risk of aspiration. Monitor for breathing difficulties. Small amounts of material which enter the mouth should be rinsed out until the taste is dissipated.

First Aid: Inhalation

Remove person to fresh air. If person is not breathing, provide artificial respiration. If necessary, provide additional oxygen once breathing is restored if trained to do so. Seek medical attention immediately.

* * * Section 5 - Fire Fighting Measures * * *

General Fire Hazards

See Section 9 for Flammability Properties.

Vapors may be ignited rapidly when exposed to heat, spark, open flame or other source of ignition. Flowing product may be ignited by self-generated static electricity. When mixed with air and exposed to an ignition source, flammable vapors can burn in the open or explode in confined spaces. Being heavier than air, vapors may travel long distances to an ignition source and flash back. Runoff to sewer may cause fire or explosion hazard.

Hazardous Combustion Products

Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke). Contact with nitric and sulfuric acids will form nitrocresols that can decompose violently.

Extinguishing Media

SMALL FIRES: Any extinguisher suitable for Class B fires, dry chemical, CO2, water spray, fire fighting foam, or gaseous extinguishing agent.

LARGE FIRES: Water spray, fog or fire fighting foam. Water may be ineffective for fighting the fire, but may be used to cool fire-exposed containers.

Firefighting foam suitable for polar solvents is recommended for fuel with greater than 10% oxygenate concentration.

Unsuitable Extinguishing Media

None

Fire Fighting Equipment/Instructions

Small fires in the incipient (beginning) stage may typically be extinguished using handheld portable fire extinguishers and other fire fighting equipment. Firefighting activities that may result in potential exposure to high heat, smoke or toxic by-products of combustion should require NIOSH/MSHA- approved pressure-demand self-contained breathing apparatus with full facepiece and full protective clothing. Isolate area around container involved in fire. Cool tanks, shells, and containers exposed to fire and excessive heat with water. For massive fires the use of unmanned hose holders or monitor nozzles may be advantageous to further minimize personnel exposure. Major fires may require withdrawal, allowing the tank to burn. Large storage tank fires typically require specially trained personnel and equipment to extinguish the fire, often including the need for properly applied fire fighting foam.

* * * Section 6 - Accidental Release Measures * * *

Recovery and Neutralization

Carefully contain and stop the source of the spill, if safe to do so.

Materials and Methods for Clean-Up

Take up with sand or other oil absorbing materials. Carefully shovel, scoop or sweep up into a waste container for reclamation or disposal. Caution, flammable vapors may accumulate in closed containers.

Emergency Measures

Evacuate nonessential personnel and remove or secure all ignition sources. Consider wind direction; stay upwind and uphill, if possible. Evaluate the direction of product travel, diking, sewers, etc. to confirm spill areas. Spills may infiltrate subsurface soil and groundwater; professional assistance may be necessary to determine the extent of subsurface impact.

Personal Precautions and Protective Equipment

Response and clean-up crews must be properly trained and must utilize proper protective equipment (see Section 8).

Environmental Precautions

Protect bodies of water by diking, absorbents, or absorbent boom, if possible. Do not flush down sewer or drainage systems, unless system is designed and permitted to handle such material. The use of fire fighting foam may be useful in certain situations to reduce vapors. The proper use of water spray may effectively disperse product vapors or the liquid itself, preventing contact with ignition sources or areas/equipment that require protection.

Prevention of Secondary Hazards

None

* * * Section 7 - Handling and Storage * * *

Handling Procedures

USE ONLY AS A MOTOR FUEL.
DO NOT SIPHON BY MOUTH

Handle as a flammable liquid. Keep away from heat, sparks, and open flame! Electrical equipment should be approved for classified area. Bond and ground containers during product transfer to reduce the possibility of static-initiated fire or explosion.

Special slow load procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when higher flash point material (such as fuel oil) is loaded into tanks previously containing low flash point products (such as this product) - see API Publication 2003, "Protection Against Ignitions Arising Out Of Static, Lightning and Stray Currents."

Storage Procedures

Keep away from flame, sparks, excessive temperatures and open flame. Use approved vented containers. Keep containers closed and clearly labeled. Empty product containers or vessels may contain explosive vapors. Do not pressurize, cut, heat, weld or expose such containers to sources of ignition.

Store in a well-ventilated area. This storage area should comply with NFPA 30 "Flammable and Combustible Liquid Code". Avoid storage near incompatible materials. The cleaning of tanks previously containing this product should follow API Recommended Practice (RP) 2013 "Cleaning Mobile Tanks In Flammable and Combustible Liquid Service" and API RP 2015 "Cleaning Petroleum Storage Tanks".

Incompatibilities

Keep away from strong oxidizers.

* * * Section 8 - Exposure Controls / Personal Protection * * *

Component Exposure Limits

Gasoline, motor fuel (86290-81-5)

ACGIH: 300 ppm TWA
500 ppm STEL

Toluene (108-88-3)

ACGIH: 20 ppm TWA
OSHA: 200 ppm TWA; 375 mg/m3 TWA
150 ppm STEL; 560 mg/m3 STEL
NIOSH: 100 ppm TWA; 375 mg/m3 TWA
150 ppm STEL; 560 mg/m3 STEL

Butane (106-97-8)

ACGIH: 1000 ppm TWA (listed under Aliphatic hydrocarbon gases: Alkane C1-4)
OSHA: 800 ppm TWA; 1900 mg/m3 TWA
NIOSH: 800 ppm TWA; 1900 mg/m3 TWA

Xylenes (o-, m-, p- isomers) (1330-20-7)

ACGIH: 100 ppm TWA
150 ppm STEL
OSHA: 100 ppm TWA; 435 mg/m3 TWA
150 ppm STEL; 655 mg/m3 STEL

Benzene, 1,2,4-trimethyl- (95-63-6)

NIOSH: 25 ppm TWA; 125 mg/m3 TWA

Ethyl alcohol (64-17-5)

ACGIH: 1000 ppm STEL
OSHA: 1000 ppm TWA; 1900 mg/m3 TWA
NIOSH: 1000 ppm TWA; 1900 mg/m3 TWA

Ethylbenzene (100-41-4)

ACGIH: 20 ppm TWA
OSHA: 100 ppm TWA; 435 mg/m3 TWA
125 ppm STEL; 545 mg/m3 STEL
NIOSH: 100 ppm TWA; 435 mg/m3 TWA
125 ppm STEL; 545 mg/m3 STEL

Benzene (71-43-2)

ACGIH: 0.5 ppm TWA
2.5 ppm STEL
Skin - potential significant contribution to overall exposure by the cutaneous route
OSHA: 5 ppm STEL (Cancer hazard, Flammable, See 29 CFR 1910.1028, 15 min); 0.5 ppm Action Level; 1 ppm TWA
NIOSH: 0.1 ppm TWA
1 ppm STEL

Hexane (110-54-3)

ACGIH: 50 ppm TWA
Skin - potential significant contribution to overall exposure by the cutaneous route
OSHA: 500 ppm TWA; 1800 mg/m3 TWA
NIOSH: 50 ppm TWA; 180 mg/m3 TWA

Engineering Measures

Use adequate ventilation to keep vapor concentrations of this product below occupational exposure and flammability limits, particularly in confined spaces.

Personal Protective Equipment: Respiratory

A NIOSH/MSHA-approved air-purifying respirator with organic vapor cartridges or canister may be permissible under certain circumstances where airborne concentrations are or may be expected to exceed exposure limits or for odor or irritation. Protection provided by air-purifying respirators is limited.

Use a positive pressure, air-supplied respirator if there is a potential for uncontrolled release, exposure levels are not known, in oxygen-deficient atmospheres, or any other circumstance where an air-purifying respirator may not provide adequate protection.

Personal Protective Equipment: Hands

Gloves constructed of nitrile, neoprene, or PVC are recommended.

PERSONAL PROTECTIVE EQUIPMENT

Personal Protective Equipment: Eyes

Safety glasses or goggles are recommended where there is a possibility of splashing or spraying.

Personal Protective Equipment: Skin and Body

Chemical protective clothing such as of E.I. DuPont TyChem®, Saranex® or equivalent recommended based on degree of exposure. Note: The resistance of specific material may vary from product to product as well as with degree of exposure. Consult manufacturer specifications for further information.

* * * Section 9 - Physical & Chemical Properties * * *

Appearance:	Translucent, straw-colored or light yellow	**Odor:**	Strong, characteristic aromatic hydrocarbon odor. Sweet-ether like
Physical State:	Liquid	**pH:**	ND
Vapor Pressure:	6.4 - 15 RVP @ 100 °F (38 °C) (275-475 mm Hg @ 68 °F (20 °C)	**Vapor Density:**	AP 3-4
Boiling Point:	85-437 °F (39-200 °C)	**Melting Point:**	ND
Solubility (H2O):	Negligible to Slight	**Specific Gravity:**	0.70-0.78
Evaporation Rate:	10-11	**VOC:**	ND
Percent Volatile:	100%	**Octanol/H2O Coeff.:**	ND
Flash Point:	-45 °F (-43 °C)	**Flash Point Method:**	PMCC
Upper Flammability Limit (UFL):	7.6%	**Lower Flammability Limit (LFL):**	1.4%
Burning Rate:	ND	**Auto Ignition:**	>530°F (>280°C)

* * * Section 10 - Chemical Stability & Reactivity Information * * *

Chemical Stability

This is a stable material.

Hazardous Reaction Potential

Will not occur.

Conditions to Avoid

Avoid high temperatures, open flames, sparks, welding, smoking and other ignition sources.

Incompatible Products

Keep away from strong oxidizers.

Hazardous Decomposition Products

Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke). Contact with nitric and sulfuric acids will form nitrocresols that can decompose violently.

* * * Section 11 - Toxicological Information * * *

Acute Toxicity

A: General Product Information

Harmful if swallowed.

B: Component Analysis - LD50/LC50

Gasoline, motor fuel (86290-81-5)

Inhalation LC50 Rat >5.2 mg/L 4 h; Oral LD50 Rat 14000 mg/kg; Dermal LD50 Rabbit >2000 mg/kg

Toluene (108-88-3)

Inhalation LC50 Rat 12.5 mg/L 4 h; Inhalation LC50 Rat >26700 ppm 1 h; Oral LD50 Rat 636 mg/kg; Dermal LD50 Rabbit 8390 mg/kg; Dermal LD50 Rat 12124 mg/kg

Butane (106-97-8)

Inhalation LC50 Rat 658 mg/L 4 h

Xylenes (o-, m-, p- isomers) (1330-20-7)
Inhalation LC50 Rat 5000 ppm 4 h; Inhalation LC50 Rat 47635 mg/L 4 h; Oral LD50 Rat 4300 mg/kg; Dermal LD50 Rabbit >1700 mg/kg

Benzene, 1,2,4-trimethyl- (95-63-6)
Inhalation LC50 Rat 18 g/m3 4 h; Oral LD50 Rat 3400 mg/kg; Dermal LD50 Rabbit >3160 mg/kg

Ethyl alcohol (64-17-5)
Oral LD50 Rat 7060 mg/kg; Inhalation LC50 Rat 124.7 mg/L 4 h

Ethylbenzene (100-41-4)
Inhalation LC50 Rat 17.2 mg/L 4 h; Oral LD50 Rat 3500 mg/kg; Dermal LD50 Rabbit 15354 mg/kg

Benzene (71-43-2)
Inhalation LC50 Rat 13050-14380 ppm 4 h; Oral LD50 Rat 1800 mg/kg

Hexane (110-54-3)
Inhalation LC50 Rat 48000 ppm 4 h; Oral LD50 Rat 25 g/kg; Dermal LD50 Rabbit 3000 mg/kg

Potential Health Effects: Skin Corrosion Property/Stimulativeness

Practically non-toxic if absorbed following acute (single) exposure. May cause skin irritation with prolonged or repeated contact. Liquid may be absorbed through the skin in toxic amounts if large areas of skin are repeatedly exposed.

Potential Health Effects: Eye Critical Damage/ Stimulativeness

Moderate irritant. Contact with liquid or vapor may cause irritation.

Potential Health Effects: Ingestion

Ingestion may cause gastrointestinal disturbances, including irritation, nausea, vomiting and diarrhea, and central nervous system (brain) effects similar to alcohol intoxication. In severe cases, tremors, convulsions, loss of consciousness, coma, respiratory arrest, and death may occur.

Potential Health Effects: Inhalation

Excessive exposure may cause irritations to the nose, throat, lungs and respiratory tract. Central nervous system (brain) effects may include headache, dizziness, loss of balance and coordination, unconsciousness, coma, respiratory failure, and death.

WARNING: the burning of any hydrocarbon as a fuel in an area without adequate ventilation may result in hazardous levels of combustion products, including carbon monoxide, and inadequate oxygen levels, which may cause unconsciousness, suffocation, and death.

Respiratory Organs Sensitization/Skin Sensitization

This product is not reported to have any skin sensitization effects.

Generative Cell Mutagenicity

This product may cause genetic defects.

Carcinogenicity

A: General Product Information

May cause cancer.

IARC has determined that gasoline and gasoline exhaust are possibly carcinogenic in humans. Inhalation exposure to completely vaporized unleaded gasoline caused kidney cancers in male rats and liver tumors in female mice. The U.S. EPA has determined that the male kidney tumors are species-specific and are irrelevant for human health risk assessment. The significance of the tumors seen in female mice is not known. Exposure to light hydrocarbons in the same boiling range as this product has been associated in animal studies with effects to the central and peripheral nervous systems, liver, and kidneys. The significance of these animal models to predict similar human response to gasoline is uncertain.

This product contains benzene. Human health studies indicate that prolonged and/or repeated overexposure to benzene may cause damage to the blood-forming system (particularly bone marrow), and serious blood disorders such as aplastic anemia and leukemia. Benzene is listed as a human carcinogen by the NTP, IARC, OSHA and ACGIH.

B: Component Carcinogenicity

Gasoline, motor fuel (86290-81-5)

ACGIH: A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans

Toluene (108-88-3)

ACGIH: A4 - Not Classifiable as a Human Carcinogen
IARC: Monograph 71 [1999]; Monograph 47 [1989] (Group 3 (not classifiable))

Xylenes (o-, m-, p- isomers) (1330-20-7)

ACGIH: A4 - Not Classifiable as a Human Carcinogen
IARC: Monograph 71 [1999]; Monograph 47 [1989] (Group 3 (not classifiable))

Ethyl alcohol (64-17-5)

ACGIH: A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans
IARC: Monograph 100E [in preparation] (in alcoholic beverages); Monograph 96 [2010] (in alcoholic beverages) (Group 1 (carcinogenic to humans))

Ethylbenzene (100-41-4)

ACGIH: A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans
IARC: Monograph 77 [2000] (Group 2B (possibly carcinogenic to humans))

Benzene (71-43-2)

ACGIH: A1 - Confirmed Human Carcinogen
OSHA: 5 ppm STEL (Cancer hazard, Flammable, See 29 CFR 1910.1028, 15 min); 0.5 ppm Action Level; 1 ppm TWA
NIOSH: potential occupational carcinogen
NTP: Known Human Carcinogen (Select Carcinogen)
IARC: Monograph 100F [in preparation]; Supplement 7 [1987]; Monograph 29 [1982] (Group 1 (carcinogenic to humans))

Reproductive Toxicity

This product is suspected of damaging fertility or the unborn child.

Specified Target Organ General Toxicity: Single Exposure

This product may cause drowsiness or dizziness.

Specified Target Organ General Toxicity: Repeated Exposure

This product causes damage to organs through prolonged or repeated exposure.

Aspiration Respiratory Organs Hazard

The major health threat of ingestion occurs from the danger of aspiration (breathing) of liquid drops into the lungs, particularly from vomiting. Aspiration may result in chemical pneumonia (fluid in the lungs), severe lung damage, respiratory failure and even death.

* * * Section 12 - Ecological Information * * *

Ecotoxicity

A: General Product Information

Very toxic to aquatic life with long lasting effects. Keep out of sewers, drainage areas and waterways. Report spills and releases, as applicable, under Federal and State regulations.

B: Component Analysis - Ecotoxicity - Aquatic Toxicity

Gasoline, motor fuel (86290-81-5)

Test & Species		Conditions
96 Hr LC50 Alburnus alburnus	119 mg/L [static]	
96 Hr LC50 Cyprinodon variegatus	82 mg/L [static]	
72 Hr EC50 Pseudokirchneriella subcapitata	56 mg/L	
24 Hr EC50 Daphnia magna	170 mg/L	

Toluene (108-88-3)

Test & Species		Conditions
96 Hr LC50 Pimephales promelas	15.22-19.05 mg/L [flow-through]	1 day old
96 Hr LC50 Pimephales promelas	12.6 mg/L [static]	
96 Hr LC50 Oncorhynchus mykiss	5.89-7.81 mg/L [flow-through]	
96 Hr LC50 Oncorhynchus mykiss	14.1-17.16 mg/L [static]	
96 Hr LC50 Oncorhynchus mykiss	5.8 mg/L [semi-static]	
96 Hr LC50 Lepomis macrochirus	11.0-15.0 mg/L [static]	
96 Hr LC50 Oryzias latipes	54 mg/L [static]	
96 Hr LC50 Poecilia reticulata	28.2 mg/L [semi-static]	
96 Hr LC50 Poecilia reticulata	50.87-70.34 mg/L [static]	
96 Hr EC50 Pseudokirchneriella subcapitata	>433 mg/L	
72 Hr EC50 Pseudokirchneriella subcapitata	12.5 mg/L [static]	
48 Hr EC50 Daphnia magna	5.46 - 9.83 mg/L [Static]	
48 Hr EC50 Daphnia magna	11.5 mg/L	

Xylenes (o-, m-, p- isomers) (1330-20-7)

Test & Species		Conditions
96 Hr LC50 Pimephales promelas	13.4 mg/L [flow-through]	

96 Hr LC50 Oncorhynchus mykiss	2.661-4.093 mg/L [static]	
96 Hr LC50 Oncorhynchus mykiss	13.5-17.3 mg/L	
96 Hr LC50 Lepomis macrochirus	13.1-16.5 mg/L [flow-through]	
96 Hr LC50 Lepomis macrochirus	19 mg/L	
96 Hr LC50 Lepomis macrochirus	7.711-9.591 mg/L [static]	
96 Hr LC50 Pimephales promelas	23.53-29.97 mg/L [static]	
96 Hr LC50 Cyprinus carpio	780 mg/L [semi-static]	
96 Hr LC50 Cyprinus carpio	>780 mg/L	
96 Hr LC50 Poecilia reticulata	30.26-40.75 mg/L [static]	
48 Hr EC50 water flea	3.82 mg/L	
48 Hr LC50 Gammarus lacustris	0.6 mg/L	

Benzene, 1,2,4-trimethyl- (95-63-6)

Test & Species		Conditions
96 Hr LC50 Pimephales promelas	7.19-8.28 mg/L [flow-through]	
48 Hr EC50 Daphnia magna	6.14 mg/L	

Ethyl alcohol (64-17-5)

Test & Species		Conditions
96 Hr LC50 Oncorhynchus mykiss	12.0 - 16.0 mL/L [static]	
96 Hr LC50 Pimephales promelas	>100 mg/L [static]	
96 Hr LC50 Pimephales promelas	13400 - 15100 mg/L [flow-through]	
48 Hr LC50 Daphnia magna	9268 - 14221 mg/L	
24 Hr EC50 Daphnia magna	10800 mg/L	
48 Hr EC50 Daphnia magna	2 mg/L [Static]	

Ethylbenzene (100-41-4)

Test & Species		Conditions
96 Hr LC50 Oncorhynchus mykiss	11.0-18.0 mg/L [static]	
96 Hr LC50 Oncorhynchus mykiss	4.2 mg/L [semi-static]	
96 Hr LC50 Pimephales promelas	7.55-11 mg/L [flow-through]	
96 Hr LC50 Lepomis macrochirus	32 mg/L [static]	
96 Hr LC50 Pimephales promelas	9.1-15.6 mg/L [static]	
96 Hr LC50 Poecilia reticulata	9.6 mg/L [static]	
72 Hr EC50 Pseudokirchneriella subcapitata	4.6 mg/L	
96 Hr EC50 Pseudokirchneriella subcapitata	>438 mg/L	
72 Hr EC50 Pseudokirchneriella subcapitata	2.6 - 11.3 mg/L [static]	

96 Hr EC50 Pseudokirchneriella subcapitata	1.7 - 7.6 mg/L [static]	
48 Hr EC50 Daphnia magna	1.8 - 2.4 mg/L	

Benzene (71-43-2)

Test & Species		Conditions
96 Hr LC50 Pimephales promelas	10.7-14.7 mg/L [flow-through]	
96 Hr LC50 Oncorhynchus mykiss	5.3 mg/L [flow-through]	
96 Hr LC50 Lepomis macrochirus	22.49 mg/L [static]	
96 Hr LC50 Poecilia reticulata	28.6 mg/L [static]	
96 Hr LC50 Pimephales promelas	22330-41160 µg/L [static]	
96 Hr LC50 Lepomis macrochirus	70000-142000 µg/L [static]	
72 Hr EC50 Pseudokirchneriella subcapitata	29 mg/L	
48 Hr EC50 Daphnia magna	8.76 - 15.6 mg/L [Static]	
48 Hr EC50 Daphnia magna	10 mg/L	

Hexane (110-54-3)

Test & Species		Conditions
96 Hr LC50 Pimephales promelas	2.1-2.98 mg/L [flow-through]	
24 Hr EC50 Daphnia magna	>1000 mg/L	

Persistence/Degradability

No information available.

Bioaccumulation

No information available.

Mobility in Soil

No information available.

* * * Section 13 - Disposal Considerations * * *

Waste Disposal Instructions

See Section 7 for Handling Procedures. See Section 8 for Personal Protective Equipment recommendations.

Disposal of Contaminated Containers or Packaging

Dispose of contents/container in accordance with local/regional/national/international regulations.

* * * Section 14 - Transportation Information * * *

Component Marine Pollutants

This material contains one or more of the following chemicals required by US DOT to be identified as marine pollutants.

Component	CAS #	
Gasoline, motor fuel	86290-81-5	DOT regulated marine pollutant

DOT Information

Shipping Name: Gasoline

UN #: 1203 **Hazard Class:** 3 **Packing Group:** II

Placard:

* * * Section 15 - Regulatory Information * * *

Regulatory Information

A: Component Analysis

This material contains one or more of the following chemicals required to be identified under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65) and/or CERCLA (40 CFR 302.4).

Toluene (108-88-3)

SARA 313: 1.0 % de minimis concentration
CERCLA: 1000 lb final RQ; 454 kg final RQ

Xylenes (o-, m-, p- isomers) (1330-20-7)

SARA 313: 1.0 % de minimis concentration
CERCLA: 100 lb final RQ; 45.4 kg final RQ

Benzene, 1,2,4-trimethyl- (95-63-6)

SARA 313: 1.0 % de minimis concentration

Ethylbenzene (100-41-4)

SARA 313: 0.1 % de minimis concentration
CERCLA: 1000 lb final RQ; 454 kg final RQ

Benzene (71-43-2)

SARA 313: 0.1 % de minimis concentration
CERCLA: 10 lb final RQ (received an adjusted RQ of 10 lbs based on potential carcinogenicity in an August 14, 1989 final rule); 4.54 kg final RQ (received an adjusted RQ of 10 lbs based on potential carcinogenicity in an August 14, 1989 final rule)

Hexane (110-54-3)

SARA 313: 1.0 % de minimis concentration
CERCLA: 5000 lb final RQ; 2270 kg final RQ

SARA Section 311/312 – Hazard Classes

Acute Health	Chronic Health	Fire	Sudden Release of Pressure	Reactive
X	X	X	--	--

Component Marine Pollutants

This material contains one or more of the following chemicals required by US DOT to be identified as marine pollutants.

Component	CAS #	
Gasoline, motor fuel	86290-81-5	DOT regulated marine pollutant

State Regulations

Component Analysis - State

The following components appear on one or more of the following state hazardous substances lists:

Component	CAS	CA	MA	MN	NJ	PA	RI
Gasoline, motor fuel	86290-81-5	No	No	No	No	Yes	No
Toluene	108-88-3	Yes	Yes	Yes	Yes	Yes	No
Butane	106-97-8	Yes	Yes	Yes	Yes	Yes	No
Xylenes (o-, m-, p- isomers)	1330-20-7	Yes	Yes	Yes	Yes	Yes	No
Benzene, 1,2,4-trimethyl-	95-63-6	No	Yes	Yes	Yes	Yes	No
Ethyl alcohol	64-17-5	Yes	Yes	Yes	Yes	Yes	No
Ethylbenzene	100-41-4	Yes	Yes	Yes	Yes	Yes	No
Benzene	71-43-2	Yes	Yes	Yes	Yes	Yes	No
Hexane	110-54-3	No	Yes	Yes	Yes	Yes	No

The following statement(s) are provided under the California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65):

WARNING! This product contains a chemical known to the state of California to cause cancer.
WARNING! This product contains a chemical known to the state of California to cause reproductive/developmental effects.

Component Analysis - WHMIS IDL

The following components are identified under the Canadian Hazardous Products Act Ingredient Disclosure List:

Component	CAS #	Minimum Concentration
Toluene	108-88-3	1 %
Butane	106-97-8	1 %
Benzene, 1,2,4-trimethyl-	95-63-6	0.1 %
Ethyl alcohol	64-17-5	0.1 %
Ethylbenzene	100-41-4	0.1 %
Benzene	71-43-2	0.1 %
Hexane	110-54-3	1 %

Additional Regulatory Information

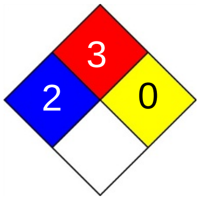
Component Analysis - Inventory

Component	CAS #	TSCA	CAN	EEC
Gasoline, motor fuel	86290-81-5	No	DSL	EINECS
Toluene	108-88-3	Yes	DSL	EINECS
Butane	106-97-8	Yes	DSL	EINECS
Xylenes (o-, m-, p- isomers)	1330-20-7	Yes	DSL	EINECS
Benzene, 1,2,4-trimethyl-	95-63-6	Yes	DSL	EINECS
Ethyl alcohol	64-17-5	Yes	DSL	EINECS
Ethylbenzene	100-41-4	Yes	DSL	EINECS
Benzene	71-43-2	Yes	DSL	EINECS
Hexane	110-54-3	Yes	DSL	EINECS

* * * Section 16 - Other Information * * *

NFPA® Hazard Rating

Health	2
Fire	3
Reactivity	0



HMIS® Hazard Rating

Health	2	Moderate
Fire	3	Serious
Physical	0	Minimal
		*Chronic

Key/Legend

EPA = Environmental Protection Agency; TSCA = Toxic Substance Control Act; ACGIH = American Conference of Governmental Industrial Hygienists; IARC = International Agency for Research on Cancer; NIOSH = National Institute for Occupational Safety and Health; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration., NJTSR = New Jersey Trade Secret Registry.

Literature References

None

Other Information

Information presented herein has been compiled from sources considered to be dependable, and is accurate and reliable to the best of our knowledge and belief, but is not guaranteed to be so. Since conditions of use are beyond our control, we make no warranties, expressed or implied, except those that may be contained in our written contract of sale or acknowledgment.

Vendor assumes no responsibility for injury to vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, vendor assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material, even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in their use of the material.

End of Sheet

Safety Data Sheet

Material Name: Diesel Fuel, All Types

SDS No. 9909
US GHS

Synonyms: Ultra Low Sulfur Diesel; Low Sulfur Diesel; No. 2 Diesel; Motor Vehicle Diesel Fuel; Non-Road Diesel Fuel; Locomotive/Marine Diesel Fuel

* * * Section 1 - Product and Company Identification * * *

Manufacturer Information

Hess Corporation
1 Hess Plaza
Woodbridge, NJ 07095-0961

Phone: 732-750-6000 Corporate EHS
Emergency # 800-424-9300 CHEMTREC
www.hess.com (Environment, Health, Safety Internet Website)

* * * Section 2 - Hazards Identification * * *

GHS Classification:

Flammable Liquids - Category 3
Skin Corrosion/Irritation – Category 2
Germ Cell Mutagenicity – Category 2
Carcinogenicity - Category 2
Specific Target Organ Toxicity (Single Exposure) - Category 3 (respiratory irritation, narcosis)
Aspiration Hazard – Category 1
Hazardous to the Aquatic Environment, Acute Hazard – Category 3

GHS LABEL ELEMENTS

Symbol(s)

Signal Word

DANGER

Hazard Statements

Flammable liquid and vapor.
Causes skin irritation.
Suspected of causing genetic defects.
Suspected of causing cancer.
May cause respiratory irritation.
May cause drowsiness or dizziness.
May be fatal if swallowed and enters airways.
Harmful to aquatic life.

Precautionary Statements

Prevention

Keep away from heat/sparks/open flames/hot surfaces. No smoking
Keep container tightly closed.
Ground/bond container and receiving equipment.

Use explosion-proof electrical/ventilating/lighting/equipment.
Use only non-sparking tools.
Take precautionary measures against static discharge.
Wear protective gloves/protective clothing/eye protection/face protection.
Wash hands and forearms thoroughly after handling.
Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Avoid breathing fume/mist/vapours/spray.

Response

In case of fire: Use water spray, fog or foam to extinguish.
IF ON SKIN (or hair): Wash with plenty of soap and water. Remove/Take off immediately all contaminated clothing and wash it before reuse. If skin irritation occurs: Get medical advice/attention.
IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a poison center/doctor if you feel unwell.
If swallowed: Immediately call a poison center or doctor. Do NOT induce vomiting.
IF exposed or concerned: Get medical advice/attention.

Storage

Store in a well-ventilated place. Keep cool.
Keep container tightly closed.
Store locked up.

Disposal

Dispose of contents/container in accordance with local/regional/national/international regulations.

* * * Section 3 - Composition / Information on Ingredients * * *

CAS #	Component	Percent
68476-34-6	Fuels, diesel, no. 2	100
91-20-3	Naphthalene	<0.1

A complex mixture of hydrocarbons with carbon numbers in the range C9 and higher.

* * * Section 4 - First Aid Measures * * *

First Aid: Eyes

In case of contact with eyes, immediately flush with clean, low-pressure water for at least 15 min. Hold eyelids open to ensure adequate flushing. Seek medical attention.

First Aid: Skin

Remove contaminated clothing. Wash contaminated areas thoroughly with soap and water or with waterless hand cleanser. Obtain medical attention if irritation or redness develops. Thermal burns require immediate medical attention depending on the severity and the area of the body burned.

First Aid: Ingestion

DO NOT INDUCE VOMITING. Do not give liquids. Obtain immediate medical attention. If spontaneous vomiting occurs, lean victim forward to reduce the risk of aspiration. Monitor for breathing difficulties. Small amounts of material which enter the mouth should be rinsed out until the taste is dissipated.

First Aid: Inhalation

Remove person to fresh air. If person is not breathing, provide artificial respiration. If necessary, provide additional oxygen once breathing is restored if trained to do so. Seek medical attention immediately.

* * * Section 5 - Fire Fighting Measures * * *

General Fire Hazards

See Section 9 for Flammability Properties.

Vapors may be ignited rapidly when exposed to heat, spark, open flame or other source of ignition. When mixed with air and exposed to an ignition source, flammable vapors can burn in the open or explode in confined spaces. Being heavier than air, vapors may travel long distances to an ignition source and flash back. Runoff to sewer may cause fire or explosion hazard.

Hazardous Combustion Products

Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke).

Extinguishing Media

SMALL FIRES: Any extinguisher suitable for Class B fires, dry chemical, CO2, water spray, fire fighting foam, and other gaseous agents.

LARGE FIRES: Water spray, fog or fire fighting foam. Water may be ineffective for fighting the fire, but may be used to cool fire-exposed containers.

Unsuitable Extinguishing Media

None

Fire Fighting Equipment/Instructions

Small fires in the incipient (beginning) stage may typically be extinguished using handheld portable fire extinguishers and other fire fighting equipment. Firefighting activities that may result in potential exposure to high heat, smoke or toxic by-products of combustion should require NIOSH/MSHA- approved pressure-demand self-contained breathing apparatus with full facepiece and full protective clothing. Isolate area around container involved in fire. Cool tanks, shells, and containers exposed to fire and excessive heat with water. For massive fires the use of unmanned hose holders or monitor nozzles may be advantageous to further minimize personnel exposure. Major fires may require withdrawal, allowing the tank to burn. Large storage tank fires typically require specially trained personnel and equipment to extinguish the fire, often including the need for properly applied fire fighting foam.

* * * Section 6 - Accidental Release Measures * * *

Recovery and Neutralization

Carefully contain and stop the source of the spill, if safe to do so.

Materials and Methods for Clean-Up

Take up with sand or other oil absorbing materials. Carefully shovel, scoop or sweep up into a waste container for reclamation or disposal. Caution, flammable vapors may accumulate in closed containers.

Emergency Measures

Evacuate nonessential personnel and remove or secure all ignition sources. Consider wind direction; stay upwind and uphill, if possible. Evaluate the direction of product travel, diking, sewers, etc. to confirm spill areas. Spills may infiltrate subsurface soil and groundwater; professional assistance may be necessary to determine the extent of subsurface impact.

Personal Precautions and Protective Equipment

Response and clean-up crews must be properly trained and must utilize proper protective equipment (see Section 8).

Environmental Precautions

Protect bodies of water by diking, absorbents, or absorbent boom, if possible. Do not flush down sewer or drainage systems, unless system is designed and permitted to handle such material. The use of fire fighting foam may be useful in certain situations to reduce vapors. The proper use of water spray may effectively disperse product vapors or the liquid itself, preventing contact with ignition sources or areas/equipment that require protection.

Prevention of Secondary Hazards

None

* * * Section 7 - Handling and Storage * * *

Handling Procedures

Handle as a combustible liquid. Keep away from heat, sparks, excessive temperatures and open flame! No smoking or open flame in storage, use or handling areas. Bond and ground containers during product transfer to reduce the possibility of static-initiated fire or explosion.

Special slow load procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when higher flash point material (such as fuel oil) is loaded into tanks previously containing low flash point products (such as this product) - see API Publication 2003, "Protection Against Ignitions Arising Out Of Static, Lightning and Stray Currents."

Storage Procedures

Keep away from flame, sparks, excessive temperatures and open flame. Use approved vented containers. Keep containers closed and clearly labeled. Empty product containers or vessels may contain explosive vapors. Do not pressurize, cut, heat, weld or expose such containers to sources of ignition.

Store in a well-ventilated area. This storage area should comply with NFPA 30 "Flammable and Combustible Liquid Code". Avoid storage near incompatible materials. The cleaning of tanks previously containing this product should follow API Recommended Practice (RP) 2013 "Cleaning Mobile Tanks In Flammable and Combustible Liquid Service" and API RP 2015 "Cleaning Petroleum Storage Tanks."

Incompatibilities

Keep away from strong oxidizers.

* * * Section 8 - Exposure Controls / Personal Protection * * *

Component Exposure Limits

Fuels, diesel, no. 2 (68476-34-6)

ACGIH:	100 mg/m3 TWA (inhalable fraction and vapor, as total hydrocarbons, listed under Diesel fuel) Skin - potential significant contribution to overall exposure by the cutaneous route (listed under Diesel fuel)

Naphthalene (91-20-3)

ACGIH: 10 ppm TWA
15 ppm STEL
Skin - potential significant contribution to overall exposure by the cutaneous route
OSHA: 10 ppm TWA; 50 mg/m3 TWA
NIOSH: 10 ppm TWA; 50 mg/m3 TWA
15 ppm STEL; 75 mg/m3 STEL

Engineering Measures

Use adequate ventilation to keep vapor concentrations of this product below occupational exposure and flammability limits, particularly in confined spaces.

Personal Protective Equipment: Respiratory

A NIOSH/MSHA-approved air-purifying respirator with organic vapor cartridges or canister may be permissible under certain circumstances where airborne concentrations are or may be expected to exceed exposure limits or for odor or irritation. Protection provided by air-purifying respirators is limited.

Use a positive pressure, air-supplied respirator if there is a potential for uncontrolled release, exposure levels are not known, in oxygen-deficient atmospheres, or any other circumstance where an air-purifying respirator may not provide adequate protection.

Personal Protective Equipment: Hands

Gloves constructed of nitrile, neoprene, or PVC are recommended.

Personal Protective Equipment: Eyes

Safety glasses or goggles are recommended where there is a possibility of splashing or spraying.

Personal Protective Equipment: Skin and Body

Chemical protective clothing such as of E.I. DuPont TyChem®, Saranex® or equivalent recommended based on degree of exposure. Note: The resistance of specific material may vary from product to product as well as with degree of exposure. Consult manufacturer specifications for further information.

* * * Section 9 - Physical & Chemical Properties * * *

Appearance:	Clear, straw-yellow.	**Odor:**	Mild, petroleum distillate odor
Physical State:	Liquid	**pH:**	ND
Vapor Pressure:	0.009 psia @ 70 °F (21 °C)	**Vapor Density:**	>1.0
Boiling Point:	320 to 690 °F (160 to 366 °C)	**Melting Point:**	ND
Solubility (H2O):	Negligible	**Specific Gravity:**	0.83-0.876 @ 60°F (16°C)
Evaporation Rate:	Slow; varies with conditions	**VOC:**	ND
Percent Volatile:	100%	**Octanol/H2O Coeff.:**	ND
Flash Point:	>125 °F (>52 °C) minimum	**Flash Point Method:**	PMCC
Upper Flammability Limit (UFL):	7.5	**Lower Flammability Limit (LFL):**	0.6
Burning Rate:	ND	**Auto Ignition:**	494°F (257°C)

* * * Section 10 - Chemical Stability & Reactivity Information * * *

Chemical Stability

This is a stable material.

Hazardous Reaction Potential

Will not occur.

Conditions to Avoid

Avoid high temperatures, open flames, sparks, welding, smoking and other ignition sources.

Incompatible Products

Keep away from strong oxidizers.

Hazardous Decomposition Products

Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke).

* * * Section 11 - Toxicological Information * * *

Acute Toxicity

A: General Product Information

Harmful if swallowed.

B: Component Analysis - LD50/LC50

Naphthalene (91-20-3)

Inhalation LC50 Rat >340 mg/m3 1 h; Oral LD50 Rat 490 mg/kg; Dermal LD50 Rat >2500 mg/kg; Dermal LD50 Rabbit >20 g/kg

Potential Health Effects: Skin Corrosion Property/Stimulativeness

Practically non-toxic if absorbed following acute (single) exposure. May cause skin irritation with prolonged or repeated contact. Liquid may be absorbed through the skin in toxic amounts if large areas of skin are repeatedly exposed.

Potential Health Effects: Eye Critical Damage/ Stimulativeness

Contact with eyes may cause mild irritation.

Potential Health Effects: Ingestion

Ingestion may cause gastrointestinal disturbances, including irritation, nausea, vomiting and diarrhea, and central nervous system (brain) effects similar to alcohol intoxication. In severe cases, tremors, convulsions, loss of consciousness, coma, respiratory arrest, and death may occur.

Potential Health Effects: Inhalation

Excessive exposure may cause irritations to the nose, throat, lungs and respiratory tract. Central nervous system (brain) effects may include headache, dizziness, loss of balance and coordination, unconsciousness, coma, respiratory failure, and death.

WARNING: the burning of any hydrocarbon as a fuel in an area without adequate ventilation may result in hazardous levels of combustion products, including carbon monoxide, and inadequate oxygen levels, which may cause unconsciousness, suffocation, and death.

Respiratory Organs Sensitization/Skin Sensitization

This product is not reported to have any skin sensitization effects.

Generative Cell Mutagenicity

This material has been positive in a mutagenicity study.

Carcinogenicity

A: General Product Information

Suspected of causing cancer.

Studies have shown that similar products produce skin tumors in laboratory animals following repeated applications without washing or removal. The significance of this finding to human exposure has not been determined. Other studies with active skin carcinogens have shown that washing the animal's skin with soap and water between applications reduced tumor formation.

B: Component Carcinogenicity

Fuels, diesel, no. 2 (68476-34-6)

ACGIH: A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans (listed under Diesel fuel)

Naphthalene (91-20-3)

ACGIH: A4 - Not Classifiable as a Human Carcinogen
NTP: Reasonably Anticipated To Be A Human Carcinogen (Possible Select Carcinogen)
IARC: Monograph 82 [2002] (Group 2B (possibly carcinogenic to humans))

Reproductive Toxicity

This product is not reported to have any reproductive toxicity effects.

Specified Target Organ General Toxicity: Single Exposure

This product is not reported to have any specific target organ general toxicity single exposure effects.

Specified Target Organ General Toxicity: Repeated Exposure

This product is not reported to have any specific target organ general toxicity repeat exposure effects.

Aspiration Respiratory Organs Hazard

The major health threat of ingestion occurs from the danger of aspiration (breathing) of liquid drops into the lungs, particularly from vomiting. Aspiration may result in chemical pneumonia (fluid in the lungs), severe lung damage, respiratory failure and even death.

* * * Section 12 - Ecological Information * * *

Ecotoxicity

A: General Product Information

Keep out of sewers, drainage areas and waterways. Report spills and releases, as applicable, under Federal and State regulations.

B: Component Analysis - Ecotoxicity - Aquatic Toxicity

Fuels, diesel, no. 2 (68476-34-6)

Test & Species		Conditions
96 Hr LC50 Pimephales promelas	35 mg/L [flow-through]	

Naphthalene (91-20-3)

Test & Species		Conditions
96 Hr LC50 Pimephales promelas	5.74-6.44 mg/L [flow-through]	
96 Hr LC50 Oncorhynchus mykiss	1.6 mg/L [flow-through]	
96 Hr LC50 Oncorhynchus mykiss	0.91-2.82 mg/L [static]	
96 Hr LC50 Pimephales promelas	1.99 mg/L [static]	

96 Hr LC50 Lepomis macrochirus	31.0265 mg/L [static]
72 Hr EC50 Skeletonema costatum	0.4 mg/L
48 Hr LC50 Daphnia magna	2.16 mg/L
48 Hr EC50 Daphnia magna	1.96 mg/L [Flow through]
48 Hr EC50 Daphnia magna	1.09 - 3.4 mg/L [Static]

Persistence/Degradability

No information available.

Bioaccumulation

No information available.

Mobility in Soil

No information available.

* * * Section 13 - Disposal Considerations * * *

Waste Disposal Instructions

See Section 7 for Handling Procedures. See Section 8 for Personal Protective Equipment recommendations.

Disposal of Contaminated Containers or Packaging

Dispose of contents/container in accordance with local/regional/national/international regulations.

* * * Section 14 - Transportation Information * * *

DOT Information

Shipping Name: Diesel Fuel

NA #: 1993 **Hazard Class:** 3 **Packing Group:** III

Placard:

* * * Section 15 - Regulatory Information * * *

Regulatory Information

Component Analysis

This material contains one or more of the following chemicals required to be identified under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65) and/or CERCLA (40 CFR 302.4).

Naphthalene (91-20-3)

CERCLA: 100 lb final RQ; 45.4 kg final RQ

SARA Section 311/312 – Hazard Classes

Acute Health	Chronic Health	Fire	Sudden Release of Pressure	Reactive
X	X	X	--	--

SARA SECTION 313 - SUPPLIER NOTIFICATION

This product may contain listed chemicals below the de minimis levels which therefore are not subject to the supplier notification requirements of Section 313 of the Emergency Planning and Community Right- To-Know Act (EPCRA) of 1986 and of 40 CFR 372. If you may be required to report releases of chemicals listed in 40 CFR 372.28, you may contact Hess Corporate Safety if you require additional information regarding this product.

State Regulations

Component Analysis - State

The following components appear on one or more of the following state hazardous substances lists:

Component	CAS	CA	MA	MN	NJ	PA	RI
Fuels, diesel, no. 2	68476-34-6	No	No	No	Yes	No	No
Naphthalene	91-20-3	Yes	Yes	Yes	Yes	Yes	No

The following statement(s) are provided under the California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65):

WARNING! This product contains a chemical known to the state of California to cause cancer.

Component Analysis - WHMIS IDL

No components are listed in the WHMIS IDL.

Additional Regulatory Information

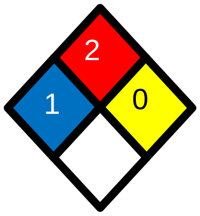
Component Analysis - Inventory

Component	CAS #	TSCA	CAN	EEC
Fuels, diesel, no. 2	68476-34-6	Yes	DSL	EINECS
Naphthalene	91-20-3	Yes	DSL	EINECS

* * * Section 16 - Other Information * * *

NFPA® Hazard Rating

NFPA® Hazard Rating	Health	1
	Fire	2
	Reactivity	0



HMIS® Hazard Rating	Health	1*	Slight
	Fire	2	Moderate
	Physical	0	Minimal
			*Chronic

Key/Legend

ACGIH = American Conference of Governmental Industrial Hygienists; ADG = Australian Code for the Transport of Dangerous Goods by Road and Rail; ADR/RID = European Agreement of Dangerous Goods by Road/Rail; AS = Standards Australia; DFG = Deutsche Forschungsgemeinschaft; DOT = Department of Transportation; DSL = Domestic Substances List; EEC = European Economic Community; EINECS = European Inventory of Existing Commercial Chemical Substances; ELINCS = European List of Notified Chemical Substances; EU = European Union; HMIS = Hazardous Materials Identification System; IARC = International Agency for Research on Cancer; IMO = International Maritime Organization; IATA = International Air Transport Association; MAK = Maximum Concentration Value in the Workplace; NDSL = Non-Domestic Substances List; NFPA = National Fire Protection Association; NOHSC = National Occupational Health & Safety Commission; NTP = National Toxicology Program; STEL = Short-term Exposure Limit; TDG = Transportation of Dangerous Goods; TLV = Threshold Limit Value; TSCA = Toxic Substances Control Act; TWA = Time Weighted Average

Literature References

None

Other Information

Information presented herein has been compiled from sources considered to be dependable, and is accurate and reliable to the best of our knowledge and belief, but is not guaranteed to be so. Since conditions of use are beyond our control, we make no warranties, expressed or implied, except those that may be contained in our written contract of sale or acknowledgment.

Vendor assumes no responsibility for injury to vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, vendor assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material, even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in their use of the material.

End of Sheet

Safety Data Sheet
Premium #7H Hydraulic Oil

Section1: Product and Company Identification

PRODUCT NAME:	Super ATF
MSDS NUMBER:	778846
INTENDED USE:	Automatic Transmission Fluid
MANUFACTURER/SUPPLIER:	Phillips 66 Lubricants P.O. Box 4428 Houston, TX 77210
EMERGENCY HEALTH AND SAFETY NUMBER:	Chemtrec: 800-424-9300 (24 hours)
CUSTOMER SERVICE:	U.S.: 800-822-6457 or International: +1-83-2486-3363
TECHNICAL INFORMATION:	1-877-445-9198
SDS INFORMATION:	800-762-0942 SDS@P66.com www.Phillips66.com

Section 2: Hazard(s) Identification

This material is not considered hazardous according to OSHA criteria.

NFPA

Section 3: Composition / Information on Ingredients

Component	CASRN	Concentration[1]
Lubricant Base Oil (Petroleum)	VARIOUS	>90
Additives	Proprietary	<10

[1] All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

Section 4: First Aid Measures

EYE CONTACT: If irritation or redness develops from exposure, flush eyes with clean water. If symptoms persist, seek medical attention.

SKIN CONTACT: Remove contaminated shoes and clothing and cleanse affected area(s) thoroughly by washing with mild soap and water or a waterless hand cleaner. If irritation or redness develops and persists, seek medical attention.

INHALATION (BREATHING): First aid is not normally required. If breathing difficulties develop, move victim away from source of exposure and into fresh air in a position comfortable for breathing. Seek immediate medical attention.

INGESTION (SWALLOWING): First aid is not normally required; however, if swallowed and symptoms develop, seek medical attention.

NOTES TO PHYSICIAN: Acute aspirations of large amounts of oil-laden material may produce a serious aspiration pneumonia. Patients who aspirate these oils should be followed for the development of long-term sequelae. Inhalation exposure to oil mists below current workplace exposure limits is unlikely to cause pulmonary abnormalities.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Conditions which may be aggravated by exposure include skin disorders

Section 5: Fire-Fighting Measures

NFPA 704 HAZARD CLASS

Health: 0 **Flammability:** 1 **Instability:** 0 (0-Minimal, 1-Slight, 2-Moderate, 3-Serious, 4-Severe)

UNUSUAL FIRE & EXPLOSION HAZARDS: This material may burn, but will not ignite readily. If container is not properly cooled, it can rupture in the heat of a fire.

EXTINGUISHING MEDIA: Dry chemical, carbon dioxide, foam, or water spray is recommended. Water or foam may cause frothing of materials heated above 212°F / 100°C. Carbon dioxide can displace oxygen. Use caution when applying carbon dioxide in confined spaces. Simultaneous use of foam and water on the same surface is to be avoided as water destroys the foam.

FIRE FIGHTING INSTRUCTIONS: For fires beyond the initial stage, emergency responders in the immediate hazard area should wear protective clothing. When the potential chemical hazard is unknown, in enclosed or confined spaces, a self contained breathing apparatus should be worn. In addition, wear other appropriate protective equipment as conditions warrant (see Section 8).

Isolate immediate hazard area and keep unauthorized personnel out. Stop spill/release if it can be done safely. Move undamaged containers from immediate hazard area if it can be done safely. Water spray may be useful in minimizing or dispersing vapors and to protect personnel. Cool equipment exposed to fire with water, if it can be done safely. Avoid spreading burning liquid with water used for cooling purposes.

HAZARDOUS COMBUSTION PRODUCTS: Combustion may yield smoke, carbon monoxide, and other products of incomplete combustion. Oxides of sulfur, nitrogen or phosphorus may also be formed.

See Section 9 for Flammable Properties including Flash Point and Flammable (Explosive) Limits

Section 6: Accidental Release Measures

PERSONAL PRECAUTIONS: This material may burn, but will not ignite readily. Keep all sources of ignition away from spill/release. Stay upwind and away from spill/release. Avoid direct contact with material. For large spillages, notify persons down wind of the spill/release, isolate immediate hazard area and keep unauthorized personnel out. Wear appropriate protective equipment, including respiratory protection, as conditions warrant (see Section 8). See Sections 2 and 7 for additional information on hazards and precautionary measures.

ENVIRONMENTAL PRECAUTIONS: Stop spill/release if it can be done safely. Prevent spilled material from entering sewers, storm drains, other unauthorized drainage systems, and natural waterways. Use water sparingly to minimize environmental contamination and reduce disposal requirements. If spill occurs on water notify appropriate authorities and advise shipping of any hazard. Spills into or upon navigable waters, the contiguous zone, or adjoining shorelines that cause a sheen or discoloration on the surface of the water, may require notification of the National Response Center (phone number 800-424-8802).

METHODS FOR CONTAINMENT AND CLEAN-UP: Notify relevant authorities in accordance with all applicable regulations. Immediate cleanup of any spill is recommended. Dike far ahead of spill for later recovery or disposal. Absorb spill with inert material such as sand or vermiculite, and place in suitable container for disposal. If spilled on water remove with appropriate methods (e.g. skimming, booms or absorbents). In case of soil contamination, remove contaminated soil for remediation or disposal, in accordance with local regulations.

Recommended measures are based on the most likely spillage scenarios for this material; however local conditions and regulations may influence or limit the choice of appropriate actions to be taken.

Section 7: Handling and Storage

PRECAUTIONS FOR SAFE HANDLING: Keep away from flames and hot surfaces. Wash thoroughly after handling. Use good personal hygiene practices and wear appropriate personal protective equipment (see section 8).

Spills will produce extremely slippery surfaces. Do not enter confined spaces such as tanks or pits without following proper entry procedures such as ASTM D-4276 and 29CFR 1910.146. Do not wear contaminated clothing or shoes.

CONDITIONS FOR SAFE STORAGE: Keep container(s) tightly closed and properly labeled. Use and store this material in cool, dry, well-ventilated area away from heat and all sources of ignition. Store only in approved containers. Keep away from any incompatible material (see Section 10). Protect container(s) against physical damage.

"Empty" containers retain residue and may be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, or other sources of ignition. They may explode and cause injury or death. "Empty" drums should be completely drained, properly bunged, and promptly shipped to the supplier or a drum reconditioner. All containers should be disposed of in an environmentally safe manner and in accordance with governmental regulations. Before working on or in tanks which contain or have contained this material, refer to OSHA regulations, ANSI Z49.1, and other references pertaining to cleaning, repairing, welding, or other contemplated operations.

Section 8: Exposure Controls / Personal Protection

Component	ACGIH	OSHA	Other
Lubricant Base Oil (Petroleum)	TWA: 5mg/m³ STEL: 10 mg/m³ as Oil Mist, if Generated	TWA: 5mg/m³ as Oil Mist, if Generated	---

Note: State, local or other agencies or advisory groups may have established more stringent limits. Consult an industrial hygienist or similar professional, or your local agencies, for further information.

ENGINEERING CONTROLS: If current ventilation practices are not adequate to maintain airborne concentrations below the established exposure limits, additional engineering controls may be required.

EYE/FACE PROTECTION: The use of eye protection that meets or exceeds ANSI Z.87.1 is recommended to protect against potential eye contact, irritation, or injury. Depending on conditions of use, a face shield may be necessary.

SKIN/HAND PROTECTION: The use of gloves impervious to the specific material handled is advised to prevent skin contact. Users should check with manufacturers to confirm the breakthrough performance of their products. Suggested protective materials: Nitrile

RESPIRATORY PROTECTION: Where there is potential for airborne exposure above the exposure limit a NIOSH certified air purifying respirator equipped with R or P95 filters may be used.

A respiratory protection program that meets or is equivalent to OSHA 29 CFR 1910.134 and ANSI Z88.2 should be followed whenever workplace conditions warrant a respirator's use. Air purifying respirators provide limited protection and cannot be used in atmospheres that exceed the maximum use concentration (as directed by regulation or the manufacturer's instructions), in oxygen deficient (less than 19.5 percent oxygen) situations, or under conditions that are immediately dangerous to life and health (IDLH).

Suggestions provided in this section for exposure control and specific types of protective equipment are based on readily available information. Users should consult with the specific manufacturer to confirm the performance of their protective equipment. Specific situations may require consultation with industrial hygiene, safety, or engineering professionals.

Section 9: Physical and Chemical Properties

NOTE: Unless otherwise stated, values are determined at 20°C (68°F) and 760 mm Hg (1 atm). Data represent typical values and are not intended to be specifications.

APPEARANCE:	Red
PHYSICAL FORM:	Liquid
ODOR:	Petroleum
ODOR THRESHOLD:	No data
pH:	Not applicable
VAPOR PRESSURE:	<1 mm Hg
VAPOR DENSITY (AIR=1):	>1
INITIAL BOILING POINT/RANGE:	No data
MELTING/FREEZING POINT:	No data
SOLUBILITY IN WATER:	Negligible
PARTITION COEFFICIENT (N-OCTANOL/WATER) (KOW):	No data
SPECIFIC GRAVITY (WATER=1):	0.85 - 0.86 @ 60ºF (15.6ºC)
BULK DENSITY:	7.08 - 7.16 lbs/gal
VISCOSITY:	6.8 - 7.7 cSt @ 100°C; 30.0 - 34.0 cSt @ 40°C
PERCENT VOLATILE:	Negligible
EVAPORATION RATE (NBUAC=1):	<1

FLASH POINT:	Minimum 315 °F / 157 °C
TEST METHOD:	Pensky-Martens Closed Cup (PMCC), ASTM D93, EPA 1010
LOWER EXPLOSIVE LIMITS (VOL % IN AIR):	No data
UPPER EXPLOSIVE LIMITS (VOL % IN AIR):	No data
AUTO-IGNITION TEMPERATURE:	No data

Section 10: Stability and Reactivity

STABILITY: Stable under normal ambient and anticipated conditions of use.

CONDITIONS TO AVOID: Extended exposure to high temperatures can cause decomposition. Avoid all possible sources of ignition.

MATERIALS TO AVOID (INCOMPATIBLE MATERIALS): Avoid contact with strong oxidizing agents and strong reducing agents.

HAZARDOUS DECOMPOSITION PRODUCTS: Not anticipated under normal conditions of use.

HAZARDOUS POLYMERIZATION: Not known to occur.

Section 11: Toxicological Information

Information on Toxicological Effects of Substance/Mixture

Acute Toxicity	Hazard	Additional Information	LC50/LD50 Data
Inhalation	Unlikely to be harmful		>5 mg/L (mist, estimated)
Dermal	Unlikely to be harmful		> 2 g/kg (estimated)
Oral	Unlikely to be harmful		> 5 g/kg (estimated)

Aspiration Hazard: Not expected to be an aspiration hazard.

Skin Corrosion/Irritation: Not expected to be irritating. Repeated exposure may cause skin dryness or cracking.

Serious Eye Damage/Irritation: Not expected to be irritating.

Symptoms of Overexposure: Inhalation of oil mists or vapors generated at elevated temperatures may cause respiratory irritation. Accidental ingestion can result in minor irritation of the digestive tract, nausea and diarrhea.

Skin Sensitization: This product is not classified as a sensitizer, but contains low concentrations (0.1 - < 1%) of a known skin sensitizer.

Respiratory Sensitization: No information available.

Specific Target Organ Toxicity (Single Exposure): Not expected to cause organ effects from single exposure.

Specific Target Organ Toxicity (Repeated Exposure): Not expected to cause organ effects from repeated exposure.

Carcinogenicity: Not expected to cause cancer.

Germ Cell Mutagenicity: Not expected to cause heritable genetic effects.

Reproductive Toxicity: Not expected to cause reproductive toxicity.

Information on Toxicological Effects of Components

Lubricant Base Oil (Petroleum)

Carcinogenicity: The petroleum base oils contained in this product have been highly refined by a variety of processes including severe hydrocracking/hydroprocessing to reduce aromatics and improve performance characteristics. All of the oils meet the IP-346 criteria of less than 3 percent PAH's and are not considered carcinogens by NTP, IARC, or OSHA.

Section 12: Ecological Information

Toxicity:

All acute aquatic toxicity studies on samples of lubricant base oils show acute toxicity values greater than 100 mg/L for invertebrates, algae and fish. These tests were carried out on water accommodated fractions and the results are consistent with the predicted aquatic toxicity of these substances based on their hydrocarbon compositions. Classification: No classified hazards.

PERSISTENCE AND DEGRADABILITY: The hydrocarbons in this material are not readily biodegradable, but since they can be degraded by microorganisms, they are regarded as inherently biodegradable.

BIOACCUMULATIVE POTENTIAL: Log Kow values measured for the hydrocarbon components of this material are greater than 5.3, and therefore regarded as having the potential to bioaccumulate. In practice, metabolic processes may reduce bioconcentration.

MOBILITY IN SOIL: Volatilization to air is not expected to be a significant fate process due to the low vapor pressure of this material. In water, base oils will float and spread over the surface at a rate dependent upon viscosity. There will be significant removal of hydrocarbons from the water by sediment adsorption. In soil and sediment, hydrocarbon components will show low mobility with adsorption to sediments being the predominant physical process. The main fate process is expected to be slow biodegradation of the hydrocarbon constituents in soil and sediment.

OTHER ADVERSE EFFECTS: None anticipated.

Section 13: Disposal Considerations

The generator of a waste is always responsible for making proper hazardous waste determinations and needs to consider state and local requirements in addition to federal regulations.

This material, if discarded as produced, would not be a federally regulated RCRA "listed" hazardous waste and is not believed to exhibit characteristics of hazardous waste. See Sections 7 and 8 for information on handling, storage and personal protection and Section 9 for physical/chemical properties. It is possible that the material as produced contains constituents which are not required to be listed in the MSDS but could affect the hazardous waste determination. Additionally, use which results in chemical or physical change of this material could subject it to regulation as a hazardous waste.

This material under most intended uses would become "Used Oil" due to contamination by physical or chemical impurities. Whenever possible, Recycle used oil in accordance with applicable federal and state or local regulations. Container contents should be completely used and containers should be emptied prior to discard.

Section 14: Transport Information

U.S. Department of Transportation (DOT)

Shipping Description:	***Not regulated***
Note:	***If shipped by land in a packaging having a capacity of 3,500 gallons or more, the provisions of 49 CFR, Part 130 apply. (Contains oil)***

International Maritime Dangerous Goods (IMDG)

Shipping Description:	***Not regulated***
Note:	***U.S. DOT compliance requirements may apply. See 49 CFR 171.22, 23 & 25.***

International Civil Aviation Org. / International Air Transport Assoc. (ICAO/IATA)

UN/ID #:	***Not regulated***
Note:	***U.S. DOT compliance requirements may apply. See 49 CFR 171.22, 23 & 24.***

	LTD. QTY	**Passenger Aircraft**	**Cargo Aircraft Only**
Packaging Instruction #:	---	---	---
Max. Net Qty. Per Package:	---	---	---

Section 15: Regulatory Information

CERCLA/SARA - Section 302 Extremely Hazardous Substances and TPQs (in pounds):

This material does not contain any chemicals subject to the reporting requirements of SARA 302 and 40 CFR 372.

CERCLA/SARA - Section 311/312 (Title III Hazard Categories)

Acute Health:	No
Chronic Health:	No
Fire Hazard:	No
Pressure Hazard:	No
Reactive Hazard:	No

CERCLA/SARA - Section 313 and 40 CFR 372:
This material does not contain any chemicals subject to the reporting requirements of SARA 313 and 40 CFR 372.

EPA (CERCLA) Reportable Quantity (in pounds):
This material does not contain any chemicals with CERCLA Reportable Quantities.

California Proposition 65:
Warning: This material may contain detectable quantities of the following chemicals, known to the State of California to cause cancer, birth defects or other reproductive harm, and which may be subject to the warning requirements of California Proposition 65 (CA Health & Safety Code Section 25249.5):

Component	Type of Toxicity
Ethyl Acrylate	Cancer

International Hazard Classification

Canada:
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the Regulations.

WHMIS Hazard Class:
None

National Chemical Inventories
All components are either listed on the US TSCA Inventory, or are not regulated under TSCA
All components are either on the DSL, or are exempt from DSL listing requirements

U.S. Export Control Classification Number: EAR99

Section 16: Other Information

DATE OF ISSUE:	28-Mar-2012
STATUS:	FINAL
PREVIOUS ISSUE DATE:	02-Sep-2008
REVISED SECTIONS OR BASIS FOR REVISION:	Manufacturer (Section 1)
SDS NUMBER:	778846

GUIDE TO ABBREVIATIONS:
ACGIH = American Conference of Governmental Industrial Hygienists; CASRN = Chemical Abstracts Service Registry Number; CEILING = Ceiling Limit (15 minutes); CERCLA = The Comprehensive Environmental Response, Compensation, and Liability Act; EPA = Environmental Protection Agency; GHS = Globally Harmonized System; IARC = International Agency for Research on Cancer; INSHT = National Institute for Health and Safety at Work; IOPC = International Oil Pollution Compensation; LEL = Lower Explosive Limit; NE = Not Established; NFPA = National Fire Protection Association; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration; PEL = Permissible Exposure Limit (OSHA); SARA = Superfund Amendments and Reauthorization Act; STEL = Short Term Exposure Limit (15 minutes); TLV = Threshold Limit Value (ACGIH); TWA = Time Weighted Average (8 hours); UEL = Upper Explosive Limit; WHMIS = Worker Hazardous Materials Information System (Canada)

DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES:
The information presented in this Material Safety Data Sheet is based on data believed to be accurate as of the date this Material Safety Data Sheet was prepared. HOWEVER, NO WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR ANY OTHER WARRANTY IS EXPRESSED OR IS TO BE IMPLIED REGARDING THE ACCURACY OR COMPLETENESS OF THE INFORMATION PROVIDED ABOVE, THE RESULTS TO BE OBTAINED FROM THE USE OF THIS INFORMATION OR THE PRODUCT, THE SAFETY OF THIS PRODUCT, OR THE HAZARDS RELATED TO ITS USE. No responsibility is assumed for any damage or injury resulting from abnormal use or from any failure to adhere to recommended practices. The information provided above, and the product, are furnished on the condition that the person receiving them shall make their own determination as to the suitability of the product for their particular purpose and on the condition that they assume the risk of their use. In addition, no authorization is given nor implied to practice any patented invention without a license.

Safety Data Sheet

Material Name: Hess 10W30 Motor Oil

SDS No. 8957
US GHS

Synonyms: Valvoline Product Code 52670413

* * * Section 1 - Product and Company Identification * * *

Manufacturer Information

Hess Corporation
1 Hess Plaza
Woodbridge, NJ 07095-0961

Phone: 732-750-6000 Corporate EHS
Emergency # 800-424-9300 CHEMTREC
www.hess.com (Environment, Health, Safety Internet Website)

* * * Section 2 - Hazards Identification * * *

GHS Classification:

Skin Corrosion/Irritation – Category 2
Specific Target Organ Toxicity – Category 3 (narcosis)
Carcinogenicity - Category 1B

GHS LABEL ELEMENTS

Symbol(s)

Signal Word

WARNING

Hazard Statements

Causes skin irritation.
May cause cancer.
May cause drowsiness or dizziness.

Precautionary Statements

Prevention

Wash hands and forearms thoroughly after handling.
Wear protective gloves/protective clothing/eye protection.
Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Avoid breathing fume/mist/vapors/spray.
Use only outdoors or in a well-ventilated area.

Response

If on skin: Wash with plenty of soap and water. Take off contaminated clothing and wash it before reuse. If skin irritation occurs: Get medical advice/attention.
If exposed or concerned: Get medical advice/attention.
If inhaled: Remove person to fresh air and keep in a position comfortable for breathing. Call poison center or doctor if you feel unwell.

Storage

Store locked up.
Store in a well-ventilated place.
Keep container tightly closed.

Disposal

Dispose of contents/container in accordance with local/regional/national/international regulations.

* * * Section 3 - Composition / Information on Ingredients * * *

CAS #	Component	Percent
64742-65-0	Petroleum distillates, solvent dewaxed heavy paraffinic	83-93

Petroleum-based lubricating oil with detergent/dispersant engine oil package with zinc compounds.

* * * Section 4 - First Aid Measures * * *

First Aid: Eyes

If symptoms develop, move individual away from exposure and into fresh air. Flush eyes gently with water while holding eyelids apart. If symptoms persist or there is visual difficulty, seek medical attention.

First Aid: Skin

Remove contaminated clothing. Wash exposed area with soap and water. If symptoms persist, seek medical attention. Launder clothing before reuse.

First Aid: Ingestion

Seek medical attention. If individual is drowsy or unconscious, do not give anything by mouth; place individual on the left side with the head down. Contact a physician, medical facility, or poison control center for advice about whether to induce vomiting. If possible, do not leave individual unattended.

First Aid: Inhalation

Remove person to fresh air. If person is not breathing provide artificial respiration. If necessary, provide additional oxygen once breathing is restored if trained to do so. Seek medical attention immediately.

First Aid: Notes to Physician

Acute aspiration of large amounts of oil-laden material may produce a serious aspiration hazard. Patients who aspirate these oils should be followed for the development of long-term sequelae. Repeated aspiration of mineral oil can produce chronic inflammation of the lungs (i.e. lipoid pneumonia) that may progress to pulmonary fibrosis. Symptoms are often subtle and radiological changes appear worse than clinical abnormalities. Occasionally, persistent cough, irritation of the upper respiratory tract, shortness of breath with exertion, fever, and bloody sputum occur. Inhalation exposure to oil mists below current workplace exposure limits is unlikely to cause pulmonary abnormalities. Preexisting disorders of the following organs (or organ systems) may be aggravated by exposure to this material: skin.

* * * Section 5 - Fire Fighting Measures * * *

General Fire Hazards

See Section 9 for Flammability Properties.

Never use welding or cutting torch on or near drum (even empty) because product (even just residue) can ignite explosively. No special fire hazards are known to be associated with this product. Dense smoke may be generated while burning.

Hazardous Combustion Products

May form: carbon dioxide and carbon monoxide, oxides of sulfur, nitrogen and phosphorous, various hydrocarbons.

Extinguishing Media

SMALL FIRES: Any extinguisher suitable for Class B fires, dry chemical, CO2, water spray, fire fighting foam, or gaseous extinguishing agent.

LARGE FIRES: Water spray, fog or fire fighting foam. Water may be ineffective for fighting the fire, but may be used to cool fire-exposed containers.

Unsuitable Extinguishing Media

None

Fire Fighting Equipment/Instructions

Small fires in the incipient (beginning) stage may typically be extinguished using handheld portable fire extinguishers and other fire fighting equipment. Firefighting activities that may result in potential exposure to high heat, smoke or toxic by-products of combustion should require NIOSH/MSHA- approved pressure-demand self-contained breathing apparatus with full facepiece and full protective clothing. Isolate area around container involved in fire. Cool tanks, shells, and containers exposed to fire and excessive heat with water. For massive fires the use of unmanned hose holders or monitor nozzles may be advantageous to further minimize personnel exposure. Major fires may require withdrawal, allowing the tank to burn. Large storage tank fires typically require specially trained personnel and equipment to extinguish the fire, often including the need for properly applied fire fighting foam.

* * * Section 6 - Accidental Release Measures * * *

Recovery and Neutralization

Carefully contain and stop the source of the spill, if safe to do so.

Materials and Methods for Clean-Up

Take up with sand or other oil absorbing materials. Carefully shovel, scoop or sweep up into a waste container for reclamation or disposal. Caution, flammable vapors may accumulate in closed containers.

SMALL SPILL: Absorb liquid on vermiculite, floor absorbent or other absorbent material. Persons not wearing proper personal protective equipment should be excluded from area of spill.

LARGE SPILL: Prevent run-off to sewers, streams, or other bodies of water. If run-off occurs, notify authorities as required, that a spill has occurred. Persons not wearing proper personal protective equipment should be excluded from area of spill until clean-up has been completed.

Emergency Measures

Evacuate nonessential personnel and remove or secure all ignition sources. Consider wind direction; stay upwind and uphill, if possible. Evaluate the direction of product travel, diking, sewers, etc. to confirm spill areas. Spills may infiltrate subsurface soil and groundwater; professional assistance may be necessary to determine the extent of subsurface impact.

Personal Precautions and Protective Equipment

Response and clean-up crews must be properly trained and must utilize proper protective equipment (see Section 8).

Environmental Precautions

Protect bodies of water by diking, absorbents, or absorbent boom, if possible. Do not flush down sewer or drainage systems, unless system is designed and permitted to handle such material. The use of fire fighting foam may be useful in certain situations to reduce vapors. The proper use of water spray may effectively disperse product vapors or the liquid itself, preventing contact with ignition sources or areas/equipment that require protection.

Prevention of Secondary Hazards

None

* * * Section 7 - Handling and Storage * * *

Handling Procedures

Handle as a combustible liquid. Keep away from heat, sparks, and open flame! Electrical equipment should be approved for classified area. Bond and ground containers during product transfer to reduce the possibility of static-initiated fire or explosion.

Special slow load procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when higher flash point material (such as fuel oil) is loaded into tanks previously containing low flash point products (such as this product) - see API Publication 2003, "Protection Against Ignitions Arising Out Of Static, Lightning and Stray Currents.

Storage Procedures

Keep away from flame, sparks, excessive temperatures and open flame. Use approved vented containers. Keep containers closed and clearly labeled. Empty product containers or vessels may contain explosive vapors. Do not pressurize, cut, heat, weld or expose such containers to sources of ignition.

Store in a well-ventilated area. This storage area should comply with NFPA 30 "Flammable and Combustible Liquid Code". Avoid storage near incompatible materials. The cleaning of tanks previously containing this product should follow API Recommended Practice (RP) 2013 "Cleaning Mobile Tanks In Flammable and Combustible Liquid Service" and API RP 2015 "Cleaning Petroleum Storage Tanks."

Incompatibilities

Avoid contact with: acids, halogens, strong oxidizing agents.

* * * Section 8 - Exposure Controls / Personal Protection * * *

Component Exposure Limits

ACGIH, OSHA, and NIOSH have not developed exposure limits for any of this product's components.

Engineering Measures

Use adequate ventilation to keep vapor concentrations of this product below occupational exposure and flammability limits, particularly in confined spaces.

Personal Protective Equipment: Respiratory

A NIOSH/MSHA-approved air-purifying respirator with organic vapor cartridges or canister may be permissible under certain circumstances where airborne concentrations are or may be expected to exceed exposure limits or for odor or irritation. Protection provided by air-purifying respirators is limited.

Use a positive pressure, air-supplied respirator if there is a potential for uncontrolled release, exposure levels are not known, in oxygen-deficient atmospheres, or any other circumstance where an air-purifying respirator may not provide adequate protection.

Personal Protective Equipment: Hands

Not normally required. However, wear resistant gloves such as nitrile rubber to prevent irritation which may result from prolonged or repeated skin contact with product.

Personal Protective Equipment: Eyes

Safety glasses or goggles are recommended where there is a possibility of splashing or spraying.

Personal Protective Equipment: Skin and Body

To prevent repeated or prolonged skin contact, wear impervious clothing and boots. Wear normal work clothing covering arms and legs.

Hygiene Measures

Emergency eye wash capability should be available in the near proximity to operations presenting a potential splash exposure. Use good personal hygiene practices. Avoid repeated and/or prolonged skin exposure. Wash hands before eating, drinking, smoking, or using toilet facilities. Do not use as a cleaning solvent on the skin. Do not use solvents or harsh abrasive skin cleaners for washing this product from exposed skin areas. Waterless hand cleaners are effective. Promptly remove contaminated clothing and launder before reuse. Use care when laundering to prevent the formation of flammable vapors which could ignite via washer or dryer. Consider the need to discard contaminated leather shoes and gloves.

* * * Section 9 - Physical & Chemical Properties * * *

Appearance:	Dry, clear and bright	**Odor:**	None
Physical State:	Liquid	**pH:**	ND
Vapor Pressure:	ND	**Vapor Density:**	ND
Boiling Point:	>425 °F (218.3°C) @ 760.00 mmHg	**Melting Point:**	ND
Solubility (H2O):	Negligible	**Specific Gravity:**	0.881 @ 60°F (16°C)
Evaporation Rate:	Slower than ethyl ether	**VOC:**	ND
Viscosity:	<= 3300.0 cps @ -20°C; 10.0 - 11.0 cst @ 100°C	**Octanol/H2O Coeff.:**	ND
Flash Point:	430 °F (221.1 °C)	**Flash Point Method:**	COC
Upper Flammability Limit (UFL):	ND	**Lower Flammability Limit (LFL):**	ND
Burning Rate:	ND	**Auto Ignition:**	ND

* * * Section 10 - Chemical Stability & Reactivity Information * * *

Chemical Stability

This is a stable material.

Hazardous Reaction Potential

Will not occur.

Conditions to Avoid

None

Incompatible Products

Avoid contact with: acids, halogens, strong oxidizing agents.

Hazardous Decomposition Products

May form: aldehydes, carbon dioxide and carbon monoxide, hydrogen sulfide, oxides of sulfur, nitrogen and phosphorus, toxic fumes, various hydrocarbons.

* * * Section 11 - Toxicological Information * * *

Acute Toxicity

A: General Product Information

Harmful if large amounts are swallowed.

B: Component Analysis - LD50/LC50

Petroleum distillates, solvent dewaxed heavy paraffinic (64742-65-0)

Inhalation LC50 Rat >4.7 mg/L 4 h; Oral LD50 Rat >5000 mg/kg; Dermal LD50 Rabbit >5000 mg/kg

Potential Health Effects: Skin Corrosion Property/Stimulativeness

May cause mild skin irritation. Prolonged or repeated contact may dry the skin. Symptoms include redness, burning, drying and cracking of the skin, and skin burns. Additional symptoms of skin contact include: acne. Passage of this material into the body through the skin is possible, but it is unlikely that this would result in harmful effects during safe handling and use.

Potential Health Effects: Eye Critical Damage/ Stimulativeness

May cause mild eye irritation. Symptoms include stinging, tearing, and redness.

Potential Health Effects: Ingestion

Swallowing small amounts of this material during normal handling is not likely to cause harmful effects. Swallowing large amounts may be harmful.

Potential Health Effects: Inhalation

It is possible to breathe this material under certain conditions of handling and use (for example, during heating, spraying, or stirring). Breathing small amounts of this material during normal handling is not likely to cause harmful effects. Breathing large amounts may be harmful. Symptoms usually occur at air concentrations higher than the recommended exposure limits.

Respiratory Organs Sensitization/Skin Sensitization

This product is not reported to have any skin sensitization effects.

Generative Cell Mutagenicity

This product is not reported to have any mutagenic effects.

Carcinogenicity

A: General Product Information

May cause cancer.

Used motor oil has been shown to cause skin cancer in laboratory animal continually exposed by repeated applications.

B: Component Carcinogenicity

None of this product's components are listed by ACGIH, IARC, OSHA, NIOSH, or NTP.

Reproductive Toxicity

This product is not reported to have any reproductive toxicity effects.

Specified Target Organ General Toxicity: Single Exposure

This product is not reported to have any specific target organ general toxicity single exposure effects.

Specified Target Organ General Toxicity: Repeated Exposure

This product is not reported to have any specific target organ general toxicity repeat exposure effects.

Aspiration Respiratory Organs Hazard

Acute aspiration of large amounts of oil-laden material may produce a serious aspiration hazard.

* * * Section 12 - Ecological Information * * *

Ecotoxicity

A: General Product Information

Keep out of sewers, drainage areas and waterways. Report spills and releases, as applicable, under Federal and State regulations.

B: Component Analysis - Ecotoxicity - Aquatic Toxicity

Petroleum distillates, solvent dewaxed heavy paraffinic (64742-65-0)

Test & Species		Conditions
96 Hr LC50 Oncorhynchus mykiss	>5000 mg/L	
48 Hr EC50 Daphnia magna	>1000 mg/L	

Persistence/Degradability

No information available.

Bioaccumulation

No information available.

Mobility in Soil

No information available.

* * * Section 13 - Disposal Considerations * * *

Waste Disposal Instructions

See Section 7 for Handling Procedures. See Section 8 for Personal Protective Equipment recommendations.

Disposal of Contaminated Containers or Packaging

Dispose of contents/container in accordance with local/regional/national/international regulations.

* * * Section 14 - Transportation Information * * *

DOT Information

Shipping Name: Not Regulated

* * * Section 15 - Regulatory Information * * *

Regulatory Information

Component Analysis

None of this products components are listed under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65), or CERCLA (40 CFR 302.4).

SARA Section 311/312 – Hazard Classes

Acute Health	Chronic Health	Fire	Sudden Release of Pressure	Reactive
X	X	--	--	--

SARA SECTION 313 - SUPPLIER NOTIFICATION

ZINC C1-C14 ALKYLDITHIOPHOSPHATE (CAS No. 68649-42-3)

State Regulations

Component Analysis - State

None of this product's components are listed on the state lists from CA, MA, MN, NJ, PA, or RI.

Component Analysis - WHMIS IDL

No components are listed in the WHMIS IDL.

Additional Regulatory Information

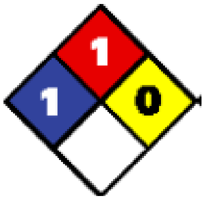
Component Analysis - Inventory

Component	CAS #	TSCA	CAN	EEC
Petroleum distillates, solvent dewaxed heavy paraffinic	64742-65-0	Yes	DSL	EINECS

* * * Section 16 - Other Information * * *

NFPA® Hazard Rating

Health	1
Fire	1
Reactivity	0



HMIS® Hazard Rating

Health	1*	Slight
Fire	1	Slight
Physical	0	Minimal
		*Chronic

Key/Legend

EPA = Environmental Protection Agency; TSCA = Toxic Substance Control Act; ACGIH = American Conference of Governmental Industrial Hygienists; IARC = International Agency for Research on Cancer; NIOSH = National Institute for Occupational Safety and Health; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration., NJTSR = New Jersey Trade Secret Registry.

Literature References

None

Other Information

Information presented herein has been compiled from sources considered to be dependable, and is accurate and reliable to the best of our knowledge and belief, but is not guaranteed to be so. Since conditions of use are beyond our control, we make no warranties, expressed or implied, except those that may be contained in our written contract of sale or acknowledgment.

Vendor assumes no responsibility for injury to vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, vendor assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material, even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in their use of the material.

End of Sheet

SAFETY DATA SHEET
Kidde 90 Multi-Purpose ABC Dry Chemical (Fire Extinguishing Agent, Pressurized and Non-pressurized)

1. IDENTIFICATION

Product Name	Kidde 90 Multi-Purpose ABC Dry Chemical (Fire Extinguishing Agent, Pressurized and Non-pressurized)
Other Names	ABC, Ammonium Phosphate, Monoammonium Phosphate, Tri-Class
Recommended use of the chemical and restrictions on use	
Identified uses	Fire Extinguishing Agent
Restrictions on use	Consult applicable fire protection codes
Company Identification	Kidde Residential & Commercial 1016 Corporate Park Drive Mebane, NC 27302 USA
Customer Information Number	(919) 563-5911 (919) 304-8200
Emergency Telephone Number	
CHEMTREC Number	(800) 424-9300 (703) 527-3887 (International)
Issue Date	October 1, 2015
Supersedes Date	April 10, 2015

Safety Data Sheet prepared in accordance with OSHA's Hazard Communication Standard (29 CFR 1910.1200) and the Globally Harmonized System of Classification and Labelling of Chemicals (GHS)

2. HAZARD IDENTIFICATION

This SDS covers the product listed above as sold in pressurized and non-pressurized containers. GHS classifications for both forms are listed below.

<u>GHS Classification – Pressurized</u>

Hazard Classification
Gas under pressure – Compressed gas

Label Elements
Hazard Symbols

Signal Word: Warning

Hazard Statements
Contents under pressure; may explode if heated.

2. HAZARD IDENTIFICATION

Precautionary Statements
Prevention
None
Response
None
Storage
Protect from sunlight.
Store in well-ventilated place.
Disposal
None

GHS Classification: Non - pressurized

Hazard Classification
This product is classified as not hazardous in accordance with the Globally Harmonized System of Classification and Labelling (GHS).

Label Elements
Hazard Symbols
None

Signal Word: None

Hazard Statements
None

Precautionary Statements
Prevention
None
Response
None
Storage
None
Disposal
None

Other Hazards
Mica may contain small quantities of quartz (crystalline silica) as an impurity. Prolonged exposure to respirable crystalline silica dust at concentrations exceeding the occupational exposure limits may increase the risk of developing a disabling lung disease known as silicosis. IARC found limited evidence for pulmonary carcinogenicity of crystalline silica in humans.

Specific Concentration Limits
The values listed below represent the percentages of ingredients of unknown toxicity.

Acute oral toxicity	< 10%
Acute dermal toxicity	< 10%
Acute inhalation toxicity	< 10%
Acute aquatic toxicity	< 10%

3. COMPOSITION/INFORMATION ON INGREDIENTS

This product is a mixture.

Component	CAS Number	Concentration
Monoammonium Phosphate	7722-76-1	85 - 95%
Ammonium Sulfate	7783-20-2	< 5%
Mica	12001-26-2	< 5%
Clay	1332-58-7	< 5%
Amorphous Silica	7631-86-9	< 5%
Dye	NA	<1%

Note: Pressurized product uses nitrogen or compressed air as the expellant.

4. FIRST- AID MEASURES

Description of necessary first-aid measures

Eyes

Immediately flood the eye with plenty of water for at least 15 minutes, holding the eye open. Obtain medical attention if soreness or redness persists.

Skin

Wash skin thoroughly with soap and water. Obtain medical attention if irritation persists.

Ingestion

Dilute by drinking large quantities of water and obtain medical attention.

Inhalation

Move victim to fresh air. Obtain medical attention immediately for any breathing difficulty.

Most important symptoms/effects, acute and delayed

Aside from the information found under Description of necessary first aid measures (above) and Indication of immediate medical attention and special treatment needed, no additional symptoms and effects are anticipated.

Indication of immediate medical attention and special treatment needed

Notes to Physicians

Treat symptomatically.

5. FIRE - FIGHTING MEASURES

Suitable Extinguishing Media

This preparation is used as an extinguishing agent and therefore is not a problem when trying to control a fire. Use extinguishing agent appropriate to other materials involved. Keep pressurized containers and surroundings cool with water spray as they may rupture or burst in the heat of a fire.

Specific hazards arising from the chemical

Pressurized containers may explode in heat of fire.

Special Protective Actions for Fire-Fighters

Wear full protective clothing and self-contained breathing apparatus as appropriate for specific fire conditions.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures
Wear appropriate protective clothing. Prevent skin and eye contact. Remove leaking container to a safe place. Ventilate the area.

Environmental Precautions
Prevent large quantities of the material from entering drains or watercourses.

Methods and materials for containment and cleaning up
Sweep up or vacuum and transfer into suitable containers for recovery or disposal.

7. HANDLING AND STORAGE

Precautions for safe handling
Wear appropriate protective clothing. Prevent skin and eye contact.

Conditions for safe storage
Pressurized containers should be properly stored and secured to prevent falling or being knocked over. Do not drag, slide or roll pressurized containers. Do not drop pressurized containers or permit them to strike against each other. Never apply flame or localized heat directly to any part of the pressurized or plastic container. Store pressurized and plastic containers away from high heat sources. Storage area should be: - cool - dry - well ventilated - under cover - out of direct sunlight

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters
Exposure limits are listed below, if they exist.

Mica
ACGIH TLV: 3 mg/m^3 TWA, measured as respirable fraction of the aerosol.
OSHA PEL: 20 mppcf, <1% crystalline silica
Clay as Kaolin, Respirable Fraction
ACGIH TLV: 2 mg/m^3 TWA
OSHA PEL: 15 mg/m^3 TWA, total dust
5 mg/m^3 TWA, respirable fraction
Nuisance Dust Limit
OSHA PEL: 50 mppcf or 15 mg/m^3 TWA, total dust
15 mppcf or 5 mg/m^3 TWA, respirable fraction

Appropriate engineering controls
Use with adequate ventilation. If this product is used in a pressurized system, there should be local procedures for the selection, training, inspection and maintenance of this equipment. When used in large volumes, use local exhaust ventilation.

Individual protection measures
Respiratory Protection
Not normally required. Use dust mask where dustiness is prevalent, or TLV is exceeded. In oxygen deficient atmospheres, use a self contained breathing apparatus, as an air purifying respirator will not provide protection.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Skin Protection
Gloves
Eye/Face Protection
Chemical goggles or safety glasses with side shields.
Body Protection
Normal work wear.

9. PHYSICAL AND CHEMICAL PROPERTIES

Non- Pressurized

Appearance	
Physical State	Solid (powder)
Color	Pale Yellow
Odor	Odorless
Odor Threshold	No data available
pH	Not applicable
Specific Gravity	No data available
Boiling Range/Point (°C/F)	Not applicable
Melting Point (°C/F)	No data available
Flash Point (PMCC) (°C/F)	Not flammable
Vapor Pressure	No data available
Evaporation Rate (BuAc=1)	No data available
Solubility in Water	No data available
Vapor Density (Air = 1)	Not applicable
VOC (g/l)	None
VOC (%)	None
Partition coefficient (n-octanol/water)	No data available
Viscosity	No data available
Auto-ignition Temperature	No data available
Decomposition Temperature	No data available
Upper explosive limit	No data available
Lower explosive limit	No data available
Flammability (solid, gas)	No data available

Expellant - Nitrogen

Appearance	
Physical State	Compressed gas
Color	Colorless
Odor	None
Odor Threshold	No data available
pH	Not applicable
Specific Gravity	0.075 lb/ft^3 @70^{o}F as vapor
Boiling Range/Point (°C/F)	-196^{o}C/-321 ^{o}F
Melting Point (°C/F)	No data available
Flash Point (PMCC) (°C/F)	Not flammable
Vapor Pressure	No data available
Evaporation Rate (BuAc=1)	No data available
Solubility in Water	No data available

9. PHYSICAL AND CHEMICAL PROPERTIES

Vapor Density (Air = 1)	Not applicable
VOC (g/l)	None
VOC (%)	None
Partition coefficient (n-octanol/water)	No data available
Viscosity	Not applicable
Auto-ignition Temperature	No data available
Decomposition Temperature	No data available
Upper explosive limit	Not explosive
Lower explosive limit	Not explosive
Flammability (solid, gas)	Not flammable

10. STABILITY AND REACTIVITY

Reactivity
Pressurized containers may rupture or explode if exposed to heat.

Chemical Stability
Stable under normal conditions.

Possibility of hazardous reactions
Hazardous polymerization will not occur.

Conditions to Avoid
Exposure to direct sunlight - contact with incompatible materials

Incompatible Materials
Strong oxidizing agents - strong acids - sodium hypochlorite

Hazardous Decomposition Products
Oxides of carbon - ammonia - oxides of phosphorus - nitrogen oxides

11. TOXICOLOGICAL INFORMATION

Acute Toxicity
Monoammonium Phosphate:
Oral LD50 (Rat) 5750 mg/kg
Dermal LD50 (Rabbit) >5000mg/kg
Inhalation LC50 (Rat) 5.1mg/l
Ammonium Sulfate:
Oral LD50 (Rat) 4250 mg/kg
Dermal LD50 (Rabbit) >2000mg/kg
Mica:
Oral LD50 (Rat) >2000 mg/kg
Amorphous Silica:
Oral LD50 (Rat) >5000 mg/kg
Dermal LD50 (Rabbit) >2000mg/kg

11. TOXICOLOGICAL INFORMATION

Clay:
Oral LD50 (Rat) >5000 mg/kg
Dermal LD50 (Rabbit) >5000mg/kg
Nitrogen
Simple asphyxiant

Specific Target Organ Toxicity (STOT) – single exposure
Monoammonium Phosphate: Available data indicates this component is not expected to cause target organ effects after a single exposure.
Ammonium Sulfate: Available data indicates this component is not expected to cause target organ effects after a single exposure.
Nitrogen: Exposure to nitrogen gas at high concentrations can cause suffocation by reducing oxygen available for breathing. Breathing very high concentrations can cause dizziness, shortness of breath, unconsciousness or asphyxiation.

Specific Target Organ Toxicity (STOT) – repeat exposure
Monoammonium Phosphate: Available data indicates this component is not expected to cause target organ effects after repeat exposure.
Ammonium Sulfate: Available data indicates this component is not expected to cause target organ effects after repeat exposure.

Serious Eye damage/Irritation
Monoammonium Phosphate: Not irritating (rabbit)
Ammonium Sulfate: Not irritating (rabbit)
Mica: Not irritating (rabbit)

Skin Corrosion/Irritation
Monoammonium Phosphate: Not irritating in rabbit test study
Ammonium Sulfate: Not irritating (rabbit)
Mica: Not irritating (rabbit)

Respiratory or Skin Sensitization
Monoammonium Phosphate: Not skin sensitizing based on test (Mouse local lymphnode assay (LLNA)) on an analogous compound
Ammonium Sulfate: Not sensitizing in Guinea pig maximisation test

Carcinogenicity
Mica may contain small quantities of quartz (crystalline silica) as an impurity. Prolonged exposure to respirable crystalline silica dust at concentrations exceeding the occupational exposure limits may increase the risk of developing a disabling lung disease known as silicosis. IARC has classified Silica Dust, Crystalline, in the form of quartz or cristobalite as 1 (carcinogenic to humans).

Germ Cell Mutagenicity
Monoammonium Phosphate: Not mutagenic in the mouse lymphoma cells in mammalian cell gene mutation assay
Ammonium Sulfate: Negative results in Ames Test, in vitro mammalian chromosome aberration test, and mammalian cell gene mutation assay.

11. TOXICOLOGICAL INFORMATION

Reproductive Toxicity
Monoammonium Phosphate: Available data indicates this component is not expected to cause reproductive toxicity or birth defects.
Ammonium Sulfate: Available data indicates this component is not expected to cause reproductive toxicity or birth defects.

Aspiration Hazard
Not an aspiration hazard.

12. ECOLOGICAL INFORMATION

Ecotoxicity
Monoammonium Phosphate:
LC50 rainbow trout >100 mg/l 96h
LC50 water flea 1790 mg/l 72h (similar substance)

Mobility in soil
No relevant studies identified.

Persistence/Degradability
No relevant studies identified.

Bioaccumulative Potential
No relevant studies identified.

Other adverse effects
No relevant studies identified.

13. DISPOSAL CONSIDERATIONS

Disposal Methods
Dispose of container in accordance with all applicable local and national regulations.

14. TRANSPORT INFORMATION

Safety Data Sheet information is intended to address a specific material and not various forms or states of containment.

Special Precautions for Shipping:
Individuals must be certified as Hazardous Material Shipper for all transportation modes.
Pressurized Fire Extinguishers are considered a hazardous material by the US Department of Transportation and Transport Canada.

DOT CFR 172.101 Data	Fire extinguishers, 2.2, UN1044
UN Proper Shipping Name	Fire extinguishers
UN Class	(2.2)
UN Number	UN1044
UN Packaging Group	Not applicable

14. TRANSPORT INFORMATION

Classification for AIR Transportation (IATA)	Consult current IATA Regulations prior to shipping by air.
Classification for Water Transport IMDG	Consult current IMDG Regulations prior to shipping by water.

When shipping via ground, portable fire extinguishers pressurized to less than 241 psi and of less than 1100 cubic inches in size meet the requirements of “Limited Quantity” as referenced in 49 CFR 173.309 (2010). There is no limited quantity designation for fire extinguishers when shipped by air or water.

This section is believed to be accurate at the time of preparation. It is not intended to be a complete statement or summary of the applicable laws, rules, or hazardous material regulations, and is subject to change. Users have the responsibility to confirm compliance with all laws, rules, and hazardous material regulations in effect at the time of shipping.

15. REGULATORY INFORMATION

United States TSCA Inventory
This product contains ingredients that are listed on or exempt from listing on the EPA Toxic Substance Control Act Chemical Substance Inventory.

Canada DSL Inventory
All ingredients in this product are listed on the Domestic Substance List (DSL) or the Non-Domestic Substance List (NDSL) or are exempt from listing.

SARA Title III Sect. 311/312 Categorization: Pressurized
Pressure hazard
SARA Title III Sect. 311/312 Categorization: Non-pressurized
None

SARA Title III Sect. 313
This product does not contain any chemicals that are listed in Section 313 at or above de minimis concentrations.

16. OTHER INFORMATION

NFPA Ratings
NFPA Code for Health - 1
NFPA Code for Flammability - 0
NFPA Code for Reactivity - 0
NFPA Code for Special Hazards - None

HMIS Ratings
HMIS Code for Health - 1
HMIS Code for Flammability - 0
HMIS Code for Physical Hazard - 0
HMIS Code for Personal Protection - See Section 8
*Chronic

16. OTHER INFORMATION

Legend
ACGIH: American Conference of Governmental Industrial Hygienists
CAS#: Chemical Abstracts Service Number
EC50: Effect Concentration 50%
IARC: International Agency for Research on Cancer
LC50: Lethal Concentration 50%
LD50: Lethal Dose 50%
N/A: Denotes no applicable information found or available
OSHA: Occupational Safety and Health Administration
PEL: Permissible Exposure Limit
STEL: Short Term Exposure Limit
TLV: Threshold Limit Value
TSCA: Toxic Substance Control Act

Revision Date: October 1, 2015
Replaces: April 10, 2015
Changes made: Update to Section 14.

Information Source and References
This SDS is prepared by Hazard Communication Specialists based on information provided by internal company references.
Prepared By: EnviroNet LLC.

The information and recommendations presented in this SDS are based on sources believed to be accurate. Kidde Residential & Commercial assumes no liability for the accuracy or completeness of this information. It is the user's responsibility to determine the suitability of the material for their particular purposes. In particular, we make NO WARRANTY OF MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED, with respect to such information, and we assume no liability resulting from its use. Users should ensure that any use or disposal of the material is in accordance with applicable Federal, State, and local laws and regulations.

This page intentionally left blank

Safety Data Sheet

RUST-OLEUM CORPORATION
* Trusted Quality Since 1921 *
www.rustoleum.com

1. Identification

Product Name:	PRO LSPR 6PK MARK FLUORESCENT ORANGE	**Revision Date:**	5/12/2017
Product Identifier:	2554838	**Supercedes Date:**	6/5/2015
Product Use/Class:	Marking Paint/Aerosols		
Supplier:	Rust-Oleum Corporation 11 Hawthorn Parkway Vernon Hills, IL 60061 USA	**Manufacturer:**	Rust-Oleum Corporation 11 Hawthorn Parkway Vernon Hills, IL 60061 USA
Preparer:	Regulatory Department		
Emergency Telephone:	24 Hour Hotline: 847-367-7700		

2. Hazard Identification

Classification

Symbol(s) of Product

Signal Word
Danger

Possible Hazards
27% of the mixture consists of ingredient(s) of unknown acute toxicity.

GHS HAZARD STATEMENTS

Carcinogenicity, category 2	H351	Suspected of causing cancer.
Compressed Gas	H280	Contains gas under pressure; may explode if heated.
Flammable Aerosol, category 1	H222	Extremely flammable aerosol.
STOT, repeated exposure, category 2	H373	May cause damage to organs through prolonged or repeated exposure.

GHS LABEL PRECAUTIONARY STATEMENTS

P201	Obtain special instructions before use.
P210	Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P211	Do not spray on an open flame or other ignition source.
P251	Do not pierce or burn, even after use.
P260	Do not breathe dust/fume/gas/mist/vapors/spray.
P280	Wear protective gloves/protective clothing/eye protection/face protection.
P308+P313	IF exposed or concerned: Get medical advice/attention.
P314	Get medical advice/attention if you feel unwell.
P405	Store locked up.
P410+P403	Protect from sunlight. Store in a well-ventilated place.
P410+P412	Protect from sunlight. Do no expose to temperatures exceeding 50°C/ 122°F.

P501 Dispose of contents/container in accordance with local, regional and national regulations.

3. Composition/Information On Ingredients

HAZARDOUS SUBSTANCES

Chemical Name	CAS-No.	Wt.% Range	GHS Symbols	GHS Statements
Propane	74-98-6	10-25	GHS04	H280
Naphtha, Petroleum, Hydrotreated Light	64742-49-0	2.5-10	GHS08	H304
n-Butane	106-97-8	2.5-10	GHS04	H280
Hydrotreated Light Distillate	64742-47-8	2.5-10	GHS08	H304
Xylenes (o-, m-, p- isomers)	1330-20-7	2.5-10	GHS02-GHS07	H226-315-319-332
Barium Sulfate	7727-43-7	2.5-10	Not Available	Not Available
Ethylbenzene	100-41-4	1.0-2.5	GHS02-GHS07-GHS08	H225-304-332-351-373
Stoddard Solvent	8052-41-3	0.1-1.0	GHS08	H304-372
Pigment Orange 13	3520-72-7	0.1-1.0	Not Available	Not Available
Crystalline Silica / Quartz	14808-60-7	0.1-1.0	Not Available	Not Available

4. First-aid Measures

FIRST AID - EYE CONTACT: Immediately flush eyes with plenty of water for at least 15 minutes holding eyelids open. Get medical attention. Do NOT allow rubbing of eyes or keeping eyes closed.

FIRST AID - SKIN CONTACT: Wash skin with soap and water. Remove contaminated clothing. Get medical attention if irritation develops or persists.

FIRST AID - INHALATION: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get immediate medical attention. Do NOT use mouth-to-mouth resuscitation. If you experience difficulty in breathing, leave the area to obtain fresh air. If continued difficulty is experienced, get medical assistance immediately.

FIRST AID - INGESTION: Aspiration hazard: Do not induce vomiting or give anything by mouth because this material can enter the lungs and cause severe lung damage. Get immediate medical attention. If swallowed, get medical attention.

5. Fire-fighting Measures

EXTINGUISHING MEDIA: Alcohol Film Forming Foam, Carbon Dioxide, Dry Chemical, Dry Sand, Water Fog

UNUSUAL FIRE AND EXPLOSION HAZARDS: FLASH POINT IS LESS THAN 20°F. EXTREMELY FLAMMABLE LIQUID AND VAPOR!Water spray may be ineffective. Closed containers may explode when exposed to extreme heat due to buildup of steam. Closed containers may explode when exposed to extreme heat. Vapors may form explosive mixtures with air. Vapors can travel to a source of ignition and flash back. Keep containers tightly closed. Isolate from heat, electrical equipment, sparks and open flame. Perforation of the pressurized container may cause bursting of the can. No unusual fire or explosion hazards noted.

SPECIAL FIREFIGHTING PROCEDURES: Water may be used to cool closed containers to prevent pressure buildup and possible autoignition or explosion. Full protective equipment including self-contained breathing apparatus should be used. Evacuate area and fight fire from a safe distance. Use water spray to keep fire-exposed containers cool. Containers may explode when heated.

6. Accidental Release Measures

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: Contain spilled liquid with sand or earth. DO NOT use combustible materials such as sawdust. Isolate the hazard area and deny entry to unnecessary and unprotected personnel. Remove all sources of ignition, ventilate area and remove with inert absorbent and non-sparking tools. Dispose of according to local, state (provincial) and federal regulations. Do not incinerate closed containers. Ventilate area, isolate spilled material, and remove with inert absorbent. Dispose of contaminated absorbent, container, and unused contents in accordance with local, state, and federal regulations.

7. Handling and Storage

HANDLING: Wash thoroughly after handling. Wash hands before eating. Remove contaminated clothing and launder before reuse. Use only in a well-ventilated area. Use only with adequate ventilation. Follow all MSDS/label precautions even after container is emptied because it may retain product residues. Avoid breathing fumes, vapors, or mist. Avoid contact with eyes, skin and clothing.

STORAGE: Store in a dry, well ventilated place. Keep container tightly closed when not in use. Keep containers tightly closed. Isolate from heat, electrical equipment, sparks and open flame. Contents under pressure. Do not store above 120 ° F. Store large quantities in buildings designed and protected for storage of flammable aerosols. Keep away from heat, sparks, flame and sources of ignition. Contents under pressure. Do not expose to heat or store above 120 ° F. Avoid excess heat. Product should be stored in tightly sealed containers and protected from heat, moisture, and foreign materials.

8. Exposure Controls/Personal Protection

Chemical Name	CAS-No.	Weight % Less Than	ACGIH TLV-TWA	ACGIH TLV-STEL	OSHA PEL-TWA	OSHA PEL-CEILING
Propane	74-98-6	20.0	N.E.	N.E.	1000 ppm	N.E.
Naphtha, Petroleum, Hydrotreated Light	64742-49-0	10.0	N.E.	N.E.	N.E.	N.E.
n-Butane	106-97-8	10.0	N.E.	1000 ppm	N.E.	N.E.
Hydrotreated Light Distillate	64742-47-8	10.0	N.E.	N.E.	N.E.	N.E.
Xylenes (o-, m-, p- isomers)	1330-20-7	5.0	100 ppm	150 ppm	100 ppm	N.E.
Barium Sulfate	7727-43-7	5.0	5 mg/m3	N.E.	15 mg/m3	N.E.
Ethylbenzene	100-41-4	5.0	20 ppm	N.E.	100 ppm	N.E.
Stoddard Solvent	8052-41-3	1.0	100 ppm	N.E.	500 ppm	N.E.
Pigment Orange 13	3520-72-7	1.0	N.E.	N.E.	N.E.	N.E.
Crystalline Silica / Quartz	14808-60-7	1.0	0.025 mg/m3	N.E.	50 µg/m3	N.E.

PERSONAL PROTECTION

ENGINEERING CONTROLS: Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits. Use explosion-proof ventilation equipment. Provide general dilution of local exhaust ventilation in volume and pattern to keep TLV of hazardous ingredients below acceptable limits. Prevent build-up of vapors by opening all doors and windows to achieve cross-ventilation.

RESPIRATORY PROTECTION: A respiratory protection program that meets OSHA 1910.134 and ANSI Z88.2 requirements must be followed whenever workplace conditions warrant a respirator's use. A NIOSH/MSHA approved air purifying respirator with organic vapor cartridge or canister may be permissible under certain circumstances where airborne concentrations are expected to exceed exposure limits.

SKIN PROTECTION: Use gloves to prevent prolonged skin contact. Use impervious gloves to prevent skin contact and absorption of this material through the skin. Nitrile or Neoprene gloves may afford adequate skin protection.

EYE PROTECTION: Use safety eyewear designed to protect against splash of liquids.

OTHER PROTECTIVE EQUIPMENT: Refer to safety supervisor or industrial hygienist for further guidance regarding types of personal protective equipment and their applications. Refer to safety supervisor or industrial hygienist for further information regarding personal protective equipment and its application.

HYGIENIC PRACTICES: Wash thoroughly with soap and water before eating, drinking or smoking. Remove contaminated clothing immediately and launder before reuse.

9. Physical and Chemical Properties

Appearance:	Aerosolized Mist	**Physical State:**	Liquid
Odor:	Solvent Like	**Odor Threshold:**	N.E.
Relative Density:	0.857	**pH:**	N.A.
Freeze Point, °C:	N.D.	**Viscosity:**	N.D.
Solubility in Water:	Slight	**Partition Coefficient, n-octanol/water:**	N.D.
Decompostion Temp., °C:	N.D.		
Boiling Range, °C:	-37 - 537	**Explosive Limits, vol%:**	0.9 - 12.6
Flammability:	Supports Combustion	**Flash Point, °C:**	-96
Evaporation Rate:	Faster than Ether	**Auto-ignition Temp., °C:**	N.D.
Vapor Density:	Heavier than Air	**Vapor Pressure:**	N.D.

(See "Other information" Section for abbreviation legend)

10. Stability and Reactivity

CONDITIONS TO AVOID: Avoid temperatures above 120°F (49°C). Avoid contact with strong acid and strong bases. Avoid all possible sources of ignition.

INCOMPATIBILITY: Incompatible with strong oxidizing agents, strong acids and strong alkalies.

HAZARDOUS DECOMPOSITION: By open flame, carbon monoxide and carbon dioxide. When heated to decomposition, it emits acrid smoke and irritating fumes. Contains solvents which may form carbon monoxide, carbon dioxide, and formaldehyde.

HAZARDOUS POLYMERIZATION: Will not occur under normal conditions.

STABILITY: This product is stable under normal storage conditions.

11. Toxicological information

EFFECTS OF OVEREXPOSURE - EYE CONTACT: Causes Serious Eye Irritation

EFFECTS OF OVEREXPOSURE - SKIN CONTACT: Substance may cause slight skin irritation. May cause skin irritation. Allergic reactions are possible. Prolonged or repeated contact may cause skin irritation.

EFFECTS OF OVEREXPOSURE - INHALATION: Harmful if inhaled. High gas, vapor, mist or dust concentrations may be harmful if inhaled. Avoid breathing fumes, spray, vapors, or mist. High vapor concentrations are irritating to the eyes, nose, throat and lungs. Prolonged or excessive inhalation may cause respiratory tract irritation.

EFFECTS OF OVEREXPOSURE - INGESTION: Harmful if swallowed. Aspiration hazard if swallowed; can enter lungs and cause damage.

EFFECTS OF OVEREXPOSURE - CHRONIC HAZARDS: May cause central nervous system disorder (e.g., narcosis involving a loss of coordination, weakness, fatigue, mental confusion, and blurred vision) and/or damage. High concentrations may lead to central nervous system effects (drowsiness, dizziness, nausea, headaches, paralysis, and blurred vision) and/or damage. Reports have associated repeated and prolonged occupational overexposure to solvents with permanent brain and nervous system damage. Overexposure to xylene in laboratory animals has been associated with liver abnormalities, kidney, lung, spleen, eye and blood damage as well as reproductive disorders. Effects in humans, due to chronic overexposure, have included liver, cardiac abnormalities and nervous system damage. IARC lists Ethylbenzene as a possible human carcinogen (group 2B).

PRIMARY ROUTE(S) OF ENTRY: Eye Contact, Ingestion, Inhalation, Skin Absorption, Skin Contact

ACUTE TOXICITY VALUES

The acute effects of this product have not been tested. Data on individual components are tabulated below:

CAS-No.	Chemical Name	Oral LD50	Dermal LD50	Vapor LC50
74-98-6	Propane	N.I.	N.I.	658 mg/L Rat
64742-49-0	Naphtha, Petroleum, Hydrotreated Light	>5000 mg/kg Rat	>3160 mg/kg Rabbit	>4951 mg/L Rat
106-97-8	n-Butane	N.I.	N.I.	658 mg/L Rat
64742-47-8	Hydrotreated Light Distillate	>5000 mg/kg Rat	>2000 mg/kg Rabbit	>5000 mg/L Rat
1330-20-7	Xylenes (o-, m-, p- isomers)	3500 mg/kg Rat	>4350 mg/kg Rabbit	29.08 mg/L Rat
100-41-4	Ethylbenzene	3500 mg/kg Rat	15400 mg/kg Rabbit	17.4 mg/L Rat
3520-72-7	Pigment Orange 13	>5000 mg/kg Rat	N.I.	N.I.
14808-60-7	Crystalline Silica / Quartz	5500 mg/kg Rat	5500	100 mg/L

N.I. - No Information

12. Ecological Information

ECOLOGICAL INFORMATION: Product is a mixture of listed components. Product is a mixture of listed components.

13. Disposal Information

DISPOSAL INFORMATION: Dispose of material in accordance to local, state, and federal regulations and ordinances. Do not allow to enter waterways, wastewater, soil, storm drains or sewer systems.

14. Transport Information

	Domestic (USDOT)	International (IMDG)	Air (IATA)	TDG (Canada)
UN Number:	N.A.	1950	1950	N.A.
Proper Shipping Name:	Paint Products in Limited Quantities	Aerosols	Aerosols	Paint Products in Limited Quantities
Hazard Class:	N.A.	2.1	2.1	N.A.
Packing Group:	N.A.	N.A.	N.A.	N.A.
Limited Quantity:	Yes	Yes	Yes	Yes

15. Regulatory Information

U.S. Federal Regulations:

CERCLA - SARA Hazard Category

This product has been reviewed according to the EPA ‘Hazard Categories’ promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following categories:

Fire Hazard, Pressure Hazard, Acute Health Hazard, Chronic Health Hazard

Sara Section 313:

This product contains the following substances subject to the reporting requirements of Section 313 of Title III of the Superfund Amendment and Reauthorization Act of 1986 and 40 CFR part 372:

Chemical Name	CAS-No.
Xylenes (o-, m-, p- isomers)	1330-20-7
Ethylbenzene	100-41-4

Toxic Substances Control Act:

This product contains the following chemical substances subject to the reporting requirements of TSCA 12(b) if exported from the United States:

Chemical Name	CAS-No.
Castor oil, sulfated, sodium salt	68187-76-8

16. Other Information

HMIS RATINGS

Health:	2*	**Flammability:**	4	**Physical Hazard:**	0	**Personal Protection:**	X

NFPA RATINGS

Health:	2	**Flammability:**	4	**Instability**	0

VOLATILE ORGANIC COMPOUNDS, g/L: 551

SDS REVISION DATE: 5/12/2017

REASON FOR REVISION: Product Composition Changed
Substance and/or Product Properties Changed in Section(s):
02 - Hazard Identification
05 - Fire-fighting Measures
16 - Other Information
Statement(s) Changed

Legend: N.A. - Not Applicable, N.E. - Not Established, N.D. - Not Determined

Appendix F

Quality Assurance Surveillance Plan

Quality Assurance Surveillance Plan

Long Term Monitoring/Land Use Control
(LTM/LUC) Management
and
LTM/LUC Optimization
at
Former Seneca Army Depot
Romulus, NY

Contract No.: W912DY-22-D-0131
Task Order No: W912DY22F0374
EPA Site ID#: NY0213820830
NY Site ID#: 8-50-006

U.S. Army Corps of Engineers
Engineering and Support Center, Huntsville
4901 University Square
Suite 19
Huntsville, AL 35816

6 Jan 2023

1.0 Introduction

This Performance-Based Quality Assurance Surveillance Plan (QASP) has been developed pursuant to the requirements of the Performance Work Statement (PWS) for this project. This plan sets forth procedures and guidelines that the United States Army Corps of Engineers (USACE) will use in evaluating the technical and safety performance of the Contractor. A copy of the Performance Metrics is furnished in the PWS so that the Contractor will be aware of the methods that the Government will employ in evaluating their performance on this contract

2.0 Purpose of the QASP

The QASP is intended to accomplish the following:

- Define the roles and responsibilities of participating Government officials,
- Define the types of work to be performed with required end results,
- Document the evaluation methods that will be employed by the Government in assessing the Contractor's performance,
- Provide the Surveillance Activity Checklists and Corrective Action Request (CAR) forms that will be used by the Government in documenting and evaluating the Contractor's performance,
- Describe the process of performance documentation, and
- Outline quality assurance procedures to be employed by the Government during performance of this Task Order to confirm that the site characterization is conducted utilizing proper procedures and in accordance with the approved work and safety plans.

3.0 Roles and responsibilities of Participating Government Officials

3.1 Base Environmental Coordinator (BEC): Jim Moore

- Responsible for coordinating all base closure activities with the Army Base Realignment and Closure (BRAC) Directorate.
- Responsible for coordinating all funding requirements for BRAC activities.

3.2 The USACE Project Manager: Chris Gallo

- Responsible for overall project direction, including regulatory, and public-related issues.
- Reviews contractor submittals.
- Schedules and provides funding for all surveillance activities with the USACE COR.
- Responsible for overall project direction, including technical, contracting and customer related issues.
- Reports problems or discrepancies to the KO as soon as possible.

3.3 Contracting Officer's Representative (COR): Charles H. "Hud" Heaton, Jr., P.E.

- Reviews vouchers and makes recommendations to the Contracting Officer (KO) for payment action based on completion of designated milestones.
- Reports problems or discrepancies to the KO as soon as possible.
- Reviews Contractor submittals.
- Schedules and provides labor codes and funding for all surveillance activities with the appropriate USACE Supervisor.
- Oversees the implementation of the QASP.

3.4 USACE Technical Manager: Barry Hodges

- Participates in preparation of the Contractor's Performance Work Statement (PWS) to ensure technical requirements are defined.
- Participates in proposal technical review.
- Reviews contractor submittals for compliance with Contract and Task Order requirements.
- Reviews the Quality Assurance Project Plan (QAPP) for compliance with standards and the PWS.
- Conducts or supports other surveillance activities as required by the project team.
- Coordinates periodic inspections of Contractor compliance with DOD, DA, and USACE explosives and safety requirements and explosives related procedures described in the work plan.
- Supports all on-site quality assurance (QA) activities.

3.5 USACE Chemist: Alexandria Lambert

- Participates in preparation of PWS and ensures that analytical requirements are adequately addressed.
- Participates in proposal review to evaluate Environmental Sampling and Chemical Analysis tasks.
- Reviews the QAPP for compliance with standard protocols for Environmental Sampling and Chemical Analysis.
- Conducts reviews of Environmental Sampling and Chemical Analysis data.
- Conducts random site inspections of contractor compliance with environmental sampling requirements of the QAPP. This includes ensuring that the contractor is utilizing appropriate sampling techniques, collecting the quantity of primary and QA/QC samples as stated in the work plan and completing the chain of custody (COC) correctly with the approved analytical methodology.
- Reviews Quality Control Plan (QCP) reporting requirements and accepts reported QC measures.

3.6 USACE Geophysicist: Chad Wood

- Participates in preparation of the Contractor's Performance Work Statement (PWS) to ensure geophysical requirements are clearly defined.
- Participates in proposal review or serves as technical consultant to evaluate geophysical tasks.
- Participates in preparation of PWS to ensure that Geophysical requirements are adequately addressed.
- Reviews Contractor submittals (documents and data) for compliance with contract requirements.
- Reviews the QAPP for compliance with geophysical standards and the PWS.
- Coordinates with USACE team members to perform periodic inspections of contractor's compliance with approved plans and performance requirements.
- Reviews Contractor's Quality Control (QC) documentation to ensure accuracy and final Government acceptance.
- Conducts surveillance activities as required.

3.7 USACE Ordnance and Explosives Safety Specialist (OESS): Tony Isadore

- Participates in preparation of PWS to ensure that Safety requirements are adequately addressed.

- Conducts reviews of contractor submittals for compliance with Department of Defense (DOD), Department of the Army (DA) and USACE explosives safety requirements.
- Reviews the QAPP for compliance with munition standards, safety, and the PWS.
- Performs periodic inspections of contractor compliance with DOD, DA, and USACE explosives safety requirements and explosives-related procedures described in the work plan.
- Makes unscheduled, periodic site visits as part of the Government surveillance.
- Conducts or supports other surveillance activities as required by the project team.
- Performs and/or supports all on-site QA activities.

3.8 USACE Contract Specialist: Cheryl Smith

- Monitors contract performance.
- Maintains central repository for all Quality Assurance (QA) tasks required for payment.
- Issues all acceptance/rejection statements.

4.0 Methodologies to be used to Monitor the Contractor's Performance

Even though the Government, through the USACE PM and Contract Officer Representative (COR), will be monitoring the contractor's performance on a continuing basis, the volume of tasks performed by the contractor makes technical inspections of every task and step impractical. Accordingly, USACE will use the Surveillance Activity Table (Attachment A) as the basis for monitoring the contractor's performance under this contract. The contractor's performance will be evaluated by the KO using the Performance Metrics for Contractor Performance Assessment Reporting System (CPARS).

4.1 Quality Assurance Surveillance Activities

In general, the work will be evaluated in terms of how well the requirements of the Task Order are satisfied, the extent to which the work performed follows the approach found in the contractor's technical proposal, clarity of documentation, and timeliness of scheduled task accomplishment. At the discretion of the KO, the COR or other government officials approved by the KO may be asked to evaluate a deliverable or set of deliverables. Quality Assurance includes but is not limited to the following:

4.2 Quality Assurance for Technical Management

The QA Surveillance Activities for Technical Management are based but not restricted to the following:

- Data packages, including all associated QC documentation (e.g., Checklists, QC Checks, Field notes, Daily reports, Field Work Record Forms provided to the Government periodically upon request).
- Periodic on-site inspections to assess field work compliance with the QAPP.

4.3 Quality Assurance for Sampling

The QA Surveillance Activities for Chemistry are based but not restricted to the following:

- Data packages, including all associated QC documentation, are submitted to the Government IAW DID HNC-005.02.
- Periodic site visits to assess field work compliance with the QAPP.

- Any PFAS Sampling will be reviewed to ensure it complies with the specific requirements for this emerging contaminant.

4.4 Quality Assurance for Geophysics and Geospatial Data

The QA Surveillance Activities for Geophysical related activities are based but not restricted to the following:

- Data packages, including all associated QC documentation, are submitted to the Government in accordance with USACE guidance contained in Engineering Manual (EM) 200-1-15, and Contract DIDs.
- The contractor shall work with the USACE geophysicist to develop standard submittals, timing and approvals of these submittals based on ongoing project activities.
- The Quality Assurance Surveillance Activities for Geospatial Data are based on data packages, including all associated QC documentation, are submitted to the Government in lots and IAW the contract.

4.5 Quality Assurance for On-Site Safety/Operations QA

The Quality Assurance Surveillance Activities for On-Site Safety/Operations QA are based but not restricted to the following:

- Occupational health and safety guidance.
- Explosives safety guidance.
- On-Site Safety Inspections.
- Review of QC documents retained on-site during field activities.
- On-Site operations inspections to assess field work compliance with the QAPP and APP.
- QA checks as requested by the USACE Project Manager or other Government project team members

5.0 Quality Assurance Reporting Forms

The forms used to document surveillance activities include Daily Quality Assurance Report, Engineering Form 6048, HNC Form 7, Memorandum for Record, and Quality Assurance Forms contained in the contract’s Data Item Descriptions.

Non-conformances will be documented on an Engineering Form 6048, (Quality Assurance Report (QAR)) form. Non-conformances are documented at the discretion of the person conducting the surveillance activity but should be fair and reasonable. Each EF 6048 will be annotated as a Critical nonconformance, Major nonconformance, or Minor nonconformance. The Contractor will be required to correct explosives safety issues immediately. All other CARs will provide a reasonable suspense date for the Contractor to review and take appropriate action, usually 15 calendar days. The Contractor is required to provide written responses to all EF 6048.

Completed forms will be consolidated and provided to the Contracting Officer at the end of each month for that month's surveillance activities. These forms, when completed, will document the Contractor's compliance with contract requirements and completion of milestone activities. The Contractor will complete a final QA Report to:

- Summarize field QA and data QA activities and describe any constraints or problems encountered

- Provide list of all Engineering Form 6048s issued for QA failures, describe corrective actions taken, and provide lessons learned
- State that contract requirements were met regarding quality of services provided
- The Contracting Officer will evaluate contractor performance using the definitions contained in the CPARS and the metrics identified in the PWS.

6.0 Surveillance Methodology

The surveillance methods listed below will be used in the administration of this QASP.

6.1 100% Inspection

All project milestones and deliverables will be evaluated through 100% inspection by onsite inspection or document review. The USACE Project Manager will document performance for each completed milestone or deliverable prior to payment, as described in Section 8.0.

6.2 Periodic Inspection

At the USACE Project Manager's discretion, periodic inspections will be conducted to evaluate progress toward key milestones and deliverables. This will include QA Safety Inspections by a government representative during any fieldwork. The USACE Project Manager may also complete a periodic progress inspection if he/she believes that deficiencies exist that must be addressed prior to milestone or deliverable completion. While corrective action or re-performance will be required if necessary, The contractor will not be financially penalized for unacceptable performance recorded in periodic progress reports, provided that final performance evaluation of the milestone or deliverable is deemed acceptable.

6.3 Customer Feedback

The contractor's performance feedback will be obtained through periodic inquiries by the USACE Project Manager with project stakeholders. The purpose of these inquiries would be to supplement the other forms of evaluation and to also provide the contractor with constructive criticism and/or recognition for the project deliverables or milestones completed. Customer feedback received will be thoroughly validated to ensure it relates to the requirements of the PWS and will be used in a prudent manner by the COR. Customer feedback will also be solicited in the form of a concurrence letter by the contractor from appropriate stakeholders for key deliverables.

7.0 Surveillance Documentation

7.1 Daily Quality Assurance Report and Daily Quality Control Report Forms

The forms used by USACE to document surveillance activities are:

- Corrective Action Report form (Attachment B)
- Quality Assurance Report form (Attachment C)
- Daily quality reports (no specific form)

7.2 Quality Assurance Report Form

Project Delivery Team members may use the Munitions Response, Quality Assurance Report Form (ENG FORM 6048) to record quality assurance evaluations of the contractor's performance for each definable feature of work, milestone, or deliverable in accordance with the methodology described in Section 6.0. The USACE Project Manager must substantiate, through narratives on the form, all superior and unacceptable ratings. Performance at the acceptable level is expected from the contractor. At a minimum, the evaluation form will indicate actual and scheduled delivery times and number of reviews required to achieve the final product. The author of the form will forward copies of all completed forms to the USACE COR within three (3) business days of performing the inspection. The USACE PM will forward all completed quality assurance monitoring forms to the contractor within 14 days.

7.3 Technical Quality Assurance/Quality Control Monitoring

In general, all work will be evaluated in terms of how well the requirements of the Task Order are satisfied, the extent to which the work performed follows the approach found in the contractor's technical proposal and/or implements the decision of Technical Project Planning, and clarity of documentation. At the discretion of the COR or the KO or Specialist, other government officials approved by the KO or Specialist may be asked to evaluate a deliverable or set of deliverables. The results of all the contractor's Technical Quality Control Monitoring will be documented using a Technical Review Form. Technical Quality Control Monitoring Documentation will document technical criteria evaluated

8.0 Attachments

The following items are attached:

Attachment A:	Surveillance Activity Table
Attachment B:	Corrective Action Request Form
Attachment C:	Quality Assurance Report (QAR) Form
Attachment D:	EA Project Personnel

QASP Approval:

____ ____6 Jan 2023_____

Charles H. Heaton Jr., P.E. Date
Contracting Officer's Representative

Attachment A

Surveillance Activity Table

Surveillance Activity Table

Definable Feature of Work	Reference	Performance indicators	Surveillance Method	Performance Documentation & QA Surveillance Record File	Performance Assessment Record Category	Responsible Member
Document Reviews						
QAPP Other Documents	PWS	• Document submitted and accepted in compliance with the contract schedule • Resubmissions required based on the amount and nature of comments regarding: Formatting; Completeness; Technical Accuracy; Regulatory compliance; Conciseness; and Decisions supported by data	100% review of submitted document	• CEHNC Form 7 • Contracting Officer Transmittal Memo • Maintained in official contract file	Quality of Product or Service	PDT
Project Execution						
QAPP Execution	PWS	• Work done in compliance with the approved plans • Data submittals accepted by the government IAW performance documentation	Periodic Inspection	• Corrective Actions Request • Geophysics QC Forms • Chemistry QC Forms • Eng Form 6048 • Memorandum for Record	Quality of Product or Service	PDT
Schedule						
Project Management: Schedule Control and Reporting	Task Order	Number of instances contractor impacts on schedule, attributable to the contractor and the impacts not previously identified.	100% of project status reports including weekly and monthly as applicable	PM Checklist, kept in the PM files.	Schedule	Government PM
Cost – Not Applicable for Firm Fixed Price Tasks						
Project Management: Cost Controls and Reporting	Task Order	Number of instances of contractor impacts on the costs attributable to the contractor, and unauthorized cost overruns	100% of project status reports including weekly and monthly as applicable	PM Checklist, kept in the PM files.	Cost Control	Government PM
Business Relations						
Meeting preparation and professional conduct	Task Order	Number of complaints regarding: 1. Personnel prepared and knowledgeable in areas of expertise 2. Professional and ethical conduct	Customer Feedback	Email; Letters; Customer survey forms. Kept in PM files	Business Relations	Government PM

Definable Feature of Work	Reference	Performance indicators	Surveillance Method	Performance Documentation & QA Surveillance Record File	Performance Assessment Record Category	Responsible Member
Management of Key Personnel						
Project Management: Personnel	Task Order	Number of instances regarding contractor personnel and their qualifications for filling key personnel positions.	Periodic inspections	Trip Report; QCRs; CARs; Eng Form 6048; kept in the official project files	Management of Key Personnel and Resources	PDT
Safety						
Execution of the: Explosives Management Plan and Explosives Siting Plan	DESR 6055.09 EP 385-1-95 DA Pam 385-64 QAPP	Number and type of violations and/or accidents regarding compliance with explosive safety and OSHA requirements	Periodic Inspection	QCRs; CARs; Eng Form 6048; Trip Reports; Kept Project Safety Specialist Files	Safety	Government Safety Specialist

Attachment B

Corrective Action Request Form

CORRECTIVE ACTION REQUEST **NO.** *(1,2,3, etc.)*

USACE Representative:
Date Issued:
Issued to:
Response Due: (*Based on type of nonconformance*)
Contract# and T.O.
Project Name/Location:

Nonconformance Type (circle one): Critical Major Minor

Description of Condition Found:

Contractor Representative Signature (Noting that CAR Received):

(The Contractor will provide the following information to the Contracting Officer and USACE PM by the "Response Due" date above. Please contact the USACE Representative listed above if you have any questions)

Actual Cause: (Contractor will investigate and determine cause of condition reported above. Actual cause should be stated as specifically as possible)

Action Taken to Correct Condition: (Corrective Action should address root cause, not the symptom)

Action Taken to Prevent Recurrence:

Action Taken to Monitor Effectiveness of Corrective Action: (Generate data as proof. State the monitoring method put in place and who is responsible for reviewing data.)

Contractor Representative Signature/Title/Date Signed: (Form must be signed before returning)

(USACE Project Team Use Only)
Review of Corrective Action:
1) Has condition improved? ___ Yes ___ No
2) Additional corrective action required? ___ Yes ___ No
Comments:
Completed form provided to Contracting Officer: (Date)

Attachment C

Munitions Response
Quality Assurance Report (QAR)
Eng Form 6048

US ARMY CORPS OF ENGINEERS (USACE)
MUNITIONS RESPONSE
QUALITY ASSURANCE REPORT (QAR) FORM

The proponent agency is CESO. *See instructions on page 2.*

1. REPORT NO. *(1,2,3, etc., for the Task Order (T.O.))*

2. USACE REPRESENTATIVE'S NAME

3. DATE ACTIVITY COMPLETED

4. PROJECT NAME

5. PROJECT LOCATION

6. WEATHER CONDITIONS

7. CONTRACTOR

8. CONTRACT NUMBER

9. T.O. NUMBER

10. DISTRIBUTED TO (*check boxes and insert individual's name*)

☐ a. District Program/Project Manager

☐ b. Design Center

☐ c. Remedial Action District TM

☐ d. Contractor

11. RESPONSE DUE DATE (*Based on type of nonconformance, IF REQUIRED)*

12. TYPE OF ACTIVITY CONDUCTED (*Include types of inspections/audits conducted, operations observed, etc.)*

13. RESULTS AND OBSERVATIONS

14. DEFICIENCY TYPE (*select one*) ☐ a. Not Applicable ☐ b. Critical ☐ c. Major ☐ d. Minor

☐ e. Other, *Specify*

15. DATE

16. USACE REPRESENTATIVE'S SIGNATURE

17. CONTRACTOR REPRESENTATIVE'S NAME

18. DATE

19. CONTRACTOR REPRESENTATIVE'S SIGNATURE (*indicating receipt of the QAR*)

20. The Contractor will provide the following information to the Contract Specialist by the "Response Due" date above. Please contact the Contracting Officer's Representative (COR) or Project Manager if you have any questions.

a. Contractor Response as to Cause and Actions Taken to Correct Current Condition and to Prevent Recurrence (*cite applicable quality control procedures or changes in plans, procedures, or practices*).

b. Contractor Representative's Authentication (*form must be signed before returning*)

(1) Printed Name	(2) Title	(3) Date Signed	(4) Signature

c. Government Evaluation (*acceptance, partial acceptance, etc.*)

d. Government Actions (*reduced payment, cure notice, show cause, other*)

e. Close Out	Name	Title	Date (*YYYY-MM-DD*)	Signature
(1) Contractor Notified				
(2) USACE PDT Representative				
(3) Contracting Officer or COR				

Attachment D

EA Key Personnel

EA Project Personnel

Person	Position	Email	Phone
Key Project Personnel			
Timothy Reese, P.E.	PM	treese@eaest.com	410-329-5185
Brenda Nuding	Project Chemist	bnuding@eaest.com	808.589.1455
Don Conan, P.E.	Project Senior Engineer	dconan@eaest.com	315-565-6551
Frank DeSantis	Technical Manager	fdesantis@eaest.com	315-565-6550
Mike Wright	SSHO	mwright@eaest.com	315-565-6572
Grant Reeder	Field QC Manager	greeder@eaest.com	315-565-6570
Amanda Kohn, P.G.	Field Geologist	akohn@eaest.com	315-431-4610
Additional Project Personnel			
Rick Hanoski, CQA, PMP, VP	Program Manager	rhanoski@eaest.com	410-584-7000
Ivy Harvey, P.E., PMP	Deputy Program Manager	iharvey@eaest.com	410-527-2438
Frank Barranco, PhD, P.E., P.G., CMQ/OE	Corporate QA/QC Manager	fbarranco@eaest.com	410-329-5137
Adrian Hughes, P.G., ASP, CSP	Health and Safety Manager	ahughes@eaest.com	410-527-2059

Appendix G

Land Use Controls Site Locations

`\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01_Seneca O&M and LUCs\05_GIS\PROJECTS\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP.aprx`

Legend

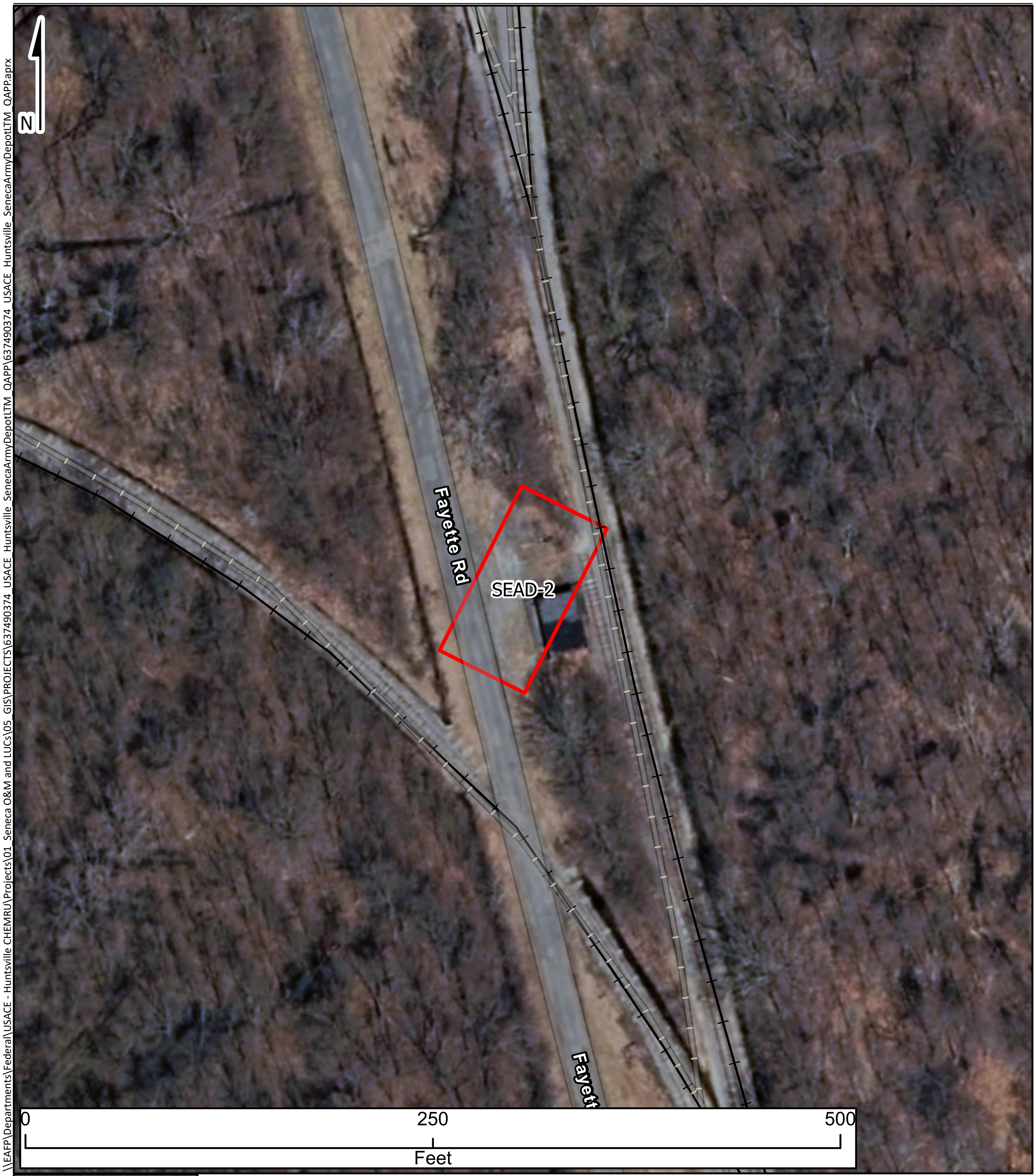
- 🟩 Former Depot Boundary
- 🟥 SEAD Site
- 〰 Drainage
- ┼ Railways
- ▬ Fenceline

Figure E-01

SEAD-1
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 2:10 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US



Legend

🟩 Former Depot Boundary

🟥 SEAD Site

〰 Drainage

┼ Railways

▬ Fenceline

Figure E-02

SEAD-2
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 2:10 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01_Seneca O&M and LUCs\05_GIS\PROJECTS\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP.aprx

\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01_Seneca O&M and LUCs\05_GIS\PROJECTS\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP.aprx

Legend

🟩	Former Depot Boundary
🟥	SEAD Site
∿	Drainage
┼	Railways
▬	Fenceline

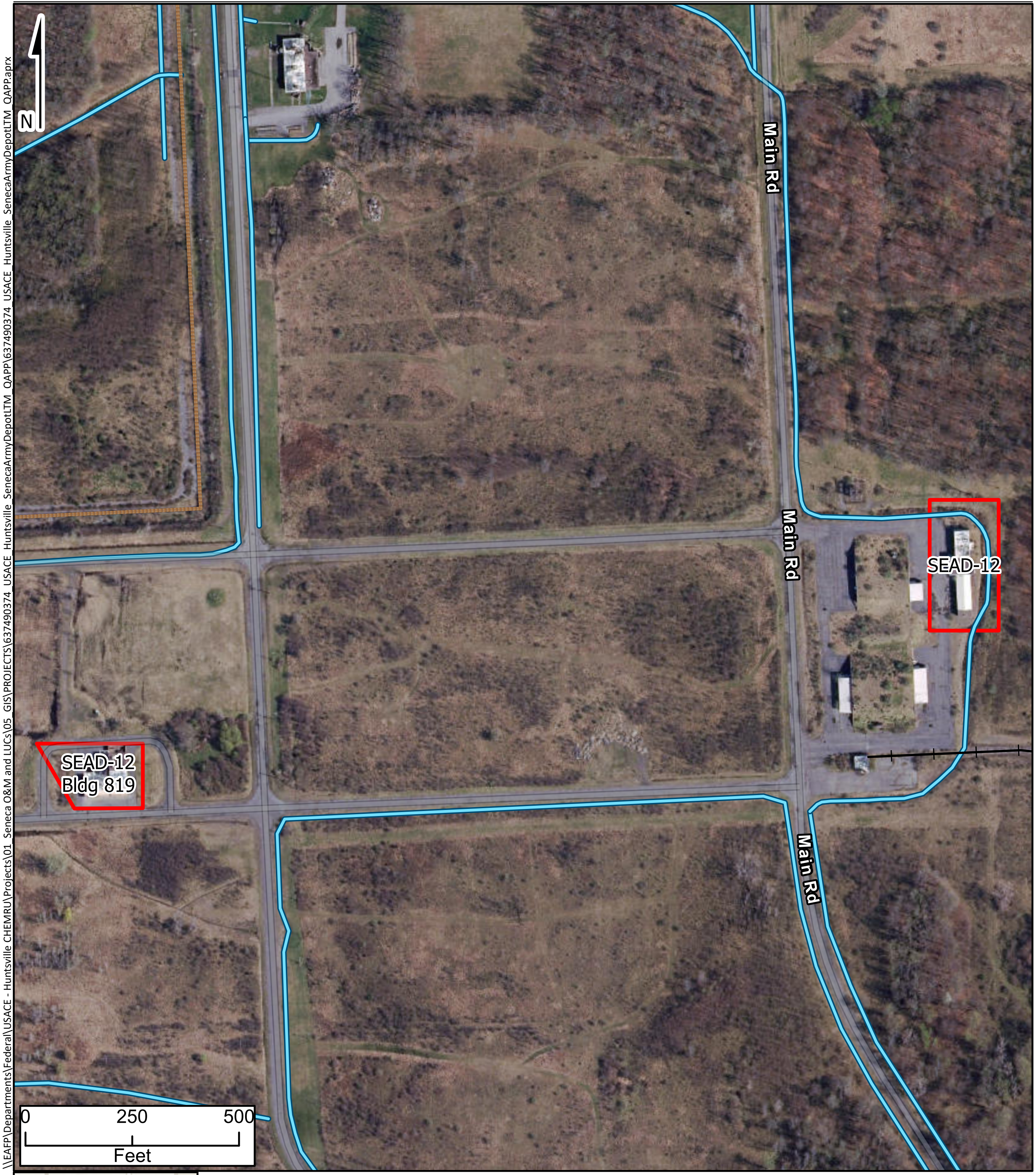
Figure E-03

SEAD-5
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 2:10 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01 Seneca O&M and LUCs\05 GIS\PROJECTS\637490374 USACE Huntsville SenecaArmyDepotLTM QAPP\637490374 USACE Huntsville SenecaArmyDepotLTM QAPP.aprx



Legend

🟩 Former Depot Boundary

🟥 SEAD Site

∿ Drainage

┼ Railways

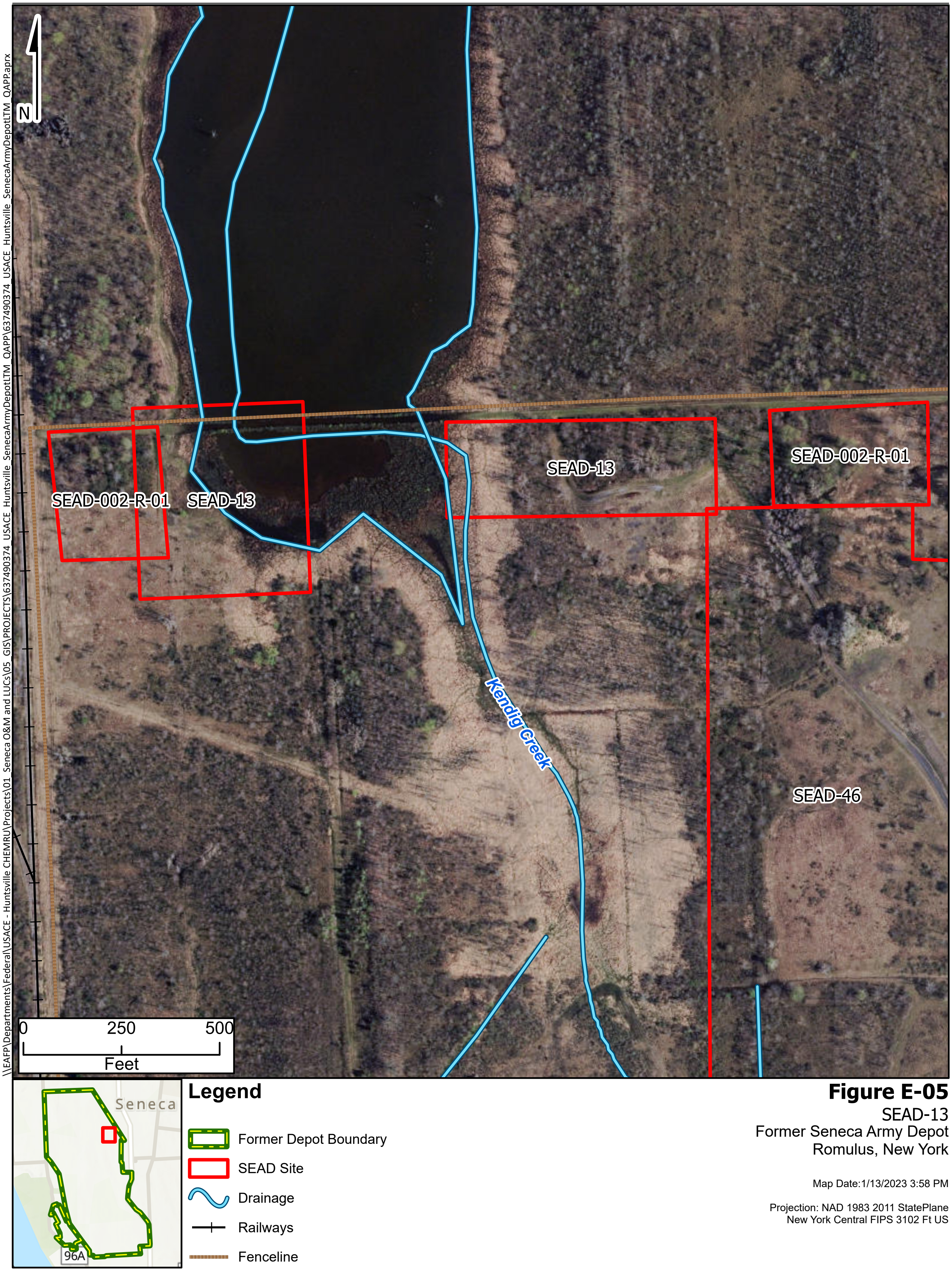
▬ Fenceline

Figure E-04

SEAD-12
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 3:50 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US



Legend

🟩 Former Depot Boundary

🟥 SEAD Site

Drainage

Railways

Fenceline

Figure E-05

SEAD-13
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 3:58 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01 Seneca O&M and LUCs\05 GIS\PROJECTS\637490374 USACE Huntsville SenecaArmyDepotLTM QAPP\637490374 USACE Huntsville SenecaArmyDepotLTM QAPP.aprx

\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01 Seneca O&M and LUCs\05 GIS\PROJECTS\637490374 USACE Huntsville SenecaArmyDepotLTM QAPP\637490374 USACE Huntsville SenecaArmyDepotLTM QAPP.aprx

Legend

🟩 Former Depot Boundary

🟥 SEAD Site

〰 Drainage

┼ Railways

▨ Fenceline

Figure E-06

SEAD-16
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 2:10 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

Legend

🟩	Former Depot Boundary
🟥	SEAD Site
~	Drainage
┼	Railways
▬	Fenceline

Figure E-07

SEAD-17
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 2:10 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01_Seneca O&M and LUCs\05_GIS\PROJECTS\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP.aprx

Legend

🟩 Former Depot Boundary

🟥 SEAD Site

〜 Drainage

┼ Railways

▬ Fenceline

Figure E-08

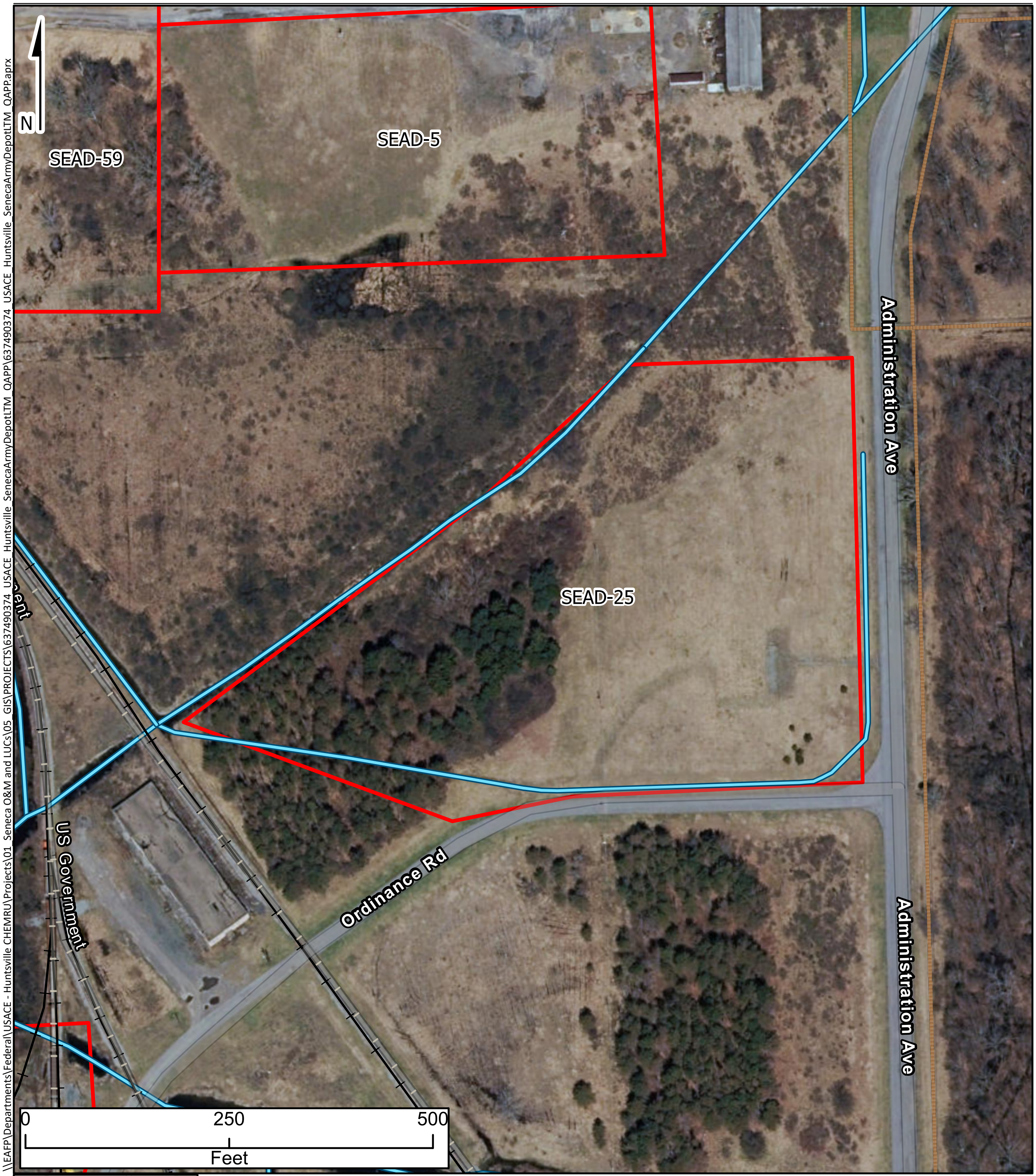
SEAD-23
Former Seneca Army Depot
Romulus, New York

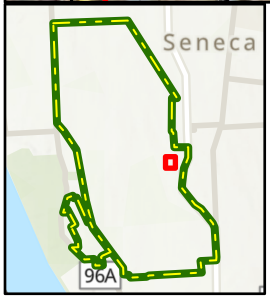
Map Date:1/13/2023 3:33 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01 Seneca O&M and LUCs\05 GIS\PROJECTS\637490374 USACE Huntsville SenecaArmyDepotLTM QAPP\637490374 USACE Huntsville SenecaArmyDepotLTM QAPP.aprx

\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01_Seneca O&M and LUCs\05_GIS\PROJECTS\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP.aprx





Legend

🟩 Former Depot Boundary

🟥 SEAD Site

∿ Drainage

+ Railways

▨ Fenceline

Figure E-09

SEAD-25
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 2:10 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

Legend

🟩 Former Depot Boundary

🟥 SEAD Site

〰 Drainage

┼ Railways

▬ Fenceline

Figure E-10

SEAD-26
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 2:10 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01_Seneca O&M and LUCs\05_GIS\PROJECTS\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP.aprx

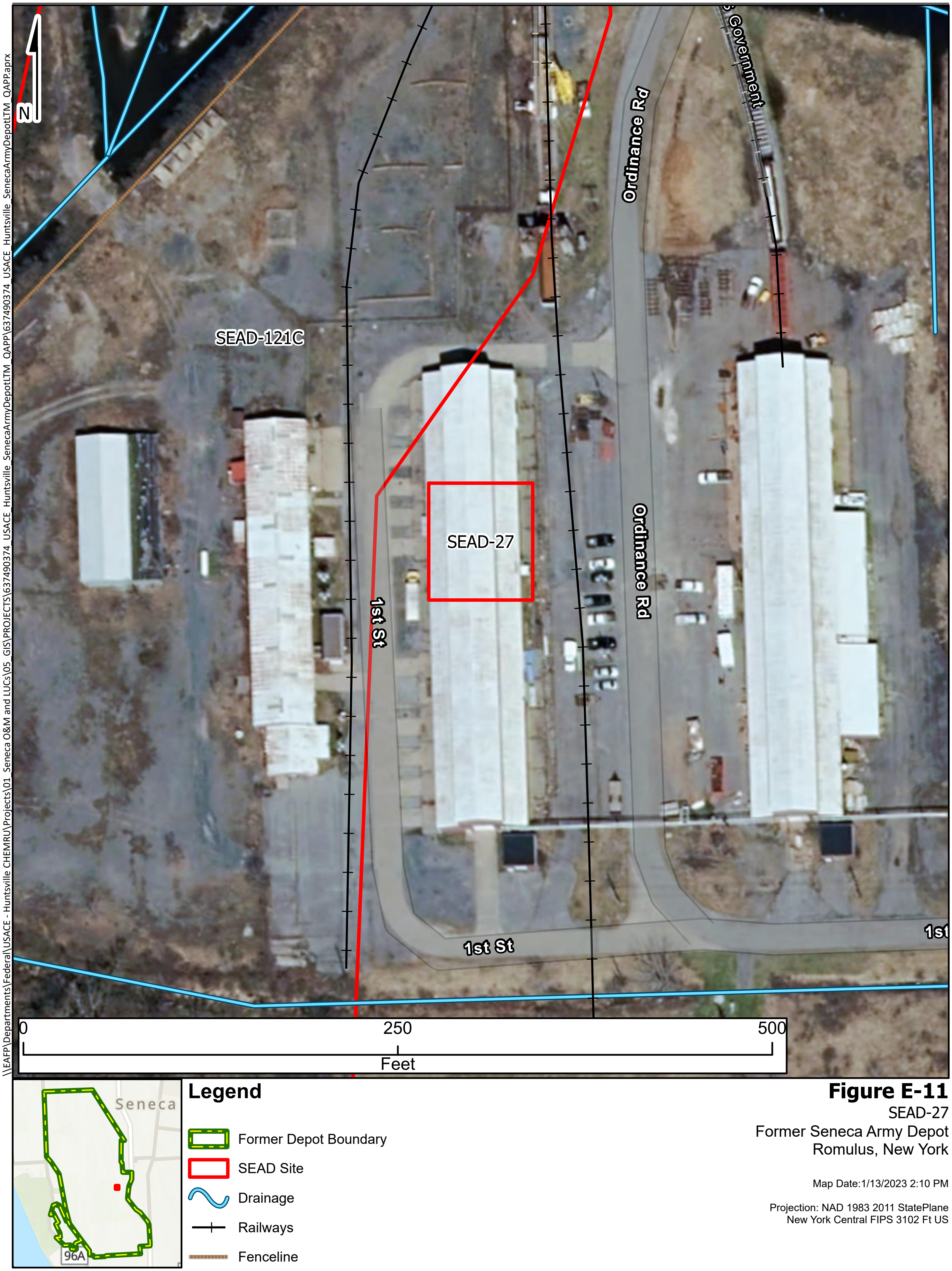


Figure E-11

SEAD-27
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 2:10 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01_Seneca O&M and LUCs\05_GIS\PROJECTS\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP.aprx

Legend

🟩	Former Depot Boundary
🟥	SEAD Site
∿	Drainage
┼	Railways
▬	Fenceline

Figure E-12

SEAD-39
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 2:10 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01 Seneca O&M and LUCs\05 GIS\PROJECTS\637490374 USACE Huntsville SenecaArmyDepotLTM QAPP\637490374 USACE Huntsville SenecaArmyDepotLTM QAPP.aprx

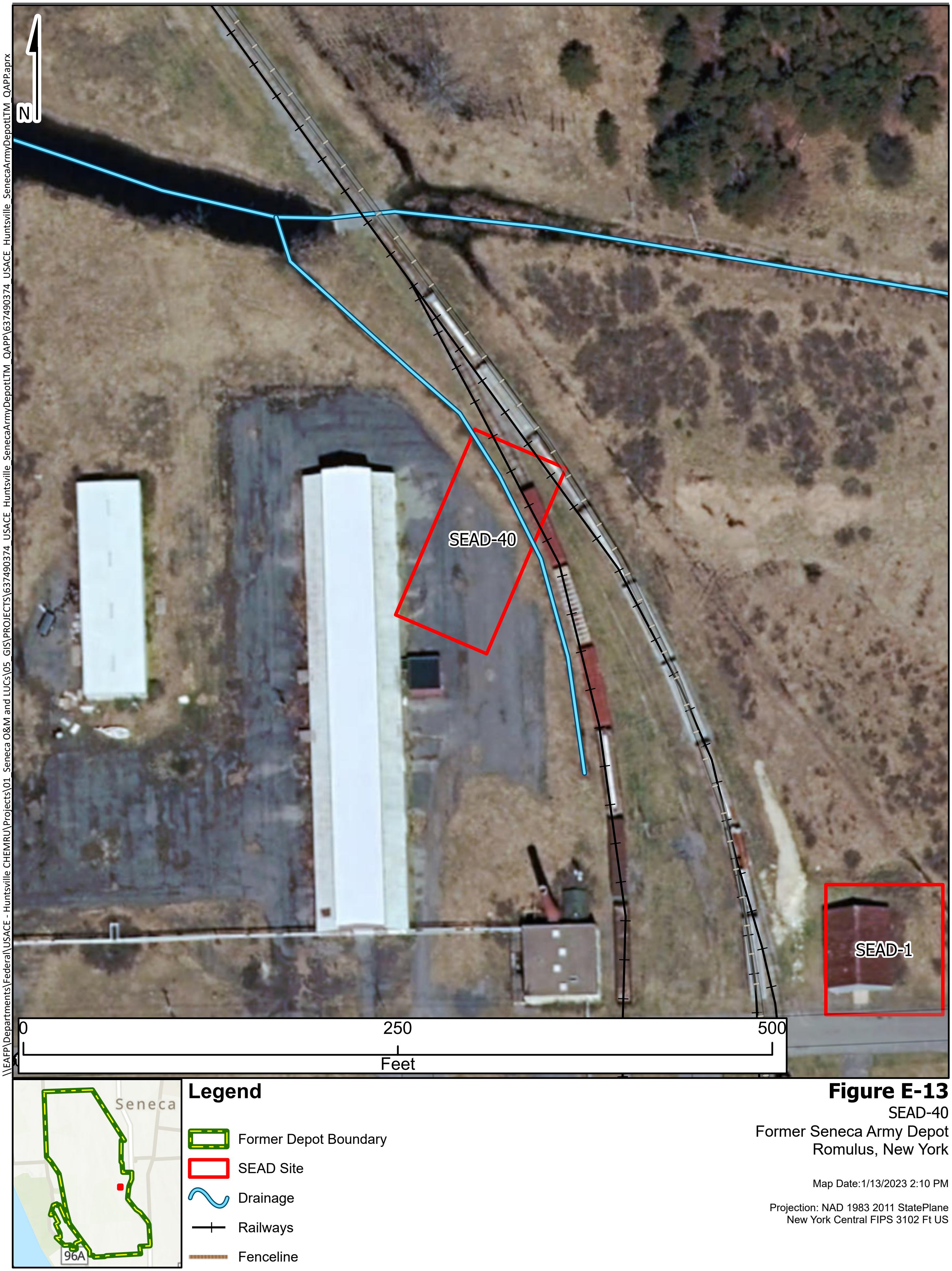


Figure E-13

SEAD-40
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 2:10 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01 Seneca O&M and LUCs\05 GIS\PROJECTS\637490374 USACE Huntsville SenecaArmyDepotLTM QAPP\637490374 USACE Huntsville SenecaArmyDepotLTM QAPP.aprx

Legend

🟩 Former Depot Boundary

🟥 SEAD Site

〰 Drainage

┼ Railways

▬ Fenceline

Figure E-14

SEAD-41 Bldg 722
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 2:10 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01 Seneca O&M and LUCs\05 GIS\PROJECTS\637490374 USACE Huntsville SenecaArmyDepotLTM QAPP\637490374 USACE Huntsville SenecaArmyDepotLTM QAPP.aprx

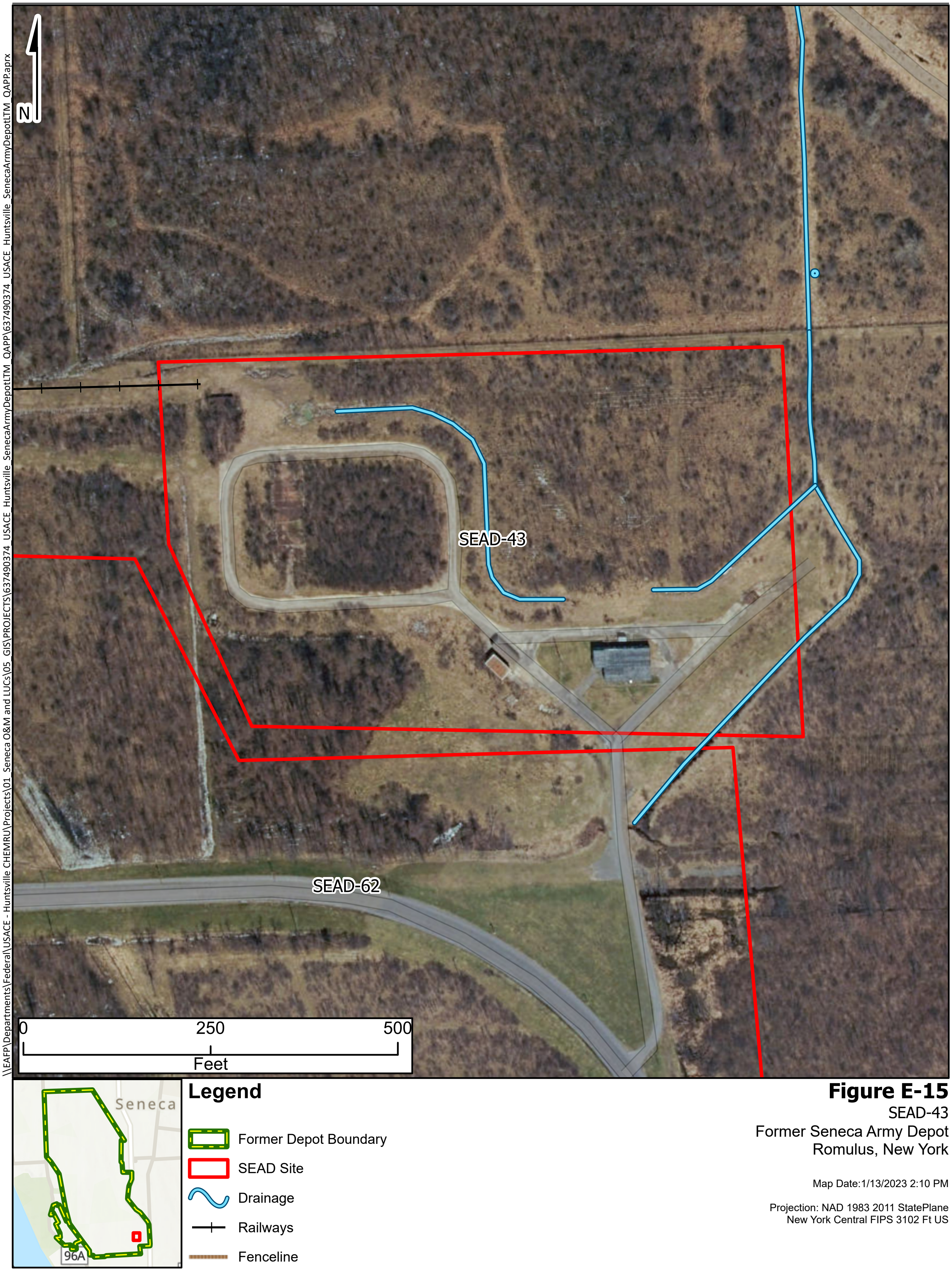


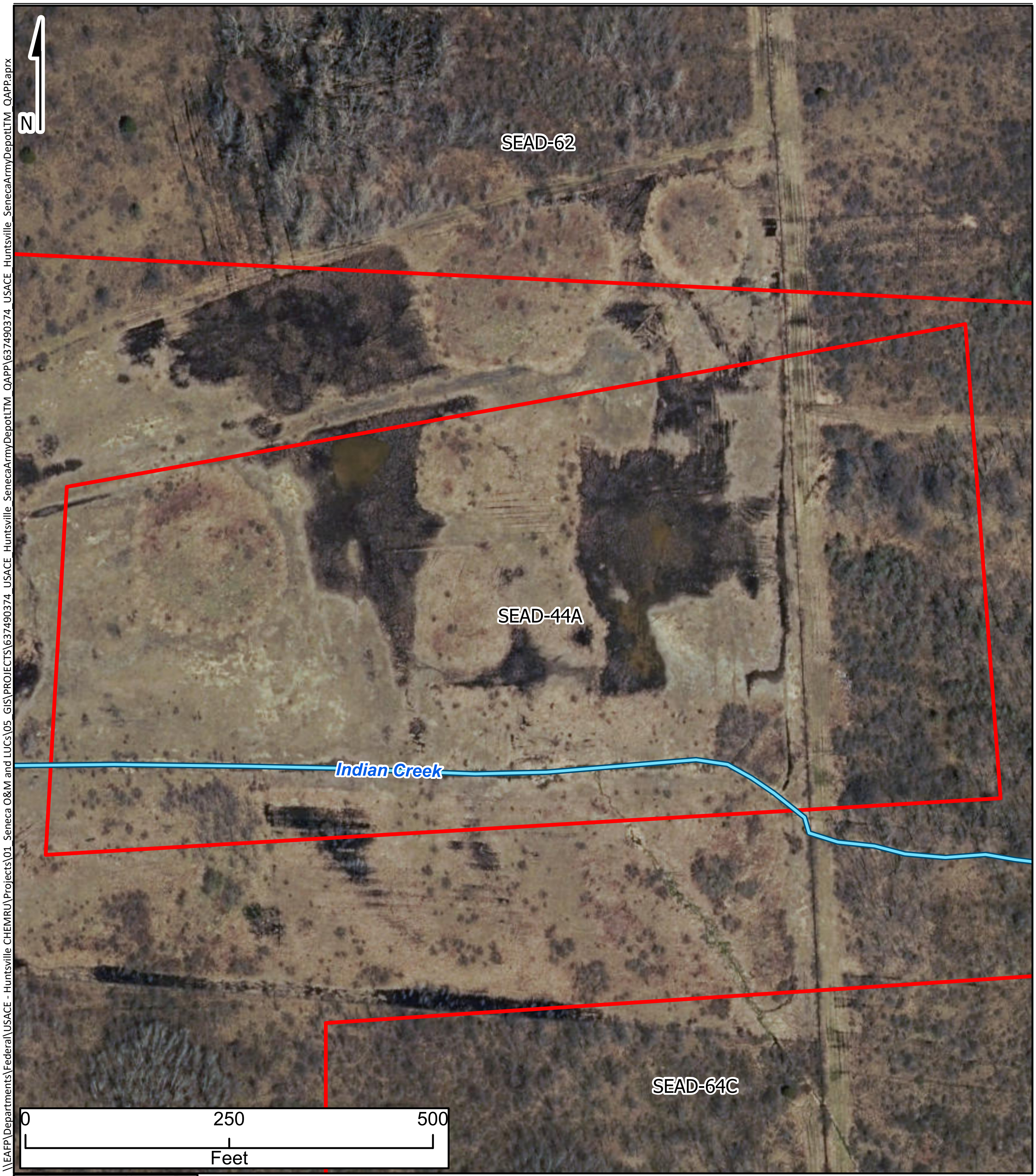
Figure E-15

SEAD-43
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 2:10 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01_Seneca O&M and LUCs\05_GIS\PROJECTS\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP.aprx



Legend

- 🟩 Former Depot Boundary
- 🟥 SEAD Site
- ∿ Drainage
- ┼ Railways
- ▬ Fenceline

Figure E-16
SEAD-44A
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 3:27 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01_Seneca O&M and LUCs\05_GIS\PROJECTS\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP.aprx

\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01_Seneca O&M and LUCs\05_GIS\PROJECTS\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP.aprx

Legend

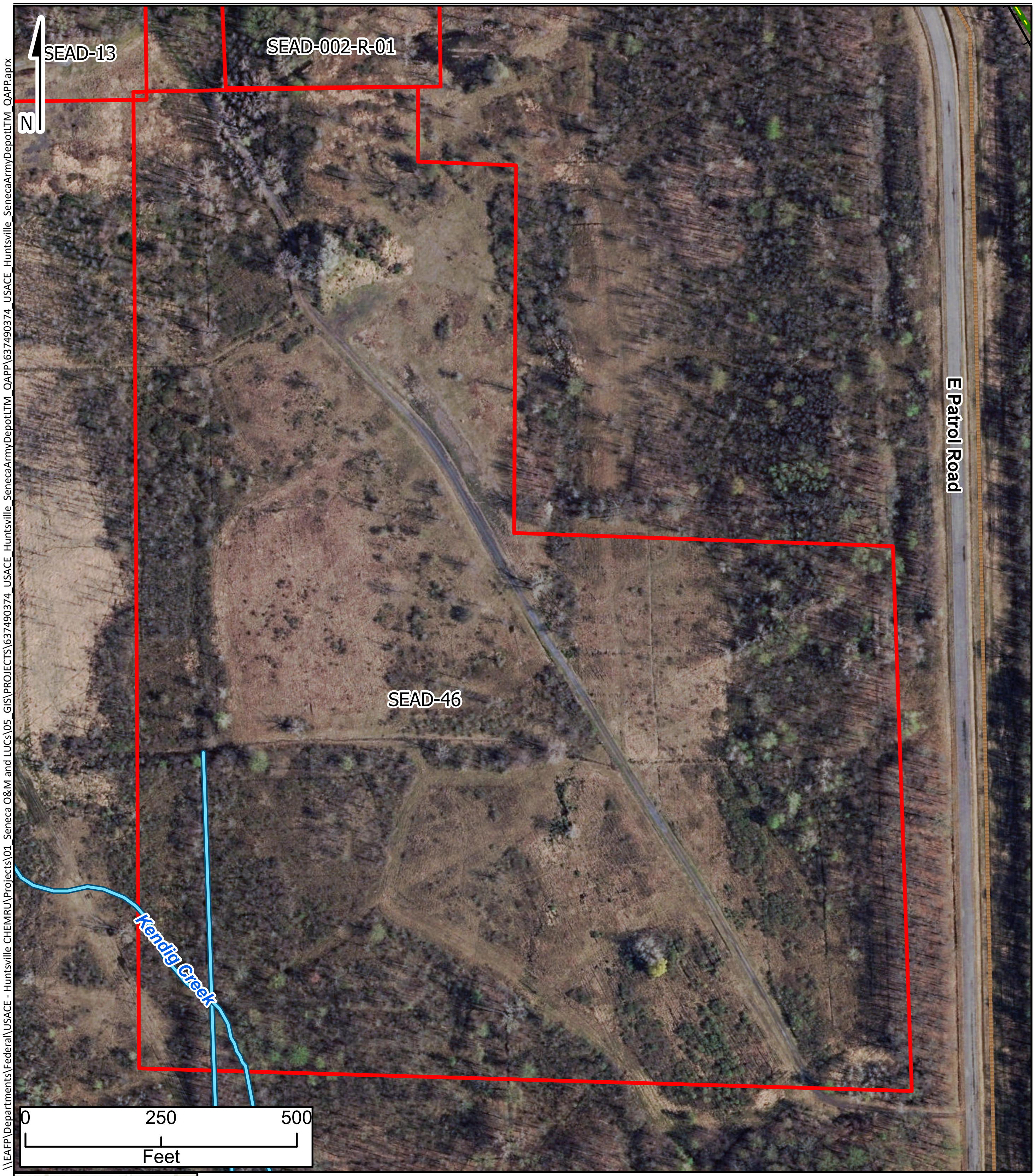
🟩 Former Depot Boundary
🟥 SEAD Site
〰 Drainage
┼ Railways
▬ Fenceline

Figure E-17

SEAD-44B
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 2:21 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US



Legend

🟩 Former Depot Boundary

🟥 SEAD Site

〰 Drainage

┼ Railways

▬ Fenceline

Figure E-18

SEAD-46
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 3:30 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01 Seneca O&M and LUCs\05 GIS\PROJECTS\637490374 USACE Huntsville SenecaArmyDepotLTM QAPP\637490374 USACE Huntsville SenecaArmyDepotLTM QAPP.aprx

\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01_Seneca O&M and LUCs\05_GIS\PROJECTS\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP.aprx

Legend

- 🟩 Former Depot Boundary
- 🟥 SEAD Site
- 〰 Drainage
- ┼ Railways
- ▬ Fenceline

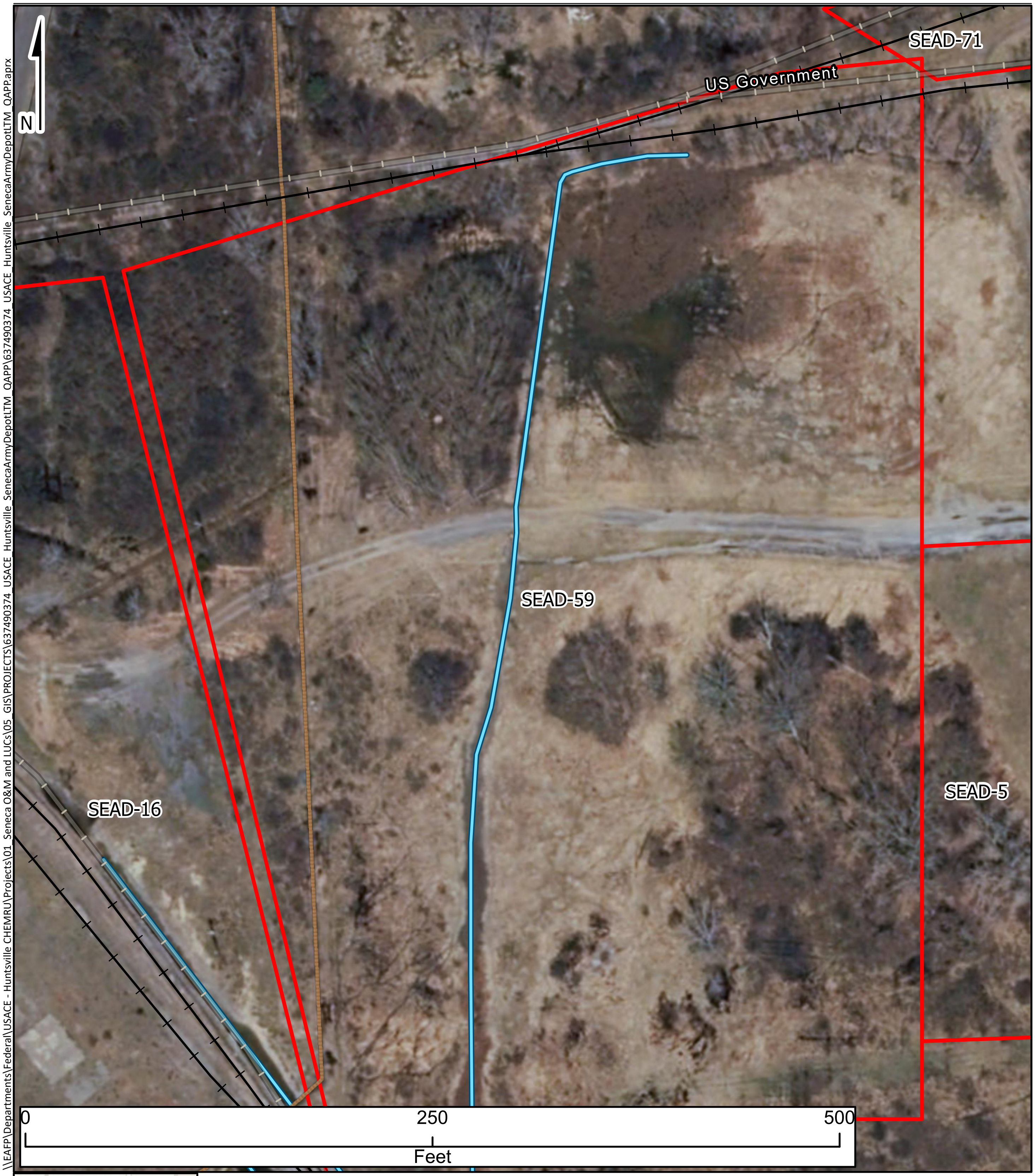
Figure E-19

SEAD-52
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 3:24 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01_Seneca O&M and LUCs\05_GIS\PROJECTS\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP.aprx



Legend

- 🟩 Former Depot Boundary
- 🟥 SEAD Site
- ∿ Drainage
- ┼ Railways
- ▬ Fenceline

Figure E-20

SEAD-59
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 2:10 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01_Seneca O&M and LUCs\05_GIS\PROJECTS\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP.aprx

Legend

🟩 Former Depot Boundary

🟥 SEAD Site

Drainage

Railways

Fenceline

Figure E-21

SEAD-62
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 3:18 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

Legend

🟩 Former Depot Boundary

🟥 SEAD Site

〰 Drainage

┼ Railways

▨ Fenceline

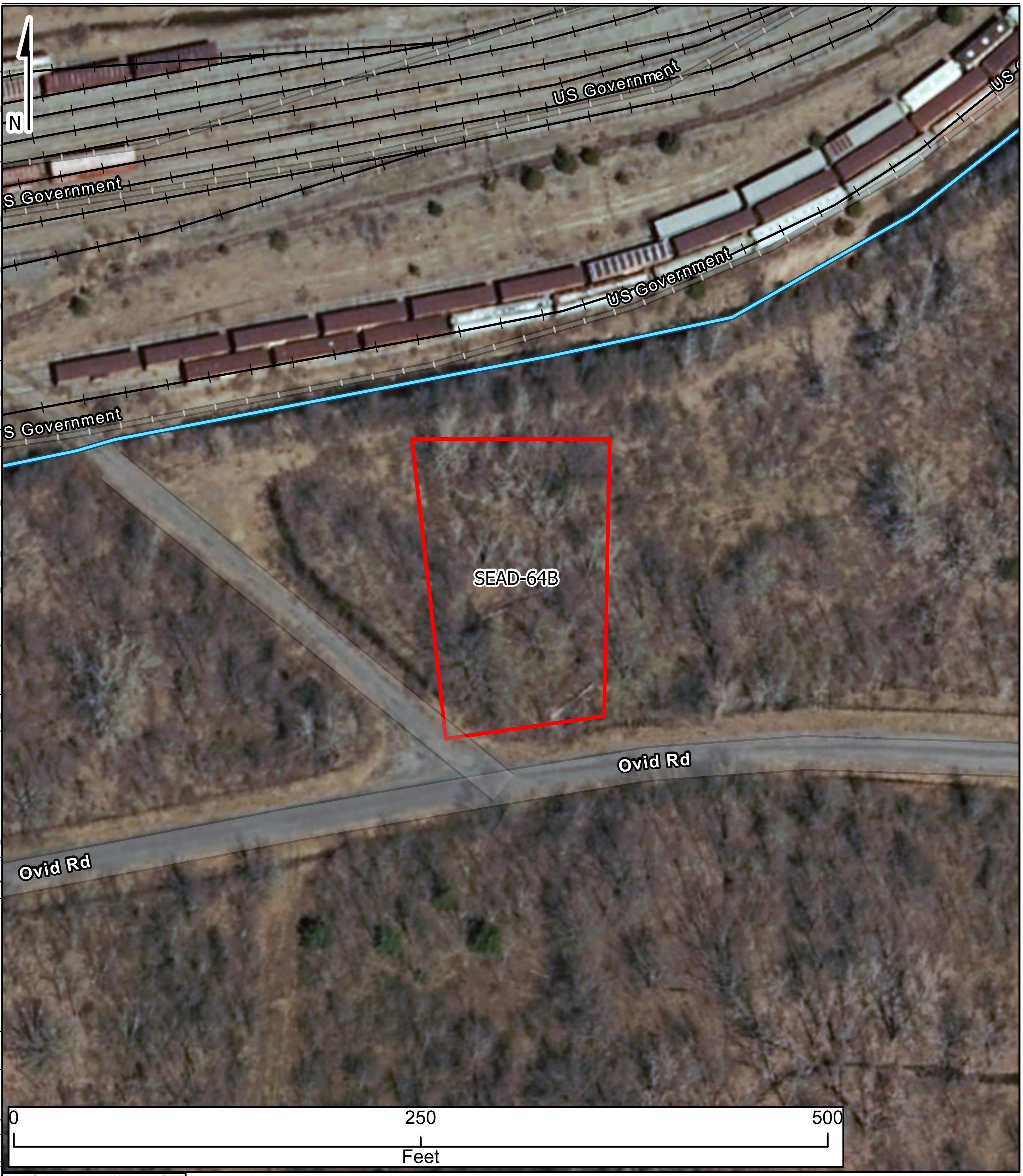
Figure E-22

SEAD-64A
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 2:10 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01 Seneca O&M and LUCs\05 GIS\PROJECTS\637490374 USACE Huntsville SenecaArmyDepotLTM QAPP\637490374 USACE Huntsville SenecaArmyDepotLTM QAPP.aprx



Legend

🟩 Former Depot Boundary

🟥 SEAD Site

〰 Drainage

┼ Railways

▬ Fenceline

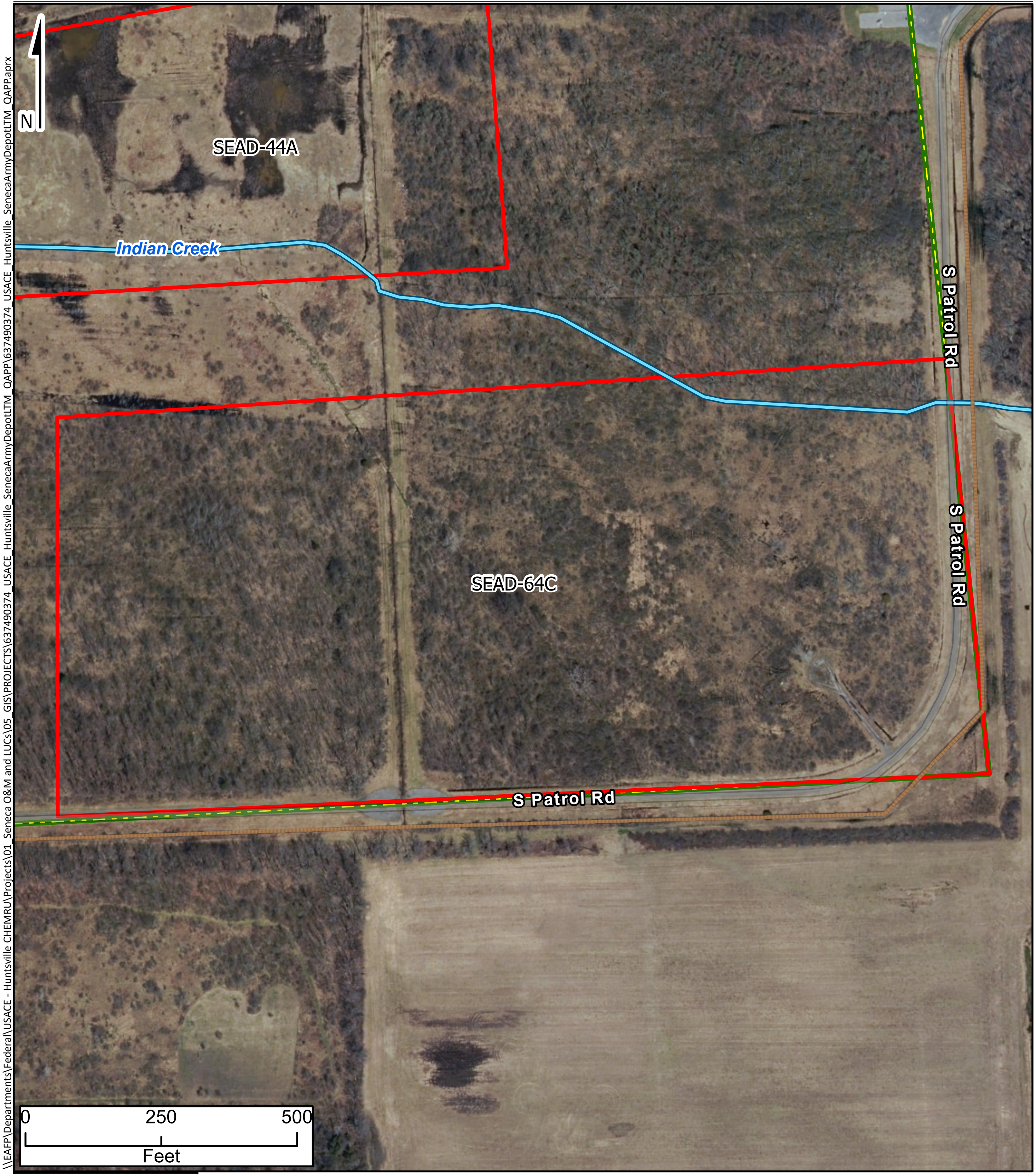
Figure E-23

SEAD-64B
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 2:10 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01_Seneca O&M and LUCs\05_GIS\PROJECTS\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP.aprx



Legend

- 🟩 Former Depot Boundary
- 🟥 SEAD Site
- ∼ Drainage
- ┼ Railways
- ▬ Fenceline

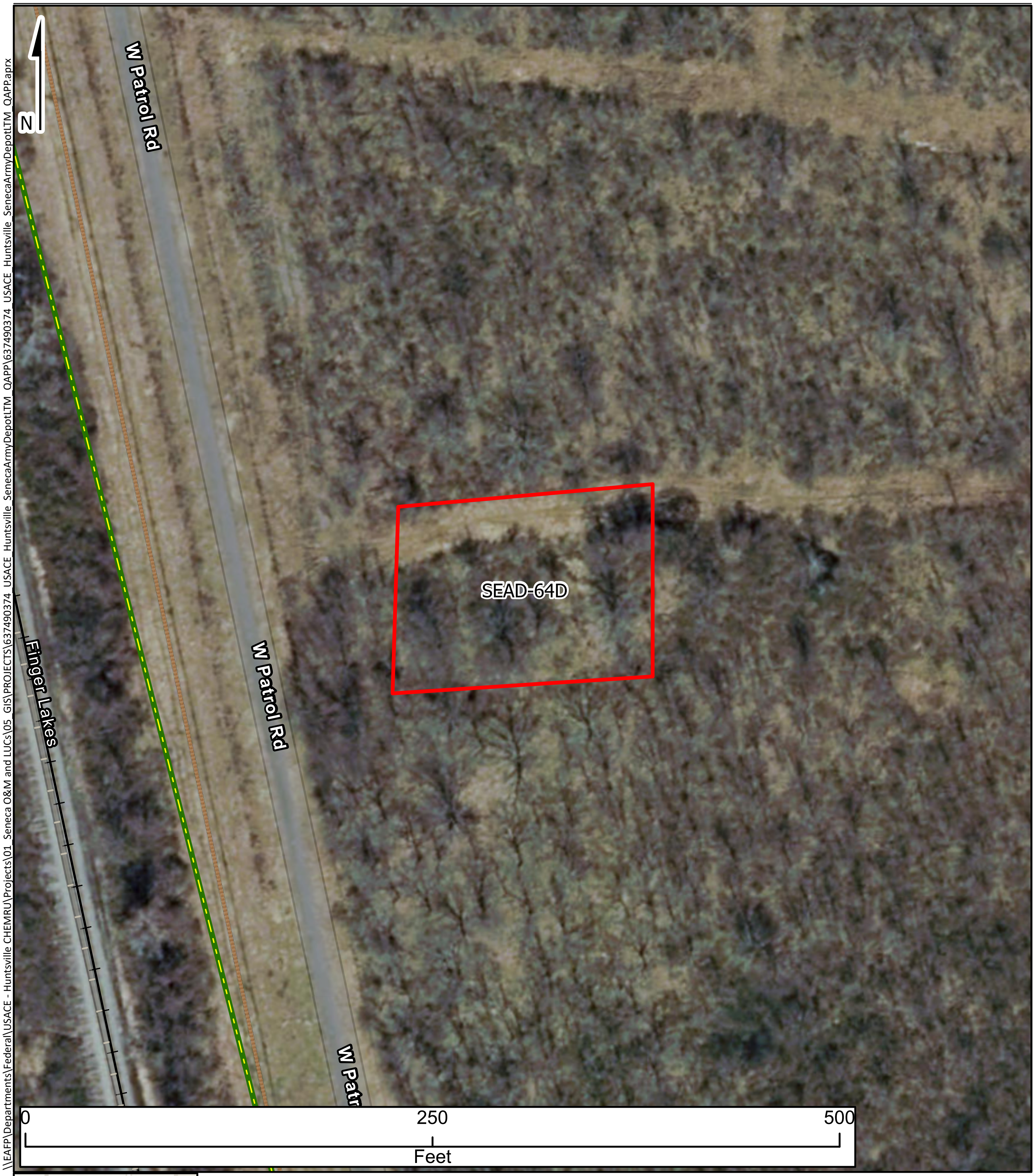
Figure E-24

SEAD-64C
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 2:43 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01_Seneca O&M and LUCs\05_GIS\PROJECTS\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP.aprx



\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01 Seneca O&M and LUCs\05 GIS\PROJECTS\637490374 USACE Huntsville SenecaArmyDepotLTM QAPP\637490374 USACE Huntsville SenecaArmyDepotLTM QAPP.aprx

Legend

🟩 Former Depot Boundary
🟥 SEAD Site
∿ Drainage
┼ Railways
▬ Fenceline

Figure E-25

SEAD-64D
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 2:10 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

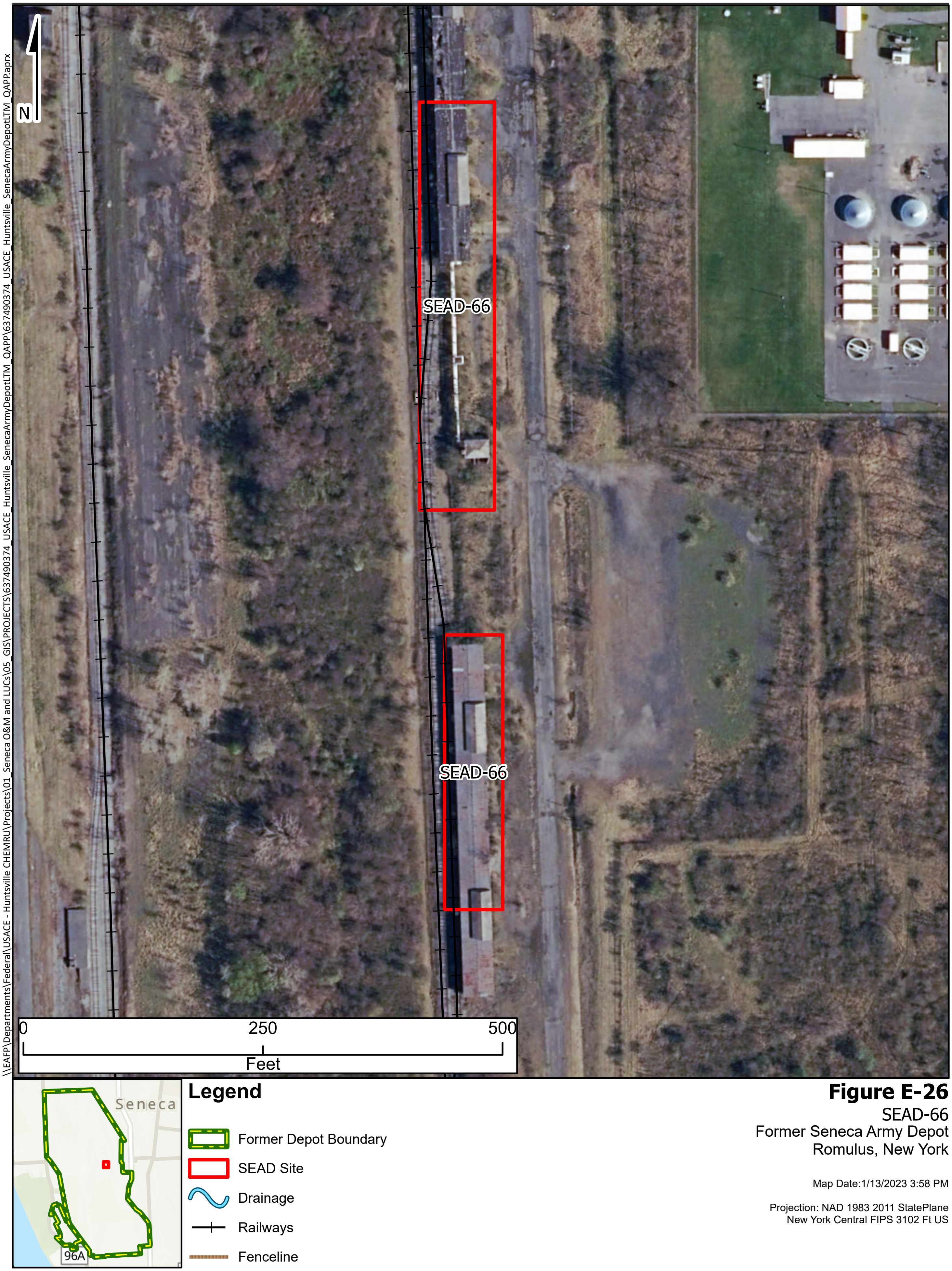


Figure E-26

SEAD-66
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 3:58 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01 Seneca O&M and LUCs\05 GIS\PROJECTS\637490374 USACE Huntsville SenecaArmyDepotLTM QAPP\637490374 USACE Huntsville SenecaArmyDepotLTM QAPP.aprx

Legend

🟩 Former Depot Boundary

🟥 SEAD Site

∿ Drainage

┼ Railways

▬ Fenceline

Figure E-27

SEAD-67
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 2:10 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01 Seneca O&M and LUCs\05 GIS\PROJECTS\637490374 USACE Huntsville SenecaArmyDepotLTM QAPP\637490374 USACE Huntsville SenecaArmyDepotLTM QAPP.aprx

\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01_Seneca O&M and LUCs\05_GIS\PROJECTS\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP.aprx

Legend

🟩 Former Depot Boundary

🟥 SEAD Site

〰 Drainage

┼ Railways

▬ Fenceline

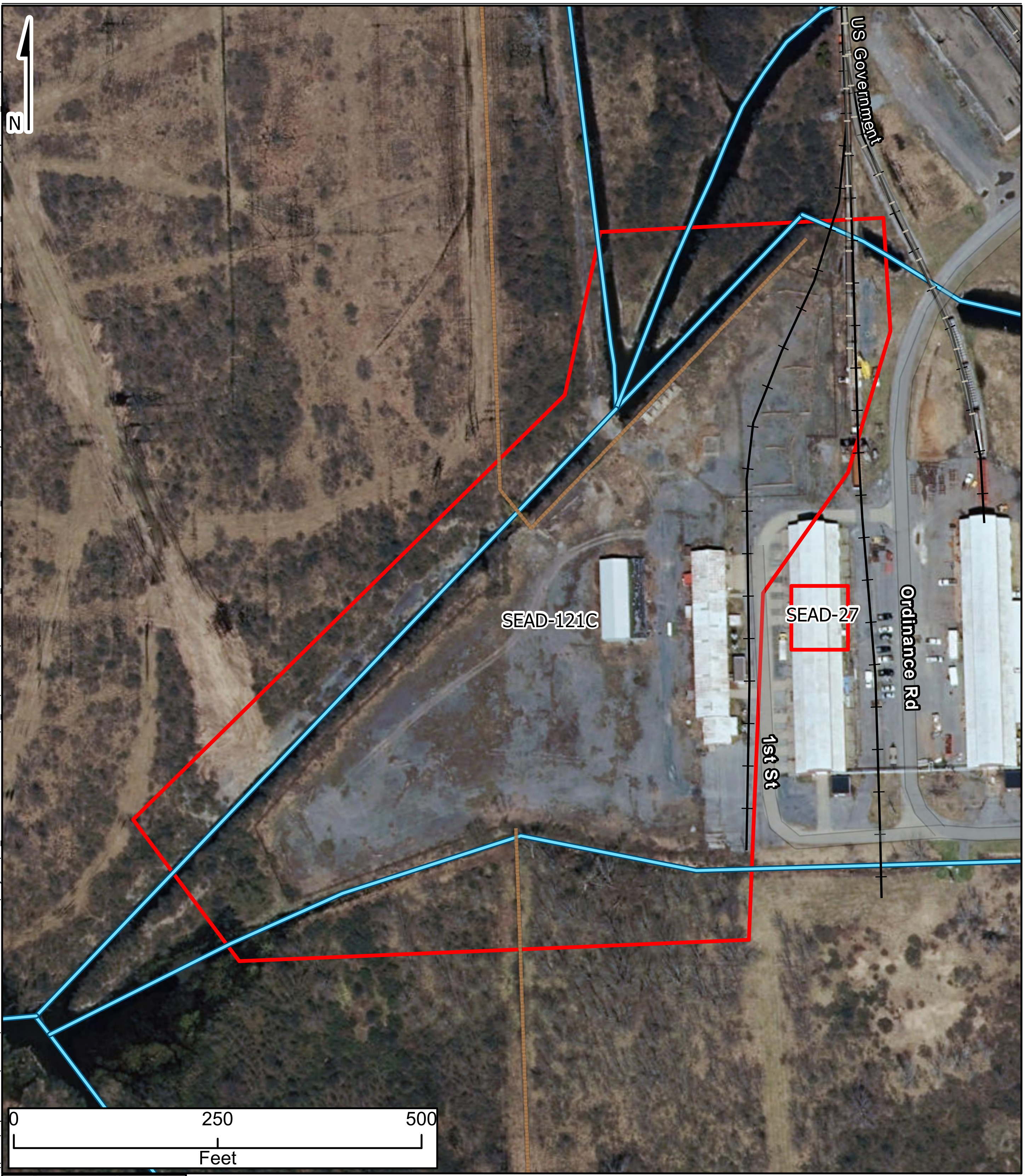
Figure E-28

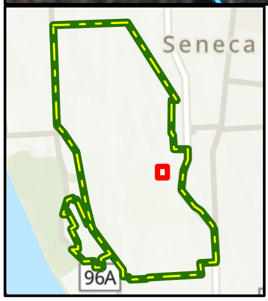
SEAD-71
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 2:10 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01_Seneca O&M and LUCs\05_GIS\PROJECTS\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP.aprx





Legend

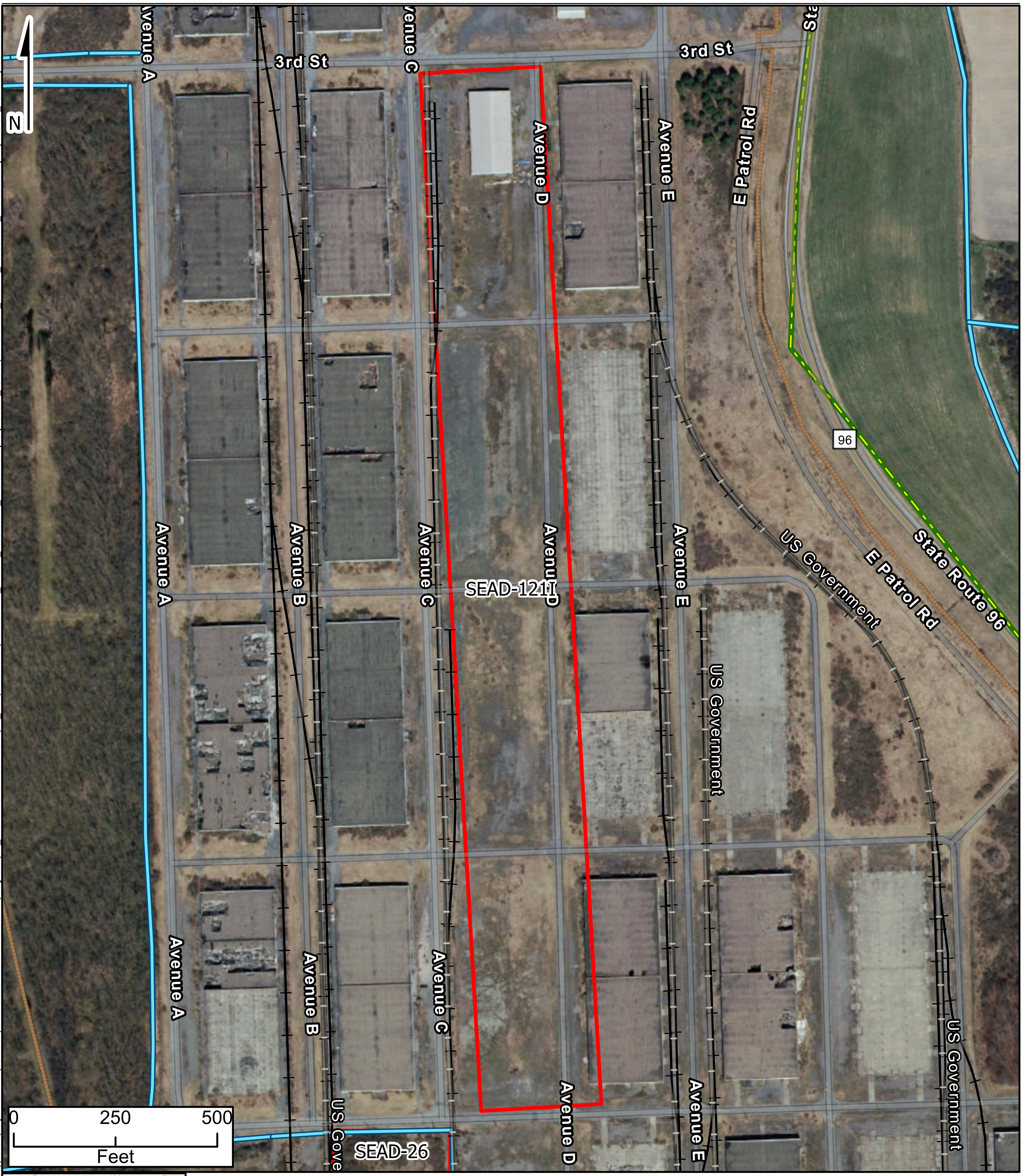
- 🟩 Former Depot Boundary
- 🟥 SEAD Site
- ~ Drainage
- ┼ Railways
- ▬ Fenceline

Figure E-29

SEAD-121C
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 2:10 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US



Legend

🟩 Former Depot Boundary

🟥 SEAD Site

〰 Drainage

┼ Railways

▬ Fenceline

Figure E-30

SEAD-121I
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 2:10 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01 Seneca O&M and LUCs\05 GIS\PROJECTS\637490374 USACE Huntsville SenecaArmyDepotLTM QAPP\637490374 USACE Huntsville SenecaArmyDepotLTM QAPP.aprx

\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01_Seneca O&M and LUCs\05_GIS\PROJECTS\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP.aprx

Legend

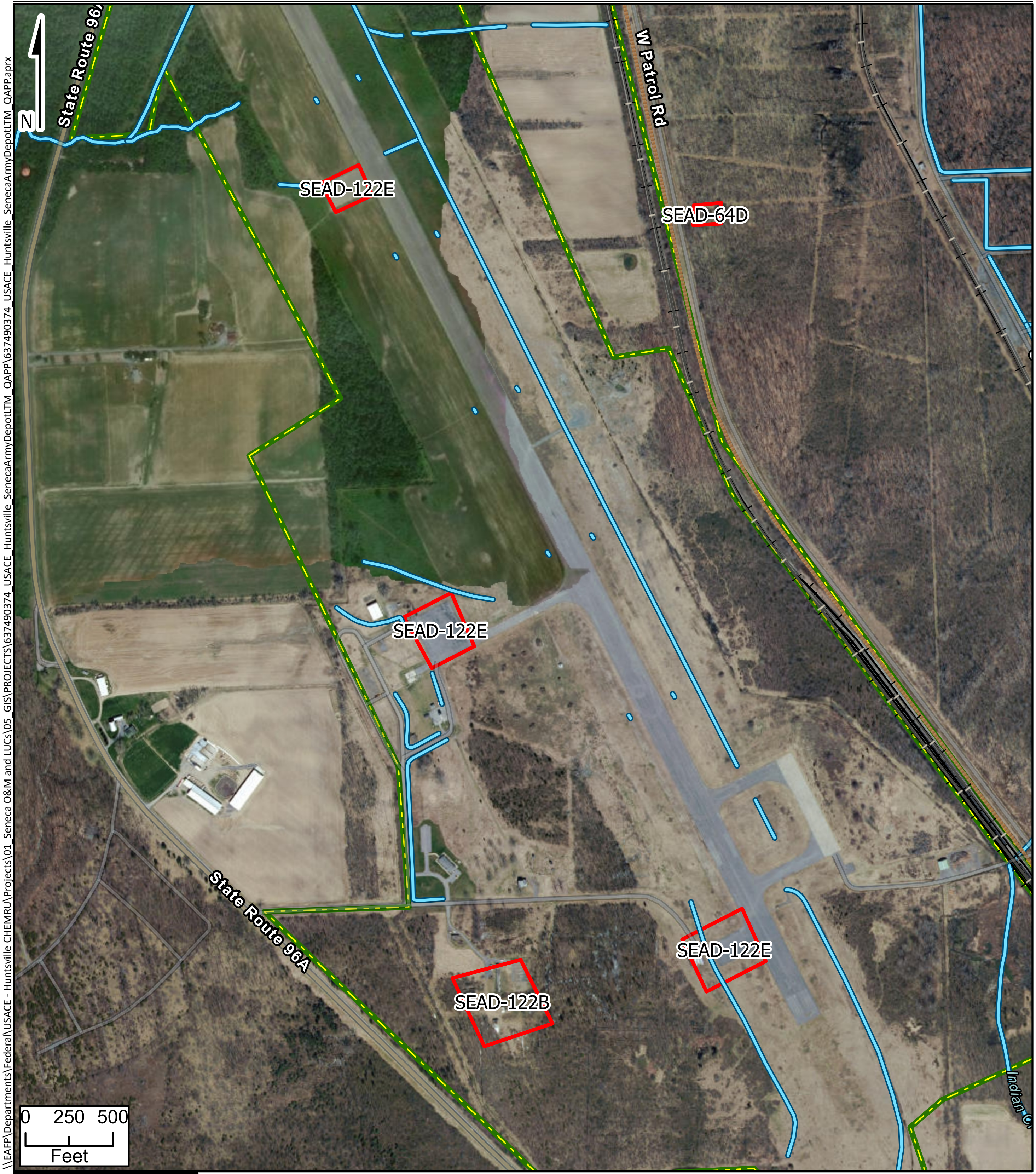
🟩 Former Depot Boundary
🟥 SEAD Site
~ Drainage
+ Railways
▨ Fenceline

Figure E-31

SEAD-122B
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 2:10 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US



Legend

🟩 Former Depot Boundary

🟥 SEAD Site

〰 Drainage

┼ Railways

▬ Fenceline

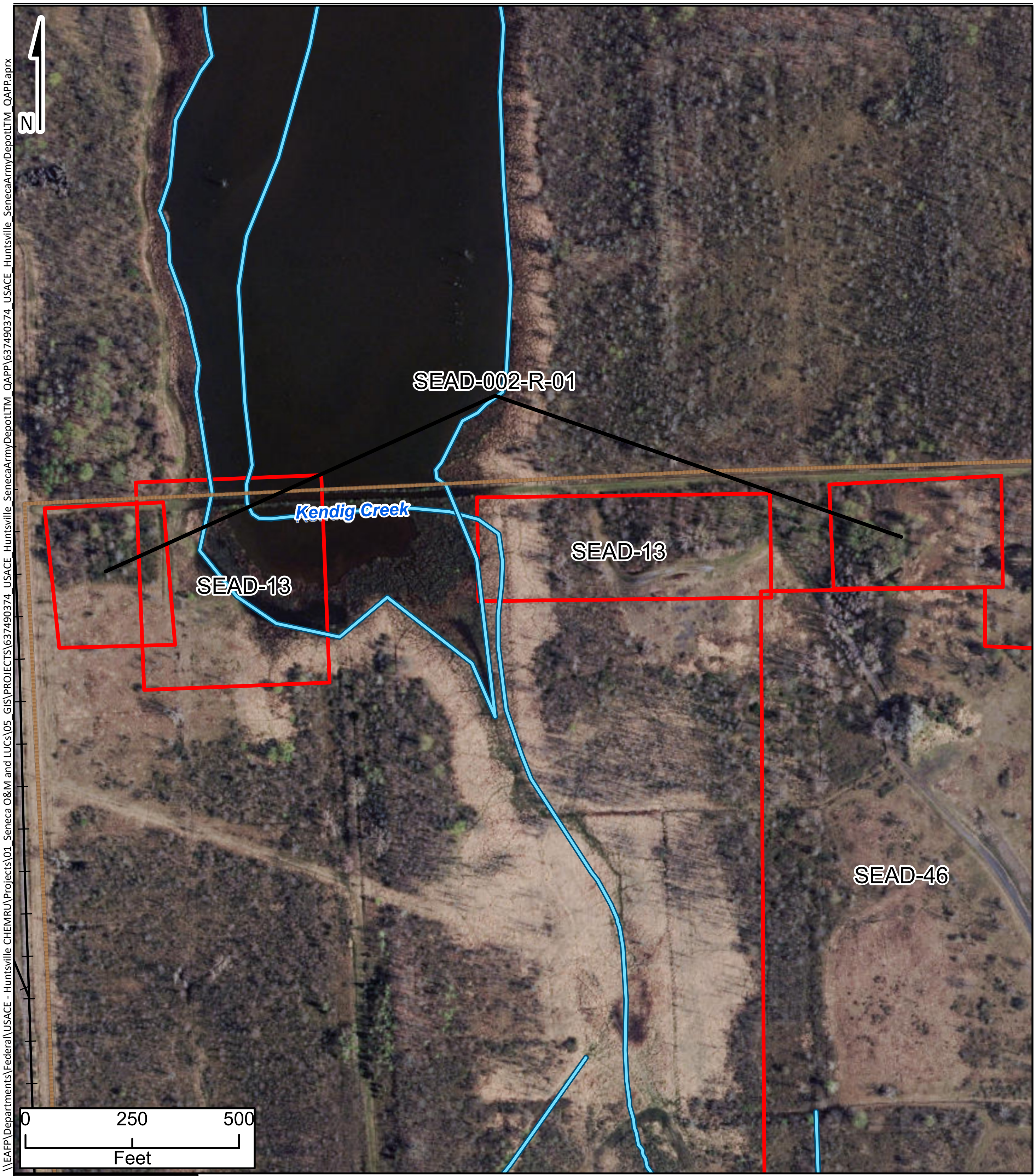
Figure E-32

SEAD-122E
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 3:50 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01 Seneca O&M and LUCs\05 GIS\PROJECTS\637490374 USACE Huntsville SenecaArmyDepotLTM QAPP\637490374 USACE Huntsville SenecaArmyDepotLTM QAPP.aprx



Legend

- 🟩 Former Depot Boundary
- 🟥 SEAD Site
- ∼ Drainage
- ┼ Railways
- ▬ Fenceline

Figure E-33

SEAD-002-R-01
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 2:53 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01_Seneca O&M and LUCs\05_GIS\PROJECTS\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP.aprx

Legend

- 🟩 Former Depot Boundary
- 🟥 SEAD Site
- ∿ Drainage
- ┼ Railways
- ▬ Fenceline

Figure E-34

SEAD-003-R-01
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 2:10 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01 Seneca O&M and LUCs\05 GIS\PROJECTS\637490374 USACE Huntsville SenecaArmyDepotLTM QAPP\637490374 USACE Huntsville SenecaArmyDepotLTM QAPP.aprx

\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01 Seneca O&M and LUCs\05 GIS\PROJECTS\637490374 USACE Huntsville SenecaArmyDepotLTM QAPP\637490374 USACE Huntsville SenecaArmyDepotLTM QAPP.aprx

Legend

- 🟩 Former Depot Boundary
- 🟥 SEAD Site
- ∿ Drainage
- ┼ Railways
- ▬ Fenceline

Figure E-35

SEAD-007-R-01
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 3:05 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

Figure E-36

SEAD-3
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 2:10 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01_Seneca O&M and LUCs\05_GIS\PROJECTS\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP.aprx

Legend

🟩 Former Depot Boundary

🟥 SEAD Site

〜 Drainage

┼ Railways

▬ Fenceline

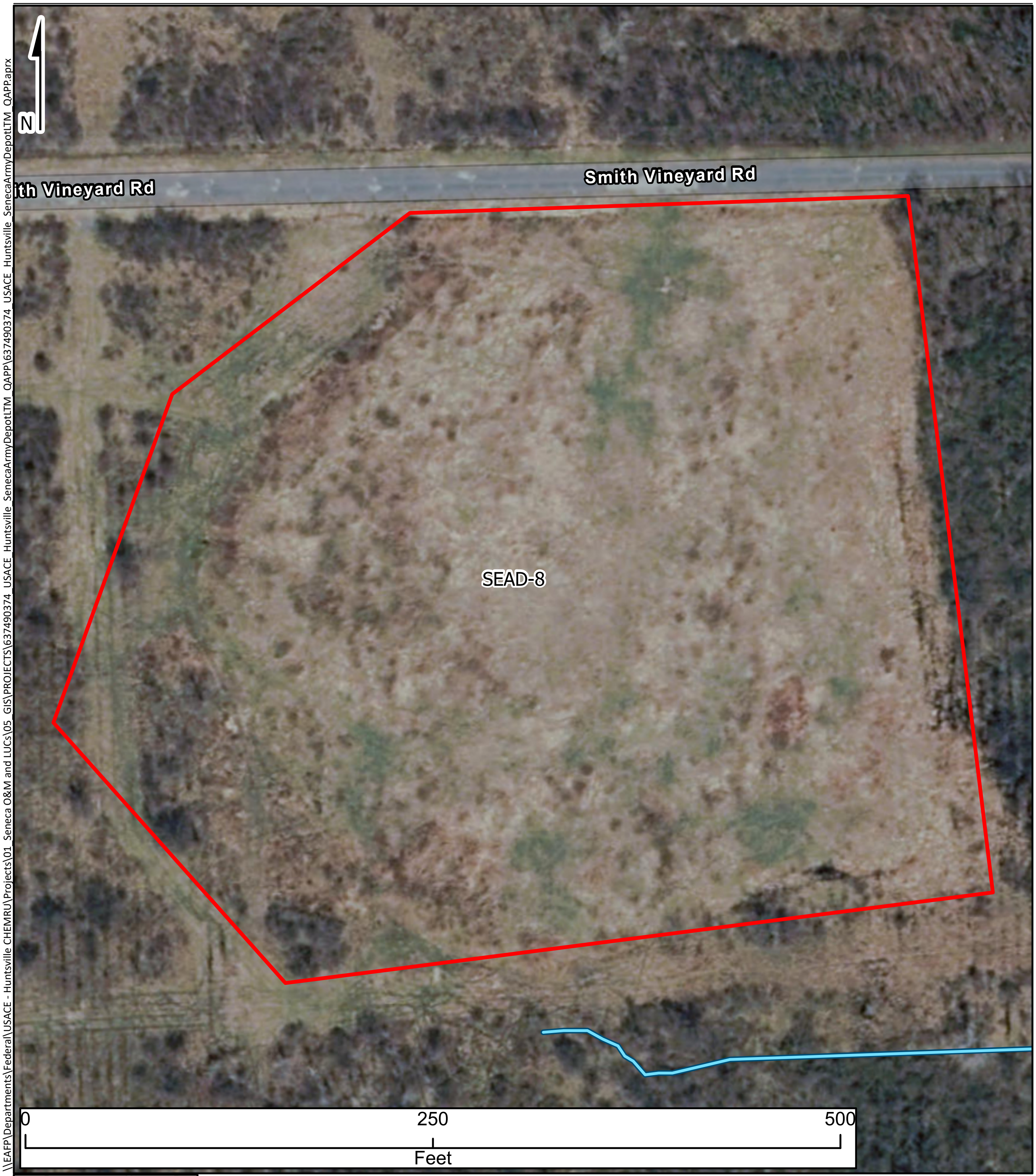
Figure E-37

SEAD-6
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 2:10 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01 Seneca O&M and LUCs\05 GIS\PROJECTS\637490374 USACE Huntsville SenecaArmyDepotLTM QAPP\637490374 USACE Huntsville SenecaArmyDepotLTM QAPP.aprx



Legend

🟩 Former Depot Boundary

🟥 SEAD Site

Drainage

Railways

Fenceline

Figure E-38

SEAD-8
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 2:10 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01_Seneca O&M and LUCs\05_GIS\PROJECTS\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP.aprx

Legend

🟩 Former Depot Boundary

🟥 SEAD Site

~ Drainage

+ Railways

▨ Fenceline

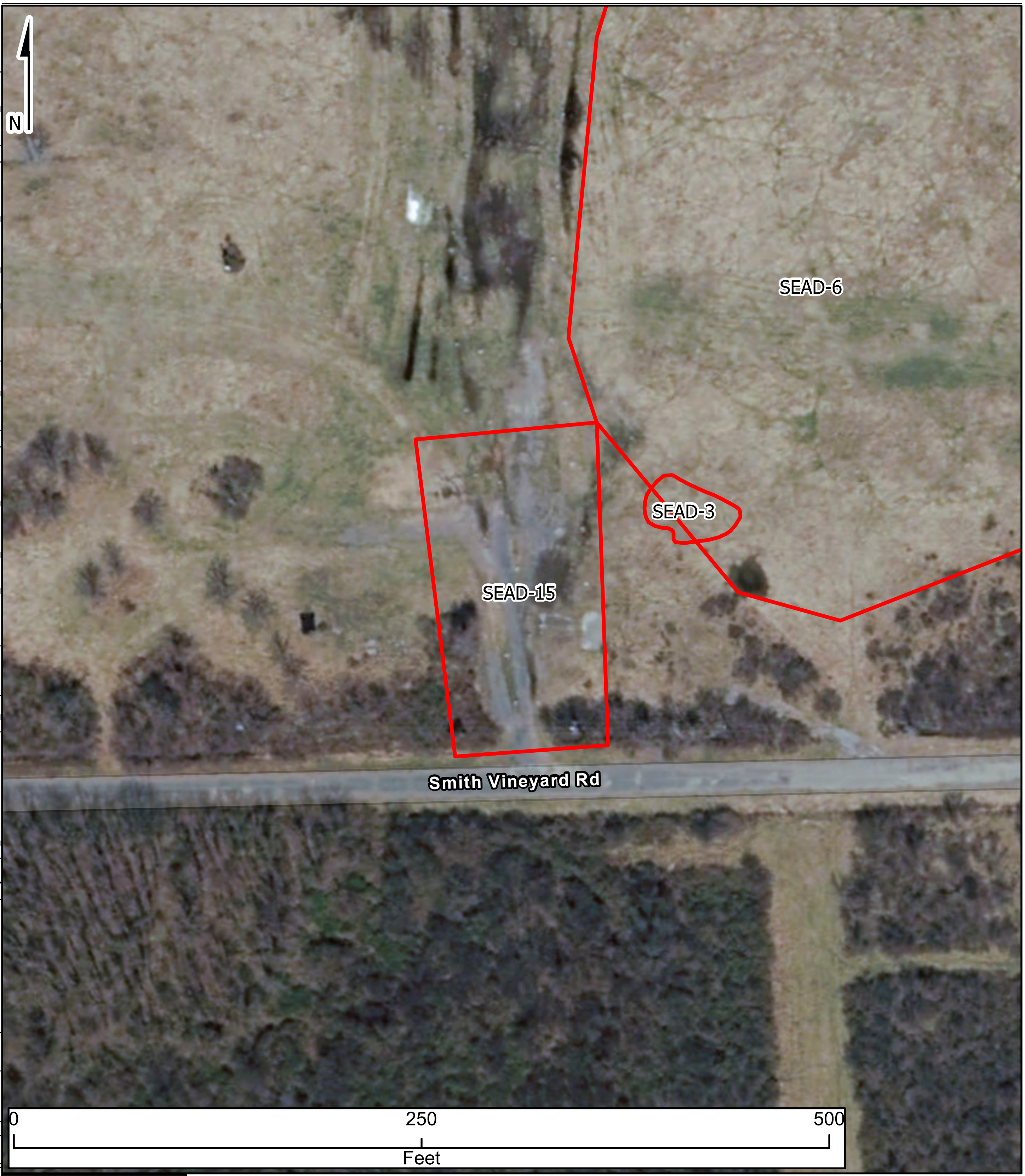
Figure E-39

SEAD-14
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 2:10 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01 Seneca O&M and LUCs\05 GIS\PROJECTS\637490374 USACE Huntsville SenecaArmyDepotLTM QAPP\637490374 USACE Huntsville SenecaArmyDepotLTM QAPP.aprx



\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01 Seneca O&M and LUCs\05 GIS\PROJECTS\637490374 USACE Huntsville SenecaArmyDepotLTM QAPP\637490374 USACE Huntsville SenecaArmyDepotLTM QAPP.aprx

Legend

🟩 Former Depot Boundary

🟥 SEAD Site

∿ Drainage

┼ Railways

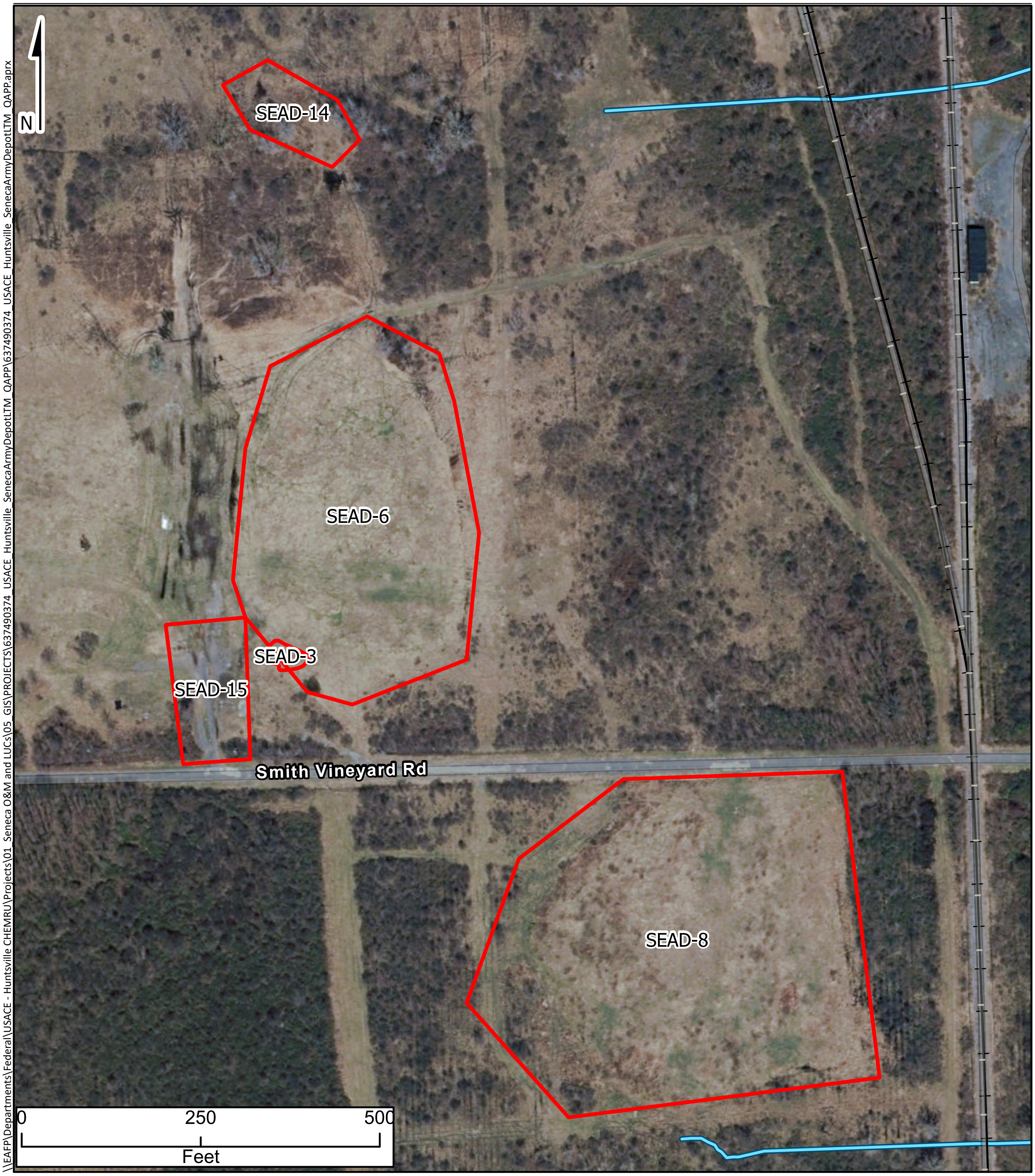
▬ Fenceline

Figure E-40

SEAD-15
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 2:10 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US



Legend

🟩	Former Depot Boundary
〰	Drainage
┼	Railways

Figure E-41
Ash Landfill Area Operable Unit 1 - LUC
SEAD-3, 6, 8, 14, and 15
Former Seneca Army Depot
Romulus, New York

Map Date:1/13/2023 1:15 PM

Projection: NAD 1983 2011 StatePlane
New York Central FIPS 3102 Ft US

\\EAFP\Departments\Federal\USACE - Huntsville CHEMRU\Projects\01_Seneca O&M and LUCs\05_GIS\PROJECTS\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP\637490374_USACE_Huntsville_SenecaArmyDepotLTM_QAPP.aprx

This page intentionally left blank