U.S. ARMY ENGINEER DIVISION
HUNTSVILLE, ALABAMA

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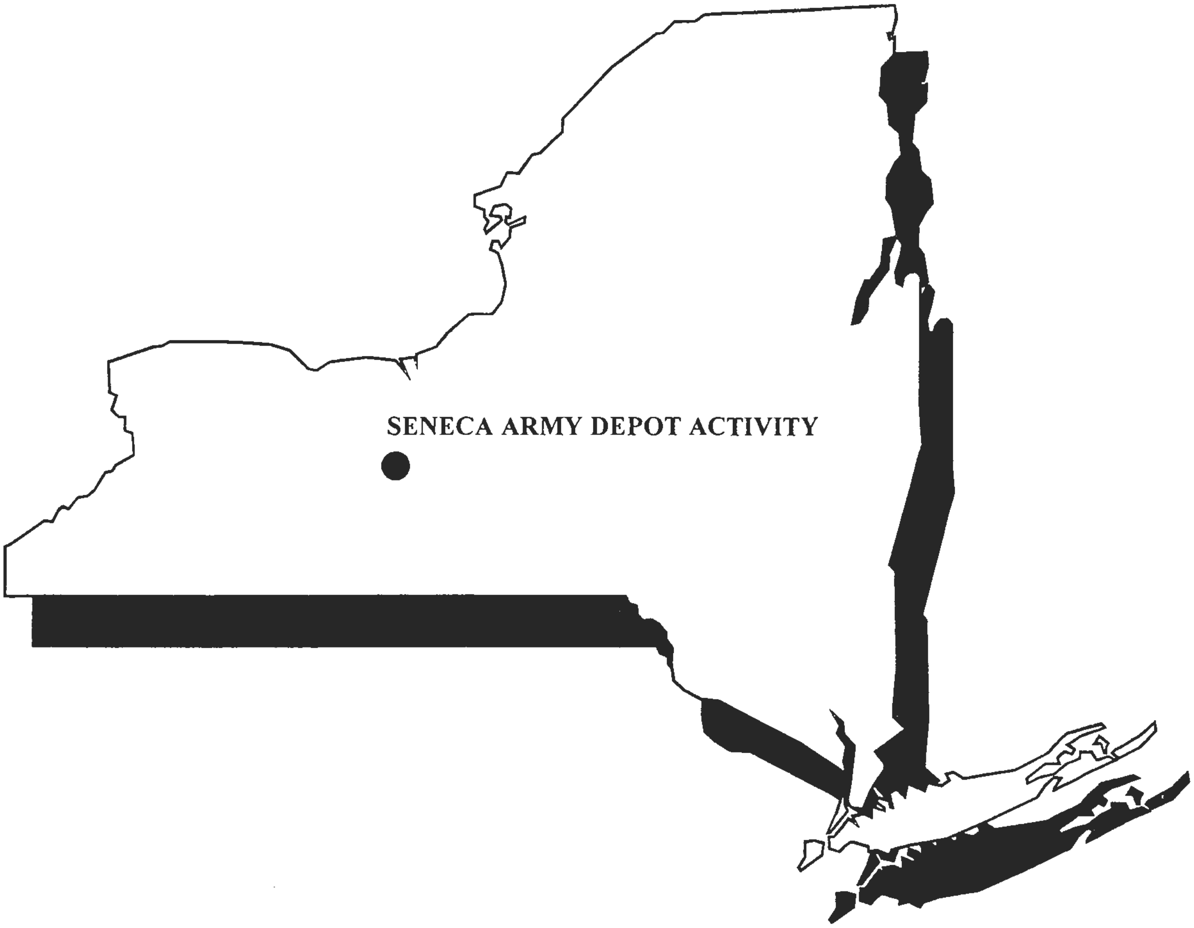

DRAFT

TECHNICAL SPECIFICATIONS FOR REMOVAL ACTIONS AT SWMUs SEAD-24, SEAD-50, SEAD-54, AND SEAD-67
SENECA ARMY DEPOT ACTIVITY

CONTRACT NO. DACA87-95-D-0031
TASK ORDER O OF DELIVERY ORDER 15

MARCH 2001

PARSONS ENGINEERING SCIENCE, INC.

30 Dan Road • Canton, Massachusetts 02021-2809 • (781) 401-3200 • Fax: (781) 401-2575

March 30, 2001

Commander
U.S. Army Corps of Engineers
Engineering and Support Center, Hunstville
Attn: Ms. Allen CEHNC-PM
4820 University Square
Huntsville, AL 35816-1822

SUBJECT: **Seneca Army Depot Activity, Draft Decision Document and Draft Technical Specifications for Removal Actions at SWMUs SEAD-24, SEAD-50, SEAD-54, and SEAD-67**

Dear Major Sheets:

Parsons Engineering Science (Parsons ES) is pleased to submit three copies of the draft Decision Document and three copies of the draft Technical Specifications for Removal Actions at the Areas of Concern (AOC) listed above. These documents were originally submitted to the Army in 1995 and again in 1999. Revisions, including the provision of a health and safety plan, have been made in order to update these documents. This work was performed in accordance with the Scope of Work (SOW) for Delivery Order 15, Annex O to the Parsons ES Contract DACA87-95-0031.

Parsons ES appreciates the opportunity to provide you with these documents. Should you have any questions, please do not hesitate to call me at (781) 401-2492 to discuss them.

Sincerely,

PARSONS ENGINEERING SCIENCE, INC.

Michael Duchesneau, P.E.
Project Manager

cc: S. Absolom, SEDA
R. Battaglia, CENAN
K. Hoddinott, USACHPPM
C. Kim, USAEC
B. Wright, USAIOC

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DRAFT
SECTION C TECHNICAL SPECIFICATIONS FOR REMOVAL ACTIONS AT SWMUs
SEAD-24, SEAD-50 and -54, and SEAD-67
SENECA ARMY DEPOT ACTIVITY

Prepared for:

Seneca Army Depot Activity
Romulus, New York

Prepared by:

Parsons Engineering Science, Inc.
Canton, Massachusetts

Contract No. DACA87-95-D-0031
Task Order O of Delivery Order 15
734530

MARCH 2001

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WORK STATEMENT

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SECTION 1
BACKGROUND

1.1 PROJECT LOCATION

Seneca Army Depot Activity (SEDA) is located in Romulus, New York, in Seneca County. The installation is bounded by State Route 96A (to the west) and State Route 96 (to the east). The cities of Geneva and Rochester are located to the northwest; Syracuse is to the northeast and Ithaca is located to the south. The subject of this source removal action is four Solid Waste Management Units (SWMUs) impacted by semi-volatile organic compounds, metals and/or asbestos in the surface soils and sediments. These are the Abandoned Powder Burning Pit (SEAD-24), the Tank Farm (SEAD-50 and 54) and the Debris Piles East of Sewage Treatment Plant NO. 4 (SEAD-67). SEAD-50 and SEAD-54 are located in the same vicinity and are considered one area (i.e., SEAD 50/54).

1.2 PROJECT DESCRIPTION

Expanded Site Inspections (ESI) performed at SEAD-24 – the Abandoned Powder Burning Pit, at SEAD-50 and SEAD-54 – the Tank Farm, and at SEAD-67 – Debris Piles East of Sewage Treatment Plant No. 4 demonstrate that releases of hazardous constituents to the environment have occurred. This work specification presents details of the Army's proposed plan for conducting a time-critical removal action at each of the identified SEADs to eliminate contaminants that have been identified in the soil and the sediment that represent potential threats to the environment and neighboring populations. These removal actions are considered time-critical because the historic military mission of the depot has been terminated and the depot has officially been closed by the Department of the Defense (DoD) and the US Army. In accordance with provisions of the DoD's Base Realignment and Closure (BRAC) process, the land and the facilities of the former depot have been surveyed and evaluated, and prospective beneficial uses of the facility have been identified. Portions of the depot are now being released to the public and private sectors for reuse under the BRAC process. As portions of the former depot are released for other beneficial uses, increased access is afforded to all portions of the former depot, resulting in an increased potential for exposure of populations to any residual chemicals that are present at former solid waste management units (SWMUs) remaining at the depot pending clean-up. Therefore, the goal of the proposed time-critical removal action at the four identified SWMUs is to eliminate and contain an identified source of residual chemical materials in the soil and sediment to remove or at least lessen the magnitude of the potential threat that it represents to surrounding populations and the environment.

1.2.1 Site Description

1.2.1.1 SEAD-24

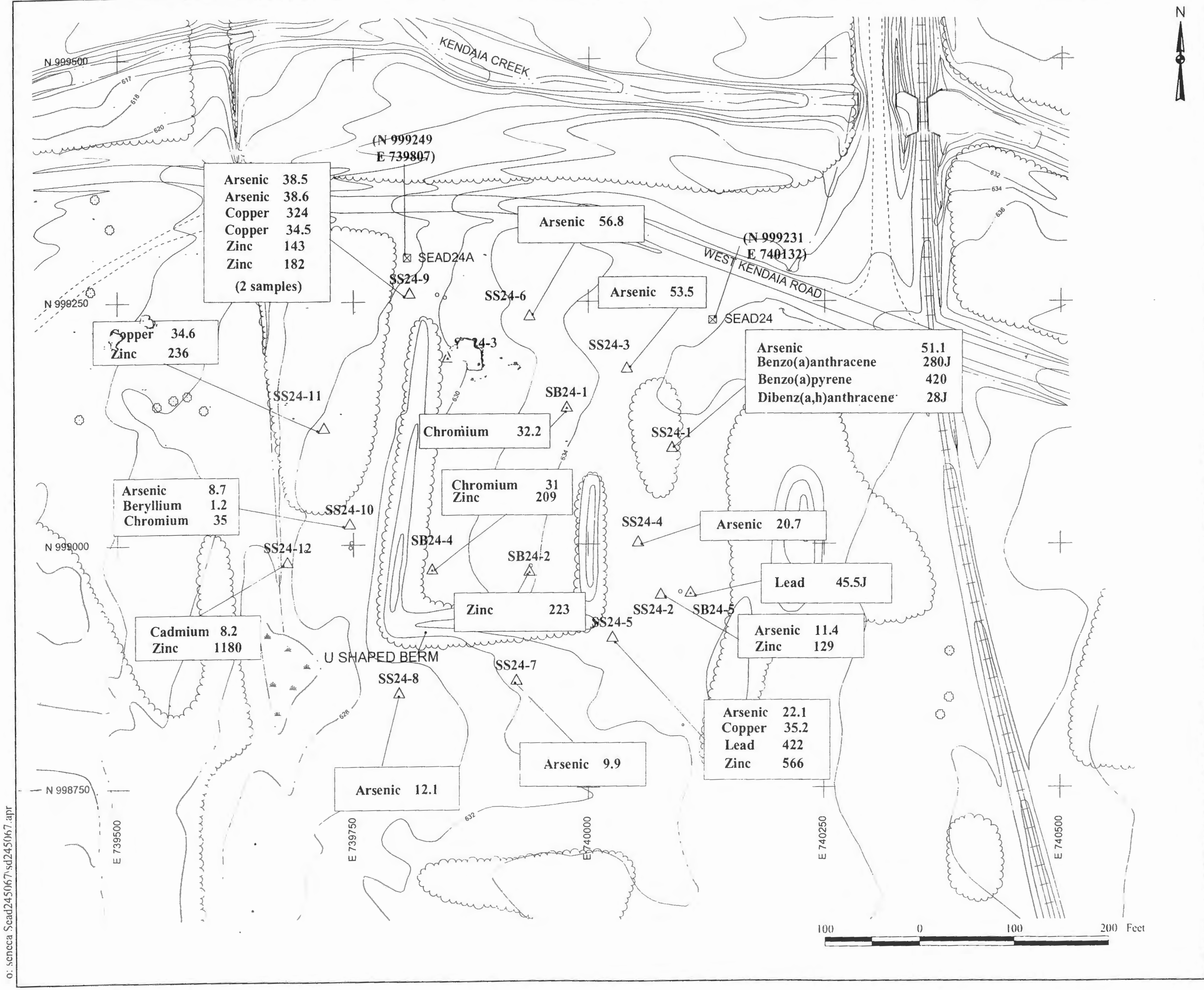
SEAD-24, the Abandoned Powder Burning Pit, is located in the west-central portion of SEDA. The burning pit comprises an area measuring approximately 325 feet by 150 feet that is surrounded on the east, south and west by a U-shaped, vegetated berm that is approximately 4 feet high (see **Figure 1**). The site is bounded by West Kendaia Road to the north and by areas of open grassland and low brush to the east, south and west. SEDA railroad tracks are located approximately 400 feet east of the U-shaped berm. Kendaia Creek is located approximately 150 feet north of West Kendaia Road. The local topography slopes gently to the west; north of West Kendaia Road the land slopes more steeply to the north-northwest towards the creek. The site can be accessed via West Kendaia Road. Within SEDA, vehicular and pedestrian access to the site is restricted, since it is located within the ammunition area.

The Abandoned Powder Burning Pit was active during the 1940s and 1950s. Although operating practices at this site are undocumented, it is presumed that black powder, M10 and M16 solid propellants, and explosive trash were disposed here by burning. It is further presumed thatpetroleum hydrocarbon fuel was used to initiate the burn. There is a shale-covered area adjacent to the bermed area; however, the use of this area is not known.

1.2.1.2 SEAD-50 and 54

SEADs 50/54 is located at the depot's historic tank farm that was located in the southeastern portion of SEDA. The tank farm was sited in a triangular-shaped tract of land immediately west of East Patrol Road between Building 350 and Buildings 356 and 357 (see **Figure 2**). Four tanks remain at the tank farm site, three of which are currently empty. The three empty tanks comprise SEAD-50; two of these tanks were previously used for the storage of antimony ore. The remaining empty tank was used to store rutile (i.e., titanium dioxide) ore. SEAD-54 encompasses the remaining tank, Tank #88, which currently contains asbestos material. SEAD-54 was listed as a separate SWMU because it contained asbestos material and will require special handling.

The topography of the area is relatively flat, with a total relief of 2 to 3 feet. There is an east-west running access road that bisects the site and connects Avenue H with East Patrol Road. The asbestos storage tank is located immediately north of the access road on the east side of SEAD-50. North of the access road, SEAD-50 is generally overgrown with vegetation, exclusive



LEGEND

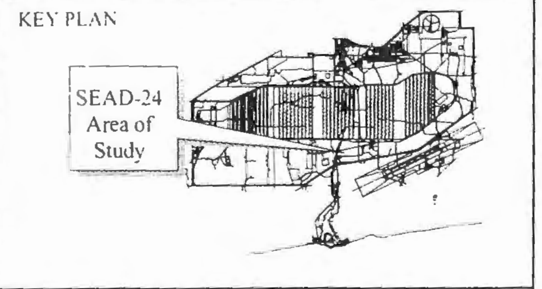
- PAVED ROAD
- GROUND CONTOUR AND ELEVATION (680)
- WETLAND
- BRUSH
- CHAIN LINK FENCE
- UTILITY POLE
- APPROXIMATE LOCATION OF FIRE HYDRANT
- RAILROAD

- △ Surface Soil Samples
- △ Berm Soil Samples
- ⊕ GroundWater Samples
- ☒ Survey Monument

TAGM LEVELS

Arsenic	8.2	mg/kg
Beryllium	1.1	mg/kg
Cadmium	8.2	mg/kg
Chromium	29.6	mg/kg
Copper	33	mg/kg
Lead	400	mg/kg
Zinc	114	mg/kg

KEY PLAN



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SENECA ARMY DEPOT ACTIVITY
ABANDONED POWDER BURNING PIT
SEAD-24

FIGURE 1

ANALYTES EXCEEDING THEIR
RESPECTIVE CRITERIA
LEVELS IN SURFACE SOILS

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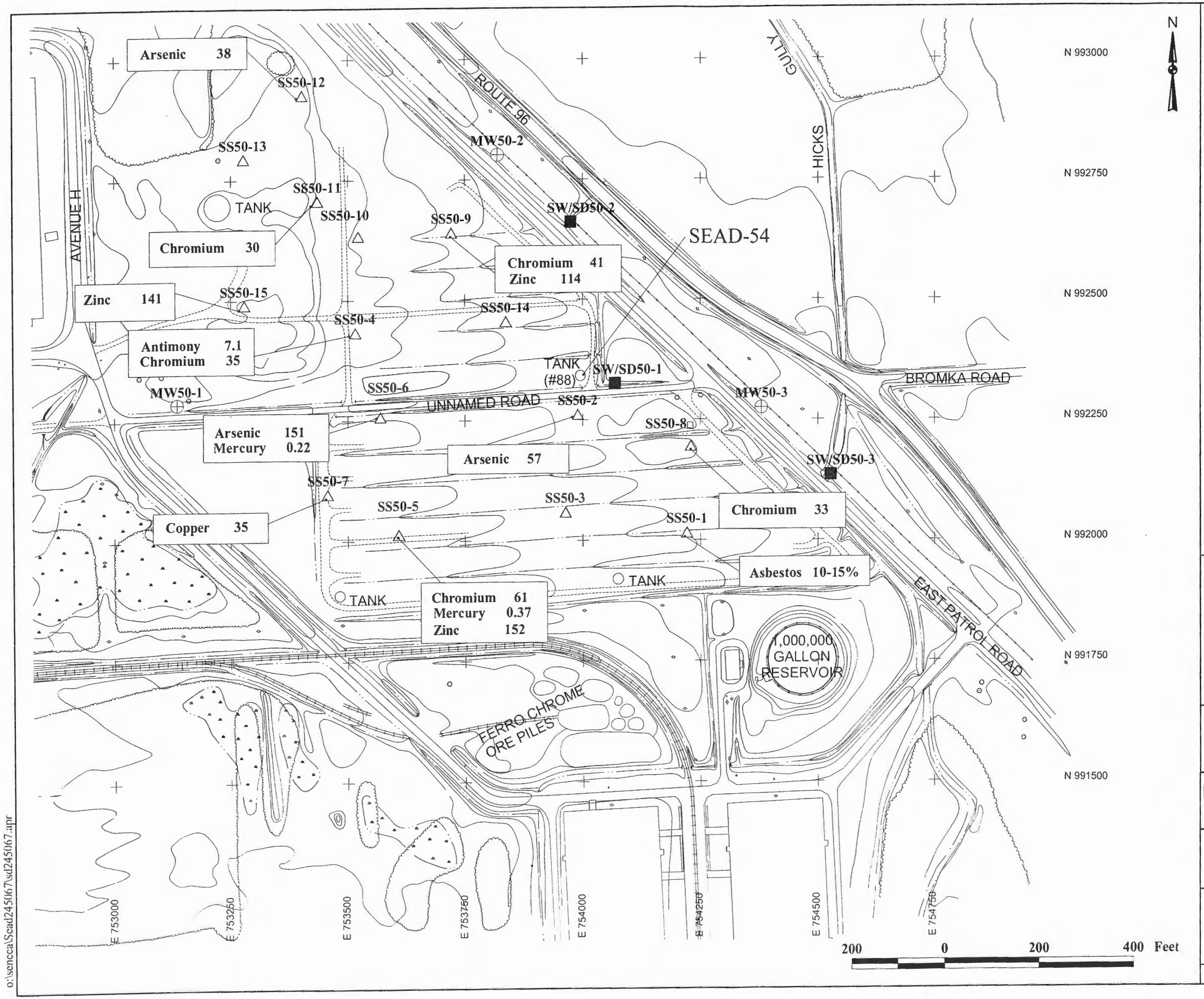


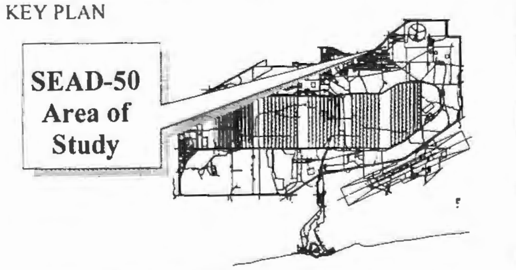
LEGEND

- PAVED ROAD
- 680 GROUND CONTOUR AND ELEVATION
- WETLAND
- BRUSH
- CHAIN LINK FENCE
- UTILITY POLE
- APPROXIMATE LOCATION OF FIRE HYDRANT
- RAILROAD
- △ Surface Soil Samples
- ■ Surface Water/Sediment Samples
- ⊕ Monitoring Well
- ☒ Survey Monument

TAGM LEVELS

Antimony	5.9	mg/kg
Arsenic	8.2	mg/kg
Chromium	29.6	mg/kg
Copper	33	mg/kg
Mercury	0.1	mg/kg
Zinc	110	mg/kg

KEY PLAN



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SENECA ARMY DEPOT ACTIVITY
TANK FARM
SEAD-50 AND SEAD-54

FIGURE 2

METALS EXCEEDING THEIR
RESPECTIVE CRITERIA
LEVELS IN SURFACE SOILS

JOB NUMBER 734530-01001

DATE MARCH 2001

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of the spots where historic tanks were located. The circular footprints of the former tanks are generally clear of vegetation and covered with gravel. The area south of the access road is flat and grassy. A ferro-chromate ore pile is located in the southern area of the historic tank farm at the border of the grassy area. There are no mapped wetlands in the area.

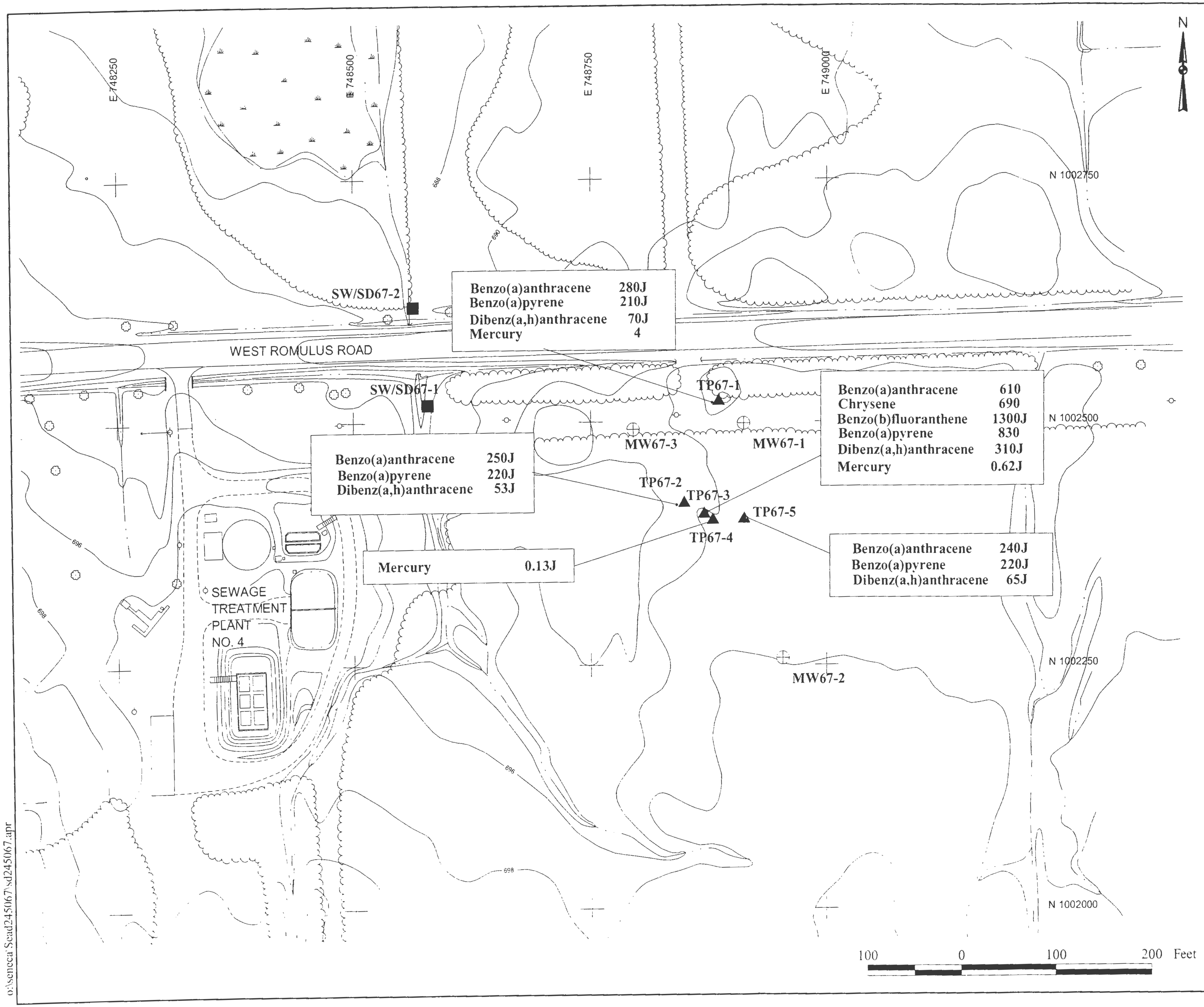
SEAD-50 is the tank farm located in the southeastern portion of SEDA in a triangular shaped area immediately west of East Patrol Road between Building 350 and Buildings 356 and 357 (**Figure 2**). There are four tanks remaining on the site, three of which are empty. The two tanks used for the storage of antimony ore and one for the storage of rutile ore are empty. SEAD-54 is Tank #88 which currently contains asbestos (**Figure 2**).

The history of the tank farm area is not well documented. At one time, there were approximately 160 aboveground storage tanks in this area. According to interviews with SEDA personnel, the tanks were always used to store dry materials such as ores and minerals, including asbestos. Through the years, all but the remaining four tanks were removed.

1.2.1.3 SEAD-67

SEAD-67 is comprised of five waste piles and two berm structures that are located east of sewage treatment plant No. 4 and south of West Romulus Road in the east-central portion of SEDA (see **Figure 3**). The site is entirely undeveloped and is heavily vegetated with low brush and deciduous trees. One, 10-foot diameter waste pile and a second, 5-foot diameter waste pile are located approximately 50 feet and 70 feet, respectively, south of West Romulus Road. Both of these piles are grass covered. A brush-covered berm, measuring approximately 60 feet long and 10 to 15 feet in width, and a second, 10-foot diameter waste pile are located approximately 175 feet south of the West Romulus Road. Continuing further south, a second, larger and irregularly-shaped berm is found. The second berm structure is located approximately 50 feet south of the first, smaller berm structure. The second berm measures approximately 110 feet in length, and is shaped roughly like a "y" that is lying on its side. The waste pile and berm locations are shown as dotted lines in **Figure 3**. All of the piles and berms are approximately 3 to 4 feet high, with the exception of the 10-foot diameter pile that is approximately 5 feet high.

The topography in SEAD-67 slopes gently to the west towards a small stream. The stream flows north where it passes beneath West Romulus Road and passes into a large wetland area that is located to the north of SEAD-67. This wetland provides tertiary treatment for wastewater discharges from the treatment plant.



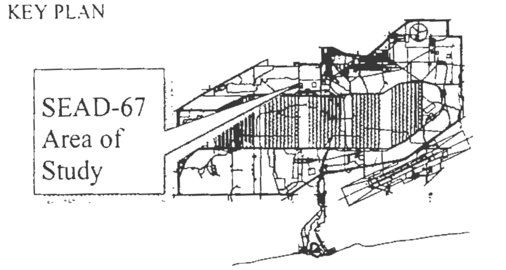
LEGEND

PAVED ROAD
GROUND CONTOUR AND ELEVATION
WETLAND
BRUSH
CHAIN LINK FENCE
UTILITY POLE
APPROXIMATE LOCATION OF FIRE HYDRANT
RAILROAD
▲ Test Pit Samples
■ Surface Water Sediment Samples
⊕ Monitoring Well
⊠ Survey Monument

TAGM LEVELS

Benzo(a)anthracene	220	ug/Kg
Benzo(b)fluoranthene	1100	ug/Kg
Benzo(a)pyrene	61	ug/Kg
Chyrsene	400	ug/Kg
Dibenz(a.h)anthracene	14	ug/Kg
Mercury	0.1	mg/Kg

KEY PLAN



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SENECA ARMY DEPOT ACTIVITY

DEBRIS PILES EAST OF SEWAGE TREATMENT PLANT NO. 4
SEAD-67

FIGURE 3

ANALYTES EXCEEDING THEIR
RESPECTIVE CRITERIA LEVELS
IN SOIL SAMPLES

JOB NUMBER 734530-01001 | DATE MARCH 2001

Little is known about the history of SEAD-67 or the origin of the bermed structures and the waste piles. The contents of the piles and the berms are unknown, as are the dates when they were first placed in this area. As the site is overgrown with thick vegetation, it is suspected that this site appeared many years ago and has been inactive since that time.

1.2.2 Previous Investigations

These removal actions are being conducted by the Army under the requirements of the Comprehensive Environmental Responsibility, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendment and Reauthorization Act (SARA). Each of the mentioned sites was the subject of one or more prior investigations. The findings and results of the previous investigations are presented and discussed below.

1.2.2.1 SEAD-24

In 1993 and 1994, an Expanded Site Inspection (ESI) was performed to determine whether a release of hazardous constituents had occurred in the Abandoned Powder Burning Pit. The ESI combined geophysical surveys and intrusive operations to characterize the nature and extent of possible contaminants that may have been present in the area.

A seismic refraction survey was performed and the results were used to define the depth of the till and weathered shale horizon and to determine the direction of the local groundwater flow. An electromagnetic EM-31 survey and a ground penetrating radar (GPR) survey were also performed and the results of these surveys were used to locate potential burial pits and buried ordnance that may have been present. The results of these surveys were also used to determine the extent of previously disturbed soil at SEAD-24.

After the geophysical surveys were completed, five borings were advanced at SEAD-24. Four of the borings were located within the bermed area of the former pit, while the fifth boring was located outside and east of the pit. The fifth boring was used to characterize the background soil quality. Three soil samples were submitted for chemical analysis from each of the five borings (i.e., 15 samples total). Another twelve surface soil samples (i.e., 0-2 inches below grade surface) were also collected at locations surrounding the pit and each of these additional samples was also submitted for chemical analysis. All of the soil sampling locations are shown on **Figure 1**.

Three monitoring wells were installed in the till/weathered shale aquifer at SEAD-24. One of these monitoring wells was installed upgradient of SEAD-24 to obtain background water quality data. The two remaining wells were installed adjacent to and downgradient of the burning pit to evaluate whether hazardous constituents have migrated from SEAD-24. One sample from each well (a total of three samples) was collected and submitted for chemical analysis. Each of the groundwater sampling location is shown on **Figure 1**.

All samples were analyzed for the following constituents: the Target Compound List (TCL), including volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs) and pesticides/ polychlorinated biphenyls (PCBs). The Target Analyte List (TAL) including metals and cyanide. Each analysis was performed in accordance with the New York State Department of Environmental Conservation (NYSDEC) Analytical Services Program (ASP) Statement of Work (SOW). Explosive compounds were analyzed by the Environmental Protection Agency (EPA) SW-846 Method 8330; herbicides were analyzed by EPA SW-846 Method 8150, nitrates were analyzed by EPA Method 352.2, and total recoverable petroleum hydrocarbons (TRPH) were analyzed by EPA Method 418.1.

The results of the soil sampling program are presented in **Table 1**. Fifty-seven different TCL/TAL analytes, including 36 organic compounds and 21 metals, plus total petroleum hydrocarbons were detected in soil samples collected from SEAD-24. Of this total, only three SVOCs and 14 metals were present at concentrations that exceeded criteria values defined in NYSDEC's Technical and Administrative Guidance Memorandum (TAGM) #4046 or by the US EPA.

Each of the SVOCs that exceeded its criteria level was a PAH (i.e., benzo(a)anthracene, benzo(a)pyrene, and dibenz(a,h)anthracene) and were found collocated in one surface soil sample location, SS24-1, which is located outside and to the east of the bermed pit. Of further note is the finding that a majority of all observed SVOCs occurred in the shallow soil samples that are located to the north and due east of the open end of the bermed pit. The compound, 2,4-dinitrotoluene, a component of explosive materials was also detected in all of the surface soil samples where the other SVOCs were found. However, this compound was also found in three surface soil samples that were collected east and southeast of the shorter eastern berm wall. These three samples are all very close to sample location SB24-2, which is the only location within the bermed area where 2,4-dinitrotoluene was found. No criteria value currently exists for 2,4-dinitrotoluene.

TABLE 1
SEAD-24 SOIL ANALYSIS RESULTS

SENECA ARMY DEPOT ACTIVITY
REMOVAL ACTION

	MATRIX							SOIL	SOIL	SOIL	SOIL	SOIL
	LOCATION							SEAD-24	SEAD-24	SEAD-24	SEAD-24	SEAD-24
	DEPTH (FEET)							0-0.2	0-0.2	0-0.2	0-0.2	0-0.2
	SAMPLE DATE							10/22/93	10/22/93	10/22/93	10/22/93	10/22/93
	ES ID		FREQUENCY		NUMBER	NUMBER	NUMBER	SS24-1	SS24-2	SS24-3	SS24-4	SS24-5
	LAB ID	MAXIMUM	OF	CRITERIA	ABOVE	OF	OF	202078	202079	202080	202081	202082
PARAMETER	**UNITS**	**DETECT**	**DETECTION**	**VALUE (a)**	**CRITERIA**	**DETECTS**	**SAMPLES**	Value (Q)	Value (Q)	Value (Q)	Value (Q)	Value (Q)
Volatile Organics												
Acetone	ug/kg	27	10.3%	200	0	3	29	14 UJ	13 U	11 U	12 U	12 U
Benzene	ug/kg	1	3.4%	60	0	1	29	14 UJ	13 U	11 U	12 U	12 U
Chlorobenzene	ug/kg	7	6 9%	1700	0	2	29	14 UJ	13 U	11 U	12 U	12 U
Chloroform	ug/kg	13	37.9%	300	0	11	29	5 J	13 U	11 U	12 U	13
Methylene Chloride	ug/kg	12	10.3%	100	0	3	29	14 UJ	13 U	11 U	12 U	12 U
Toluene	ug/kg	2	3.4%	1500	0	1	29	14 UJ	13 U	11 U	12 U	12 U
Trichloroethene	ug/kg	1	3.4%	700	0	1	29	14 UJ	13 U	11 U	12 U	12 U
Herbicides												
2,4,5-T	ug/kg	8	3.4%	1900	0	1	29	6.1 U	6.7 U	5.5 U	6 2 U	6.1 U
Dicamba	ug/kg	9.7	3.4%		0	1	29	6.1 U	6.7 U	5.5 U	6.2 U	6.1 U
MCPP	ug/kg	6600	3.4%		0	1	29	6600	6700 U	5500 U	6200 U	6100 U
Nitroaromatics												
1,3-Dinitrobenzene	ug/kg	76	3.4%		0	1	29	130 U	130 U	130 U	130 U	130 U
2,4-Dinitrotoluene	ug/kg	4400	20.7%		0	6	29	130 U	310	640	130 U	4400
Tetryl	ug/kg	120	6.9%		0	2	29	130 U	130 U	130 U	130 U	130 U
Semivolatile Organics												
2,4-Dinitrotoluene	ug/kg	12000	27.6%		0	8	29	74 J	440 U	250 J	420	12000
Acenaphthylene	ug/kg	54	3.4%	41000	0	1	29	54 J	440 U	360 U	400 U	1600 U
Anthracene	ug/kg	19	3.4%	50000*	0	1	29	19 J	440 U	360 U	400 U	1600 U
Benzo(a)anthracene	ug/kg	280	13.8%	220	1	4	29	**280** J	440 U	360 U	400 U	1600 U
Benzo(a)pyrene	ug/kg	420	13.8%	61	1	4	29	**420**	440 U	360 U	400 U	1600 U
Benzo(b)fluoranthene	ug/kg	350	17.2%	1100	0	5	29	350 J	440 U	360 U	400 U	1600 U
Benzo(g,h,i)perylene	ug/kg	170	6.9%	50000*	0	2	29	170 J	440 U	360 U	400 U	1600 U
Benzo(k)fluoranthene	ug/kg	340	17.2%	1100	0	5	29	340 J	440 U	360 U	400 U	1600 U
bis(2-Ethylhexyl)phthalate	ug/kg	1300	51.7%	50000*	0	15	29	400 U	440 U	360 U	400 U	1600 U
Chrysene	ug/kg	320	24 1%	400	0	7	29	320 J	440 U	18 J	400 U	1600 U
Dibenz(a,h)anthracene	ug/kg	28	3.4%	14	1	1	29	**28** J	440 U	360 U	400 U	1600 U
Di-n-butylphthalate	ug/kg	1100	24.1%	8100	0	7	29	400 U	440 U	31 J	400 U	370 J
Fluoranthene	ug/kg	210	24.1%	50000*	0	7	29	210 J	440 U	20 J	400 U	1600 U
Indeno(1,2,3-cd)pyrene	ug/kg	220	6.9%	3200	0	2	29	220 J	440 U	360 U	400 U	1600 U
N-Nitrosodiphenylamine	ug/kg	810	24.1%	50000*	0	7	29	30 J	440 U	74 J	70 J	650 J
Phenanthrene	ug/kg	44	13.8%	50000*	0	4	29	37 J	440 U	360 U	400 U	1600 U
Pyrene	ug/kg	260	24.1%	50000*	0	7	29	260 J	440 U	18 J	400 U	1600 U
Pesticides/PCB												
4,4'-DDE	ug/kg	12	17 2%	2100	0	5	29	4 U	4.4 U	3.6 U	4.1 U	3.6 J
4,4'-DDT	ug/kg	35	6.9%	2100	0	2	29	4 U	4.4 U	3.6 U	4.1 U	4 UJ
alpha-Chlordane	ug/kg	4.7	3.4%	540	0	1	29	2 U	2.3 U	1.9 U	2.1 U	2 UJ
Endosulfan I	ug/kg	2.3	10.3%	900	0	3	29	2 U	2.3 U	1.9 U	2.1 U	2 UJ
Endrin aldehyde	ug/kg	4.2	3.4%		0	1	29	4 U	4.4 U	3.6 U	4.1 U	4 UJ
gamma-Chlordane	ug/kg	6	3.4%	540	0	1	29	2 U	2.3 U	1.9 U	2.1 U	2 UJ
Metals												
Aluminum	mg/kg	25500	100.0%	19300	3	29	29	9540	16800	12000	18900	13200
Arsenic	mg/kg	56.8	100.0%	8.2	11	29	29	**51.1**	**11.4**	**53.5**	**20.7**	**22.1**
Barium	mg/kg	149	100.0%	300	0	29	29	71.6	149	57.8	105	121
Beryllium	mg/kg	1.2	100.0%	1.1	1	29	29	0.43 J	0.89 J	0.51 J	0.91 J	0.59 J
Cadmium	mg/kg	8.2	6.9%	2.3	1	2	29	0.64 U	0.72 U	0.71 U	0.69 U	0.75 U
Calcium	mg/kg	106000	100.0%	121000	0	29	29	79300	3290	23600	2140	23000
Chromium	mg/kg	35.1	100.0%	29.6	3	29	29	12.2	24.5	22.2	23.9	21.9
Cobalt	mg/kg	20 5	100.0%	30	0	29	29	4.7 J	13.9	10.9	11.5	10.4 J
Copper	mg/kg	324	100 0%	33	4	29	29	13.5 J	20 J	28.2 J	26.1 J	**35.2** J
Iron	mg/kg	37700	100.0%	36500	2	29	29	14000	30900	25500	29200	25000

TABLE 1
SEAD-24 SOIL ANALYSIS RESULTS

SENECA ARMY DEPOT ACTIVITY
REMOVAL ACTION

	MATRIX							SOIL	SOIL	SOIL	SOIL	SOIL
	LOCATION							SEAD-24	SEAD-24	SEAD-24	SEAD-24	SEAD-24
	DEPTH (FEET)							0-0.2	0-0.2	0-0.2	0-0.2	0-0.2
	SAMPLE DATE							10/22/93	10/22/93	10/22/93	10/22/93	10/22/93
	ES ID		**FREQUENCY**		**NUMBER**	**NUMBER**	**NUMBER**	SS24-1	SS24-2	SS24-3	SS24-4	SS24-5
	LAB ID	**MAXIMUM**	**OF**	**CRITERIA**	**ABOVE**	**OF**	**OF**	202078	202079	202080	202081	202082
PARAMETER	**UNITS**	**DETECT**	**DETECTION**	**VALUE (a)**	**CRITERIA**	**DETECTS**	**SAMPLES**	Value (Q)	Value (Q)	Value (Q)	Value (Q)	Value (Q)
Lead	mg/kg	422	100.0%	400 (2)	1	29	29	15.1	46.6	59.4	51.3	**422**
Magnesium	mg/kg	43700	100.0%	21500	2	29	29	**43700**	4320	5960	4600	5470
Manganese	mg/kg	1770	100.0%	1060	2	29	29	393	**1770**	353	244	550
Mercury	mg/kg	0.15	51.7%	0.1	1	15	29	0.04 J	0.05 J	0.04 J	**0.15**	0.04 U
Nickel	mg/kg	535	100.0%	49	2	29	29	13.8	30	39.5	26.4	31.6
Potassium	mg/kg	2510	100.0%	2380	1	29	29	1140	1340	1190	1710	1560
Selenium	mg/kg	0.3	10.3%	2	0	3	29	0.2 UJ	0.23 UJ	0.2 UJ	0.26 UJ	0.23 UJ
Sodium	mg/kg	161	100.0%	172	0	29	29	146 J	51.9 J	95.5 J	56 J	88.4 J
Thallium	mg/kg	0.14	3.4%	0.7	0	1	29	2.2 U	0.25 U	0.22 U	0.29 U	0.25 U
Vanadium	mg/kg	39.3	100.0%	150	0	29	29	17.7	30.1	17.1	32.8	22.3
Zinc	mg/kg	1180	100.0%	110	10	29	29	58.7	**129**	100	85.1	**566**
Other Analyses												
Nitrate/Nitrite-Nitrogen	mg/kg	2.1	100.0%		0	29	29	2.1	0.56	0.22	0.18	0.6
Total Solids	%W/W	93.2	100.0%		0	29	29	81.6	75.4	91.4	80.7	81.9
Total Petroleum Hydrocarbons	mg/kg	158	100.0%		0	29	29	99	81	73	72	78

Notes.
1) NYSDEC Technical and Administrative Guidance Memorandum #4046, except as noted.
2) US EPA, OSWER Directive # 9200.4-27 Soil Lead Guidance, August 1998
* = As per proposed TAGM, total VOCs < 10ppm; total Semi-VOCs <500ppm; individual semi-VOCs < 50 ppm.
NA = Not Available
U = Compound was not detected.
J = the reported value is an estimated concentration.
R = the data was rejected in the data validating process.
UJ = the compound was not detected; the associated reporting limit is approximate.

TABLE 1
SEAD-24 SOIL ANALYSIS RESULTS

SENECA ARMY DEPOT ACTIVITY
REMOVAL ACTION

	MATRIX							SOIL	SOIL	SOIL	SOIL	SOIL
	LOCATION							SEAD-24	SEAD-24	SEAD-24	SEAD-24	SEAD-24
	DEPTH (FEET)							0-0.2	0-0.2	0-0.2	0-0.2	0-0.2
	SAMPLE DATE							10/22/93	10/22/93	10/22/93	10/22/93	10/22/93
	ES ID		FREQUENCY		NUMBER	NUMBER	NUMBER	SS24-6	SS24-7	SS24-8	SS24-9	SS24-13
	LAB ID	MAXIMUM	OF	CRITERIA	ABOVE	OF	OF	202083	202084	202085	202086	202092
PARAMETER	UNITS	DETECT	DETECTION	VALUE (a)	CRITERIA	DETECTS	SAMPLES	Value (Q)	Value (Q)	Value (Q)	Value (Q)	Value (Q)
Volatile Organics												
Acetone	ug/kg	27	10.3%	200	0	3	29	27	7 J	14 U	13 U	13 UJ
Benzene	ug/kg	1	3.4%	60	0	1	29	13 U	12 U	14 U	13 U	13 UJ
Chlorobenzene	ug/kg	7	6.9%	1700	0	2	29	13 U	12 U	14 U	13 U	13 UJ
Chloroform	ug/kg	13	37.9%	300	0	11	29	5 J	1 J	3 J	13 U	4 J
Methylene Chloride	ug/kg	12	10.3%	100	0	3	29	13 U	12 U	14 U	13 U	13 UJ
Toluene	ug/kg	2	3.4%	1500	0	1	29	13 U	12 U	14 U	13 U	13 UJ
Trichloroethene	ug/kg	1	3.4%	700	0	1	29	13 U	12 U	14 U	13 U	13 UJ
Herbicides												
2,4,5-T	ug/kg	8	3.4%	1900	0	1	29	6.4 U	6.1 U	6.9 U	8	6.1 U
Dicamba	ug/kg	9.7	3.4%		0	1	29	6.4 U	6.1 U	6.9 U	6.1 U	9.7
MCPP	ug/kg	6600	3.4%		0	1	29	6400 U	6100 U	6900 U	6100 U	6100 U
Nitroaromatics												
1,3-Dinitrobenzene	ug/kg	76	3.4%		0	1	29	130 U	130 U	130 U	130 U	130 U
2,4-Dinitrotoluene	ug/kg	4400	20.7%		0	6	29	240	130 U	130 U	900	560
Tetryl	ug/kg	120	6.9%		0	2	29	130 U	130 U	120 J	130 U	130 U
Semivolatile Organics												
2,4-Dinitrotoluene	ug/kg	12000	27.6%		0	8	29	93 J	400 U	450 U	5100	7600
Acenaphthylene	ug/kg	54	3.4%	41000	0	1	29	420 U	400 U	450 U	800 U	1600 U
Anthracene	ug/kg	19	3.4%	50000*	0	1	29	420 U	400 U	450 U	800 U	1600 U
Benzo(a)anthracene	ug/kg	280	13.8%	220	1	4	29	38 J	400 U	450 U	41 J	78 J
Benzo(a)pyrene	ug/kg	420	13.8%	61	1	4	29	34 J	400 U	450 U	45 J	1600 U
Benzo(b)fluoranthene	ug/kg	350	17.2%	1100	0	5	29	42 J	400 U	450 U	52 J	83 J
Benzo(g,h,i)perylene	ug/kg	170	6.9%	50000*	0	2	29	24 J	400 U	450 U	800 U	1600 U
Benzo(k)fluoranthene	ug/kg	340	17.2%	1100	0	5	29	40 J	400 U	450 U	44 J	74 J
bis(2-Ethylhexyl)phthalate	ug/kg	1300	51.7%	50000*	0	15	29	420 U	400 U	450 U	520	620
Chrysene	ug/kg	320	24.1%	400	0	7	29	51 J	400 U	450 U	59 J	100 J
Dibenz(a,h)anthracene	ug/kg	28	3.4%	14	1	1	29	420 U	400 U	450 U	800 U	1600 U
Di-n-butylphthalate	ug/kg	1100	24.1%	8100	0	7	29	25 J	400 U	450 U	110 J	1100 J
Fluoranthene	ug/kg	210	24.1%	50000*	0	7	29	82 J	400 U	450 U	95 J	160 J
Indeno(1,2,3-cd)pyrene	ug/kg	220	6.9%	3200	0	2	29	22 J	400 U	450 U	800 U	1600 U
N-Nitrosodiphenylamine	ug/kg	810	24.1%	50000*	0	7	29	420 U	400 U	450 U	440 J	810 J
Phenanthrene	ug/kg	44	13.8%	50000*	0	4	29	37 J	400 U	450 U	44 J	1600 U
Pyrene	ug/kg	260	24.1%	50000*	0	7	29	72 J	400 U	450 U	99 J	150 J
Pesticides/PCB												
4,4'-DDE	ug/kg	12	17.2%	2100	0	5	29	2 J	12	4.5 U	11 J	8.6 J
4,4'-DDT	ug/kg	35	6.9%	2100	0	2	29	4.1 U	35	4.5 U	4 UJ	2.7 J
alpha-Chlordane	ug/kg	4.7	3.4%	540	0	1	29	2.1 U	4.7 J	2.3 U	2 UJ	2.1 UJ
Endosulfan I	ug/kg	2.3	10.3%	900	0	3	29	1.1 J	2.1 U	2.3 U	1.9 J	2.3 J
Endrin aldehyde	ug/kg	4.2	3.4%		0	1	29	4.2 J	4 U	4.5 U	4 UJ	4 UJ
gamma-Chlordane	ug/kg	6	3.4%	540	0	1	29	2.1 U	6	2.3 U	2 UJ	2.1 UJ
Metals												
Aluminum	mg/kg	25500	100.0%	19300	3	29	29	13600	18700	14700	11500	14300
Arsenic	mg/kg	56.8	100.0%	8.2	11	29	29	**56.8**	**9.9**	**12.1**	**38.5**	**38.6**
Barium	mg/kg	149	100.0%	300	0	29	29	81.9	118	105	68.8	96.6
Beryllium	mg/kg	1.2	100.0%	1.1	1	29	29	0.66 J	0.86	0.81 J	0.53 J	0.67 J
Cadmium	mg/kg	8.2	6.9%	2.3	1	2	29	0.65 U	0.55 U	0.77 U	0.68 U	0.71 U
Calcium	mg/kg	106000	100.0%	121000	0	29	29	19900	2100	3940	11800	8670
Chromium	mg/kg	35.1	100.0%	29.6	3	29	29	20.4	25.2	23.3	20	23.8
Cobalt	mg/kg	20.5	100.0%	30	0	29	29	10.6	13	12.6	10.7	11
Copper	mg/kg	324	100.0%	33	4	29	29	22.2 J	23.9 J	22.5 J	**324** J	**34.5** J
Iron	mg/kg	37700	100.0%	36500	2	29	29	24300	29100	29700	23900	26300

TABLE 1
SEAD-24 SOIL ANALYSIS RESULTS

SENECA ARMY DEPOT ACTIVITY
REMOVAL ACTION

	MATRIX							SOIL	SOIL	SOIL	SOIL	SOIL
	LOCATION							SEAD-24	SEAD-24	SEAD-24	SEAD-24	SEAD-24
	DEPTH (FEET)							0-0.2	0-0.2	0-0.2	0-0.2	0-0 2
	SAMPLE DATE							10/22/93	10/22/93	10/22/93	10/22/93	10/22/93
	ES ID		FREQUENCY		NUMBER	NUMBER	NUMBER	SS24-6	SS24-7	SS24-8	SS24-9	SS24-13
	LAB ID	MAXIMUM	OF	CRITERIA	ABOVE	OF	OF	202083	202084	202085	202086	202092
PARAMETER	**UNITS**	**DETECT**	**DETECTION**	**VALUE (a)**	**CRITERIA**	**DETECTS**	**SAMPLES**	Value (Q)	Value (Q)	Value (Q)	Value (Q)	Value (Q)
Lead	mg/kg	422	100.0%	400 (2)	1	29	29	40.7	15.4	24.4	86.5	112
Magnesium	mg/kg	43700	100.0%	21500	2	29	29	4400	5190	4730	5010	5390
Manganese	mg/kg	1770	100.0%	1060	2	29	29	724	677	448	546	519
Mercury	mg/kg	0.15	51.7%	0.1	1	15	29	0.03 U	0.05 J	0.04 J	0.04 J	0.04 J
Nickel	mg/kg	535	100.0%	49	2	29	29	26.8	30.1	34.8	32.3	35.4
Potassium	mg/kg	2510	100.0%	2380	1	29	29	1360	2090	1590	1020 J	1410
Selenium	mg/kg	0.3	10.3%	2	0	3	29	0.21 UJ	0.22 UJ	0.23 UJ	0.2 UJ	0.25 UJ
Sodium	mg/kg	161	100.0%	172	0	29	29	69.8 J	52.3 J	59.8 J	68 J	74.3 J
Thallium	mg/kg	0.14	3.4%	0.7	0	1	29	0.23 U	0.24 U	0.25 U	0.21 U	0.28 U
Vanadium	mg/kg	39.3	100.0%	150	0	29	29	24.4	32.8	27.2	18.3	24
Zinc	mg/kg	1180	100.0%	110	10	29	29	97.2	63.8	88.5	**143**	**182**
Other Analyses												
Nitrate/Nitrite-Nitrogen	mg/kg	2.1	100.0%		0	29	29	0.11	0.26	0.16	0.28	0.37
Total Solids	%W/W	93.2	100.0%		0	29	29	78.6	82.2	73.2	81.7	81.5
Total Petroleum Hydrocarbons	mg/kg	158	100.0%		0	29	29	93	59	46	61	158

Notes
1) NYSDEC Technical and Administrative Guidance Memorandum #4046, except as noted.
2) US EPA, OSWER Directive # 9200.4-27 Soil Lead Guidance, August 1998
* = As per proposed TAGM, total VOCs < 10ppm; total Semi-VOCs <500ppm; individual semi-VOCs < 50 ppm.
NA = Not Available
U = Compound was not detected.
J = the reported value is an estimated concentration.
R = the data was rejected in the data validating process.
UJ = the compound was not detected; the associated reporting limit is approximate.

TABLE 1
SEAD-24 SOIL ANALYSIS RESULTS

SENECA ARMY DEPOT ACTIVITY
REMOVAL ACTION

	MATRIX							SOIL	SOIL	SOIL	SOIL	SOIL
	LOCATION							SEAD-24	SEAD-24	SEAD-24	SEAD-24	SEAD-24
	DEPTH (FEET)							0-0.2	0-0.2	0-0.2	0-2	4-6
	SAMPLE DATE							10/22/93	10/22/93	10/22/93	11/30/93	11/30/93
	ES ID		FREQUENCY		NUMBER	NUMBER	NUMBER	SS24-10	SS24-11	SS24-12	SB24-1.1	SB24-1.3
	LAB ID	MAXIMUM	OF	CRITERIA	ABOVE	OF	OF	202089	202090	202091	205918	205919
PARAMETER	UNITS	DETECT	DETECTION	VALUE (a)	CRITERIA	DETECTS	SAMPLES	Value (Q)	Value (Q)	Value (Q)	Value (Q)	Value (Q)
Volatile Organics												
Acetone	ug/kg	27	10 3%	200	0	3	29	13 U	11 U	13 U	20 U	26 U
Benzene	ug/kg	1	3.4%	60	0	1	29	13 U	11 U	13 U	12 U	11 U
Chlorobenzene	ug/kg	7	6.9%	1700	0	2	29	13 U	11 U	7 J	12 U	11 U
Chloroform	ug/kg	13	37.9%	300	0	11	29	13 U	11 U	3 J	12 U	11 U
Methylene Chloride	ug/kg	12	10.3%	100	0	3	29	13 U	11 U	13 U	12 U	11 U
Toluene	ug/kg	2	3.4%	1500	0	1	29	13 U	11 U	13 U	12 U	11 U
Trichloroethene	ug/kg	1	3.4%	700	0	1	29	13 U	11 U	13 U	12 U	11 U
Herbicides												
2,4,5-T	ug/kg	8	3.4%	1900	0	1	29	6.3 U	5.6 U	6.5 U	6.2 U	5.6 UJ
Dicamba	ug/kg	9.7	3.4%		0	1	29	6.3 U	5.6 U	6.5 U	6.2 U	5.6 UJ
MCPP	ug/kg	6600	3.4%		0	1	29	6300 U	5600 U	6500 U	6200 U	5600 UJ
Nitroaromatics												
1,3-Dinitrobenzene	ug/kg	76	3.4%		0	1	29	130 U	130 U	130 U	130 UJ	130 U
2,4-Dinitrotoluene	ug/kg	4400	20 7%		0	6	29	130 U	130 U	130 U	130 UJ	130 U
Tetryl	ug/kg	120	6.9%		0	2	29	130 U	130 U	130 U	130 UJ	130 U
Semivolatile Organics												
2,4-Dinitrotoluene	ug/kg	12000	27.6%		0	8	29	420 U	370 U	430 U	400 U	370 U
Acenaphthylene	ug/kg	54	3.4%	41000	0	1	29	420 U	370 U	430 U	400 U	370 U
Anthracene	ug/kg	19	3.4%	50000*	0	1	29	420 U	370 U	430 U	400 U	370 U
Benzo(a)anthracene	ug/kg	280	13.8%	220	1	4	29	420 U	370 U	430 U	400 U	370 U
Benzo(a)pyrene	ug/kg	420	13.8%	61	1	4	29	420 U	370 U	430 U	400 U	370 U
Benzo(b)fluoranthene	ug/kg	350	17.2%	1100	0	5	29	420 U	370 U	430 U	400 U	370 U
Benzo(g,h,i)perylene	ug/kg	170	6.9%	50000*	0	2	29	420 U	370 U	430 U	400 U	370 U
Benzo(k)fluoranthene	ug/kg	340	17.2%	1100	0	5	29	420 U	370 U	430 U	400 U	370 U
bis(2-Ethylhexyl)phthalate	ug/kg	1300	51.7%	50000*	0	15	29	420 U	370 U	430 U	1200	860
Chrysene	ug/kg	320	24.1%	400	0	7	29	420 U	370 U	20 J	400 U	370 U
Dibenz(a,h)anthracene	ug/kg	28	3.4%	14	1	1	29	420 U	370 U	430 U	400 U	370 U
Di-n-butylphthalate	ug/kg	1100	24.1%	8100	0	7	29	420 U	370 U	430 U	400 U	370 U
Fluoranthene	ug/kg	210	24.1%	50000*	0	7	29	420 U	370 U	29 J	400 U	370 U
Indeno(1,2,3-cd)pyrene	ug/kg	220	6.9%	3200	0	2	29	420 U	370 U	430 U	400 U	370 U
N-Nitrosodiphenylamine	ug/kg	810	24.1%	50000*	0	7	29	420 U	370 U	430 U	400 U	370 U
Phenanthrene	ug/kg	44	13.8%	50000*	0	4	29	420 U	370 U	430 U	400 U	370 U
Pyrene	ug/kg	260	24.1%	50000*	0	7	29	420 U	370 U	29 J	400 U	370 U
Pesticides/PCB												
4,4'-DDE	ug/kg	12	17 2%	2100	0	5	29	4.1 U	3.6 U	4.3 U	4 U	3.7 U
4,4'-DDT	ug/kg	35	6.9%	2100	0	2	29	4.1 U	3.6 U	4.3 U	4 U	3.7 U
alpha-Chlordane	ug/kg	4.7	3.4%	540	0	1	29	2.1 U	1.9 U	2.2 U	2.1 U	1.9 U
Endosulfan I	ug/kg	2 3	10 3%	900	0	3	29	2.1 U	1.9 U	2.2 U	2.1 U	1.9 U
Endrin aldehyde	ug/kg	4.2	3.4%		0	1	29	4.1 U	3.6 U	4.3 U	4 U	3.7 U
gamma-Chlordane	ug/kg	6	3.4%	540	0	1	29	2.1 U	1.9 U	2.2 U	2.1 U	1 9 U
Metals												
Aluminum	mg/kg	25500	100 0%	19300	3	29	29	**25500**	12900	15900	**24000**	11400
Arsenic	mg/kg	56.8	100 0%	8.2	11	29	29	**8.7**	6 4	8.1	5.2	3 9
Barium	mg/kg	149	100 0%	300	0	29	29	119	28.2 J	88.8	97.3	58 9
Beryllium	mg/kg	1 2	100 0%	1.1	1	29	29	**1.2**	0.57 J	0.81 J	0.9 J	0 5 J
Cadmium	mg/kg	8.2	6.9%	2.3	1	2	29	0.7 U	0.75 J	**8.2**	0.59 U	0.51 U
Calcium	mg/kg	106000	100.0%	121000	0	29	29	2770	13400	4660	4950	58500
Chromium	mg/kg	35.1	100.0%	29.6	3	29	29	**35.1**	25.1	23.8	**32.2**	17.6
Cobalt	mg/kg	20.5	100.0%	30	0	29	29	17.8	14.8	11.5 J	12.2	9.5
Copper	mg/kg	324	100.0%	33	4	29	29	32.6 J	**34.6** J	24.4 J	28.9	26.4
Iron	mg/kg	37700	100 0%	36500	2	29	29	**37500**	30600	27500	33200	22700

TABLE 1
SEAD-24 SOIL ANALYSIS RESULTS

SENECA ARMY DEPOT ACTIVITY
REMOVAL ACTION

	MATRIX							SOIL	SOIL	SOIL	SOIL	SOIL
	LOCATION							SEAD-24	SEAD-24	SEAD-24	SEAD-24	SEAD-24
	DEPTH (FEET)							0-0.2	0-0.2	0-0.2	0-2	4-6
	SAMPLE DATE							10/22/93	10/22/93	10/22/93	11/30/93	11/30/93
	ES ID		**FREQUENCY**		**NUMBER**	**NUMBER**	**NUMBER**	SS24-10	SS24-11	SS24-12	SB24-1.1	SB24-1.3
	LAB ID	**MAXIMUM**	**OF**	**CRITERIA**	**ABOVE**	**OF**	**OF**	202089	202090	202091	205918	205919
PARAMETER	**UNITS**	**DETECT**	**DETECTION**	**VALUE (a)**	**CRITERIA**	**DETECTS**	**SAMPLES**	Value (Q)	Value (Q)	Value (Q)	Value (Q)	Value (Q)
Lead	mg/kg	422	100.0%	400 (2)	1	29	29	24.6	30.9	121	13.5 J	13.1 J
Magnesium	mg/kg	43700	100.0%	21500	2	29	29	6660	6750	5000	6990	11300
Manganese	mg/kg	1770	100.0%	1060	2	29	29	612	293	512	438	397
Mercury	mg/kg	0.15	51.7%	0.1	1	15	29	0.05 J	0.04 U	0.06 J	0.04 J	0.02 UJ
Nickel	mg/kg	535	100.0%	49	2	29	29	46.6	**52.4**	**535**	43.4	30.8
Potassium	mg/kg	2510	100.0%	2380	1	29	29	**2510**	1200	1650	2120	1610
Selenium	mg/kg	0.3	10.3%	2	0	3	29	0.21 UJ	0.27 J	0.26 UJ	0.19 UJ	0.21 UJ
Sodium	mg/kg	161	100.0%	172	0	29	29	63 J	91.5 J	53.5 J	86.5 J	116 J
Thallium	mg/kg	0.14	3.4%	0.7	0	1	29	0.23 U	0.23 U	0.28 U	0.21 UJ	0.23 UJ
Vanadium	mg/kg	39.3	100.0%	150	0	29	29	39.3	18.2	26.1	33	17
Zinc	mg/kg	1180	100.0%	110	10	29	29	108	**236**	**1180**	99.9	**114**
Other Analyses												
Nitrate/Nitrite-Nitrogen	mg/kg	2.1	100.0%		0	29	29	0.3	0.05	0.14	0.01	0.02
Total Solids	%W/W	93.2	100.0%		0	29	29	78.1	90.5	76.7	81	89.5
Total Petroleum Hydrocarbons	mg/kg	158	100.0%		0	29	29	47	38	87	32	68

Notes

1) NYSDEC Technical and Administrative Guidance Memorandum #4046, except as noted.

2) US EPA, OSWER Directive # 9200.4-27 Soil Lead Guidance, August 1998

* = As per proposed TAGM, total VOCs < 10ppm; total Semi-VOCs <500ppm; individual semi-VOCs < 50 ppm.
NA = Not Available
U = Compound was not detected.
J = the reported value is an estimated concentration.
R = the data was rejected in the data validating process.
UJ = the compound was not detected; the associated reporting limit is approximate.

TABLE 1
SEAD-24 SOIL ANALYSIS RESULTS

SENECA ARMY DEPOT ACTIVITY
REMOVAL ACTION

PARAMETER	MATRIX LOCATION DEPTH (FEET) SAMPLE DATE ES ID LAB ID UNITS	MAXIMUM DETECT	FREQUENCY OF DETECTION	CRITERIA VALUE (a)	NUMBER ABOVE CRITERIA	NUMBER OF DETECTS	NUMBER OF SAMPLES	SOIL SEAD-24 10-12 11/30/93 SB24-1.5 205920 Value (Q)	SOIL SEAD-24 0-2 11/30/93 SB24-1.7 205921 Value (Q)	SOIL SEAD-24 0-2 12/01/93 SB24-2.1 205922 Value (Q)	SOIL SEAD-24 6-8 12/01/93 SB24-2.3 205923 Value (Q)	SOIL SEAD-24 12-14 12/01/93 SB24-2.4 205952 Value (Q)
Volatile Organics												
Acetone	ug/kg	27	10.3%	200	0	3	29	11 U	11 U	12 U	14 U	11 U
Benzene	ug/kg	1	3.4%	60	0	1	29	11 U	11 U	12 U	11 U	11 U
Chlorobenzene	ug/kg	7	6.9%	1700	0	2	29	11 U	11 U	12 U	11 U	11 U
Chloroform	ug/kg	13	37.9%	300	0	11	29	11 U	11 U	12 U	11 U	6 J
Methylene Chloride	ug/kg	12	10.3%	100	0	3	29	11 U	11 U	12 U	11 U	12
Toluene	ug/kg	2	3.4%	1500	0	1	29	11 U	11 U	12 U	11 U	11 U
Trichloroethene	ug/kg	1	3.4%	700	0	1	29	11 U	11 U	12 U	11 U	11 U
Herbicides												
2,4,5-T	ug/kg	8	3.4%	1900	0	1	29	5.4 U	5.9 U	6.1 U	5.6 U	5.4 U
Dicamba	ug/kg	9.7	3.4%		0	1	29	5.4 U	5.9 U	6.1 U	5.6 U	5.4 U
MCPP	ug/kg	6600	3.4%		0	1	29	5400 U	5900 U	6100 U	5600 U	5400 U
Nitroaromatics												
1,3-Dinitrobenzene	ug/kg	76	3.4%		0	1	29	130 U	130 U	130 U	130 U	76 J
2,4-Dinitrotoluene	ug/kg	4400	20.7%		0	6	29	130 U	130 U	130 U	130 U	130 U
Tetryl	ug/kg	120	6.9%		0	2	29	130 U	130 U	130 U	130 U	130 U
Semivolatile Organics												
2,4-Dinitrotoluene	ug/kg	12000	27.6%		0	8	29	350 U	390 UJ	980 J	370 UJ	350 U
Acenaphthylene	ug/kg	54	3.4%	41000	0	1	29	350 U	390 UJ	410 UJ	370 UJ	350 U
Anthracene	ug/kg	19	3.4%	50000*	0	1	29	350 U	390 UJ	410 UJ	370 UJ	350 U
Benzo(a)anthracene	ug/kg	280	13.8%	220	1	4	29	350 U	390 UJ	410 UJ	370 UJ	350 U
Benzo(a)pyrene	ug/kg	420	13.8%	61	1	4	29	350 U	390 UJ	410 UJ	370 UJ	350 U
Benzo(b)fluoranthene	ug/kg	350	17.2%	1100	0	5	29	350 U	390 UJ	410 UJ	370 UJ	350 U
Benzo(g,h,i)perylene	ug/kg	170	6.9%	50000*	0	2	29	350 U	390 UJ	410 UJ	370 UJ	350 U
Benzo(k)fluoranthene	ug/kg	340	17.2%	1100	0	5	29	350 U	390 UJ	410 UJ	370 UJ	350 U
bis(2-Ethylhexyl)phthalate	ug/kg	1300	51.7%	50000*	0	15	29	38 J	1300 J	30 J	27 J	41 J
Chrysene	ug/kg	320	24.1%	400	0	7	29	350 U	390 UJ	410 UJ	370 UJ	350 U
Dibenz(a,h)anthracene	ug/kg	28	3.4%	14	1	1	29	350 U	390 UJ	410 UJ	370 UJ	350 U
Di-n-butylphthalate	ug/kg	1100	24.1%	8100	0	7	29	350 U	390 UJ	410 UJ	370 UJ	350 U
Fluoranthene	ug/kg	210	24.1%	50000*	0	7	29	350 U	390 UJ	410 UJ	370 UJ	350 U
Indeno(1,2,3-cd)pyrene	ug/kg	220	6.9%	3200	0	2	29	350 U	390 UJ	410 UJ	370 UJ	350 U
N-Nitrosodiphenylamine	ug/kg	810	24.1%	50000*	0	7	29	350 U	390 UJ	280 J	370 UJ	350 U
Phenanthrene	ug/kg	44	13.8%	50000*	0	4	29	350 U	390 UJ	410 UJ	370 UJ	350 U
Pyrene	ug/kg	260	24.1%	50000*	0	7	29	350 U	390 UJ	410 UJ	370 UJ	350 U
Pesticides/PCB												
4,4'-DDE	ug/kg	12	17.2%	2100	0	5	29	3.5 U	3.8 U	4 U	3.7 U	3.5 U
4,4'-DDT	ug/kg	35	6.9%	2100	0	2	29	3.5 U	3.8 U	4 U	3.7 U	3.5 U
alpha-Chlordane	ug/kg	4.7	3.4%	540	0	1	29	1.8 U	2 U	2.1 U	1.9 U	1.8 U
Endosulfan I	ug/kg	2.3	10.3%	900	0	3	29	1.8 U	2 U	2.1 U	1.9 U	1.8 U
Endrin aldehyde	ug/kg	4.2	3.4%		0	1	29	3.5 U	3.8 U	4 U	3.7 U	3.5 U
gamma-Chlordane	ug/kg	6	3.4%	540	0	1	29	1.8 U	2 U	2.1 U	1.9 U	1.8 U
Metals												
Aluminum	mg/kg	25500	100.0%	19300	3	29	29	9280	17600	16500	9620	14200
Arsenic	mg/kg	56.8	100.0%	8.2	11	29	29	3.8	5	3.8	4.4	4.9
Barium	mg/kg	149	100.0%	300	0	29	29	57.2	67.3	111	79.3	54.3
Beryllium	mg/kg	1.2	100.0%	1.1	1	29	29	0.44 J	0.78	0.97	0.45 J	0.61
Cadmium	mg/kg	8.2	6.9%	2.3	1	2	29	0.38 U	0.47 U	0.53 U	0.43 U	0.38 U
Calcium	mg/kg	106000	100.0%	121000	0	29	29	58400	13300	3070	63300	56900
Chromium	mg/kg	35.1	100.0%	29.6	3	29	29	15.5	27.5	22.5	15.5	23
Cobalt	mg/kg	20.5	100.0%	30	0	29	29	9.7	13.3	10.3	9.6	10.7
Copper	mg/kg	324	100.0%	33	4	29	29	14.9	26.1	24.5	24.7	17.1
Iron	mg/kg	37700	100.0%	36500	2	29	29	18800	32100	27400	19800	26000

TABLE 1
SEAD-24 SOIL ANALYSIS RESULTS

SENECA ARMY DEPOT ACTIVITY
REMOVAL ACTION

	MATRIX							SOIL	SOIL	SOIL	SOIL	SOIL
	LOCATION							SEAD-24	SEAD-24	SEAD-24	SEAD-24	SEAD-24
	DEPTH (FEET)							10-12	0-2	0-2	6-8	12-14
	SAMPLE DATE							11/30/93	11/30/93	12/01/93	12/01/93	12/01/93
	ES ID		FREQUENCY		NUMBER	NUMBER	NUMBER	SB24-1.5	SB24-1.7	SB24-2.1	SB24-2.3	SB24-2.4
	LAB ID	MAXIMUM	OF	CRITERIA	ABOVE	OF	OF	205920	205921	205922	205923	205952
PARAMETER	**UNITS**	**DETECT**	**DETECTION**	**VALUE (a)**	**CRITERIA**	**DETECTS**	**SAMPLES**	Value (Q)	Value (Q)	Value (Q)	Value (Q)	Value (Q)
Lead	mg/kg	422	100.0%	400 (2)	1	29	29	5.9 J	14.9 J	80.3	11.9 J	4.7 J
Magnesium	mg/kg	43700	100.0%	21500	2	29	29	12700	8050	4830	16400	11500
Manganese	mg/kg	1770	100.0%	1060	2	29	29	384	509	413	388	434
Mercury	mg/kg	0.15	51.7%	0.1	1	15	29	0.03 UJ	0.03 J	0.03 J	0.03 UJ	0.03 J
Nickel	mg/kg	535	100.0%	49	2	29	29	23.7	42.2	28.9	26.4	34
Potassium	mg/kg	2510	100.0%	2380	1	29	29	1130	1230	1170	1350	1760
Selenium	mg/kg	0.3	10.3%	2	0	3	29	0.19 UJ	0.23 UJ	0.22 UJ	2 UJ	0.28 J
Sodium	mg/kg	161	100.0%	172	0	29	29	127 J	74.9 J	51.3 J	135 J	161 J
Thallium	mg/kg	0.14	3.4%	0.7	0	1	29	0.21 UJ	0.25 UJ	0.24 UJ	0.22 UJ	0.25 U
Vanadium	mg/kg	39.3	100.0%	150	0	29	29	13.5	26	28	15.2	20.1
Zinc	mg/kg	1180	100.0%	110	10	29	29	44.3	86	**223**	62.6	48.9
Other Analyses												
Nitrate/Nitrite-Nitrogen	mg/kg	2.1	100.0%		0	29	29	0.17	0.01	0.01	0.12	0.14
Total Solids	%W/W	93.2	100.0%		0	29	29	92.7	85.2	81.5	90.1	92.9
Total Petroleum Hydrocarbons	mg/kg	158	100.0%		0	29	29	43	74	33	45	106

Notes:
1) NYSDEC Technical and Administrative Guidance Memorandum #4046, except as noted.
2) US EPA, OSWER Directive # 9200.4-27 Soil Lead Guidance, August 1998
* = As per proposed TAGM, total VOCs < 10ppm; total Semi-VOCs <500ppm; individual semi-VOCs < 50 ppm
NA = Not Available
U = Compound was not detected.
J = the reported value is an estimated concentration.
R = the data was rejected in the data validating process.
UJ = the compound was not detected; the associated reporting limit is approximate.

TABLE 1
SEAD-24 SOIL ANALYSIS RESULTS

SENECA ARMY DEPOT ACTIVITY
REMOVAL ACTION

	MATRIX							SOIL	SOIL	SOIL	SOIL	SOIL
	LOCATION							SEAD-24	SEAD-24	SEAD-24	SEAD-24	SEAD-24
	DEPTH (FEET)							0-2	4-6	8-10	0-2	6-8
	SAMPLE DATE							12/02/93	12/02/93	12/02/93	12/01/93	12/01/93
	ES ID							SB24-3.1	SB24-3.3	SB24-3.5	SB24-4.1	SB24-4.4
	LAB ID							206044	206045	206046	205953	205954
PARAMETER	UNITS	MAXIMUM DETECT	FREQUENCY OF DETECTION	CRITERIA VALUE (a)	NUMBER ABOVE CRITERIA	NUMBER OF DETECTS	NUMBER OF SAMPLES	Value (Q)	Value (Q)	Value (Q)	Value (Q)	Value (Q)
Volatile Organics												
Acetone	ug/kg	27	10.3%	200	0	3	29	12 U	11 U	11 U	12 U	12 U
Benzene	ug/kg	1	3.4%	60	0	1	29	12 U	11 U	11 U	12 U	12 U
Chlorobenzene	ug/kg	7	6.9%	1700	0	2	29	12 U	11 U	11 U	12 U	12 U
Chloroform	ug/kg	13	37.9%	300	0	11	29	12 U	11 U	11 U	5 J	12 U
Methylene Chloride	ug/kg	12	10.3%	100	0	3	29	12 U	11 U	11 U	12 U	12 U
Toluene	ug/kg	2	3.4%	1500	0	1	29	12 U	11 U	11 U	12 U	12 U
Trichloroethene	ug/kg	1	3.4%	700	0	1	29	12 U	11 U	11 U	12 U	12 U
Herbicides												
2,4,5-T	ug/kg	8	3.4%	1900	0	1	29	6.3 U	5.9 U	5.4 U	5.9 U	5.6 U
Dicamba	ug/kg	9.7	3.4%		0	1	29	6.3 U	5.9 U	5.4 U	5.9 U	5.6 U
MCPP	ug/kg	6600	3.4%		0	1	29	6300 U	5900 U	5400 U	5900 U	5600 U
Nitroaromatics												
1,3-Dinitrobenzene	ug/kg	76	3.4%		0	1	29	130 U	130 U	130 U	130 U	130 U
2,4-Dinitrotoluene	ug/kg	4400	20.7%		0	6	29	130 U	130 U	130 U	130 U	130 U
Tetryl	ug/kg	120	6.9%		0	2	29	1100 U	1700 U	1600 U	110 J	130 U
Semivolatile Organics												
2,4-Dinitrotoluene	ug/kg	12000	27.6%		0	8	29	420 U	380 U	350 U	400 U	380 U
Acenaphthylene	ug/kg	54	3.4%	41000	0	1	29	420 U	380 U	350 U	400 U	380 U
Anthracene	ug/kg	19	3.4%	50000*	0	1	29	420 U	380 U	350 U	400 U	380 U
Benzo(a)anthracene	ug/kg	280	13.8%	220	1	4	29	420 U	380 U	350 U	400 U	380 U
Benzo(a)pyrene	ug/kg	420	13.8%	61	1	4	29	24 J	380 U	350 U	400 U	380 U
Benzo(b)fluoranthene	ug/kg	350	17.2%	1100	0	5	29	27 J	380 U	350 U	400 U	380 U
Benzo(g,h,i)perylene	ug/kg	170	6.9%	50000*	0	2	29	420 U	380 U	350 U	400 U	380 U
Benzo(k)fluoranthene	ug/kg	340	17.2%	1100	0	5	29	27 J	380 U	350 U	400 U	380 U
bis(2-Ethylhexyl)phthalate	ug/kg	1300	51.7%	50000*	0	15	29	420 U	89 J	56 J	400 U	86 J
Chrysene	ug/kg	320	24.1%	400	0	7	29	37 J	380 U	350 U	400 U	380 U
Dibenz(a,h)anthracene	ug/kg	28	3.4%	14	1	1	29	420 U	380 U	350 U	400 U	380 U
Di-n-butylphthalate	ug/kg	1100	24.1%	8100	0	7	29	420 U	380 U	22 J	400 U	380 U
Fluoranthene	ug/kg	210	24.1%	50000*	0	7	29	62 J	380 U	350 U	400 U	380 U
Indeno(1,2,3-cd)pyrene	ug/kg	220	6.9%	3200	0	2	29	420 U	380 U	350 U	400 U	380 U
N-Nitrosodiphenylamine	ug/kg	810	24.1%	50000*	0	7	29	420 U	380 U	350 U	400 U	380 U
Phenanthrene	ug/kg	44	13.8%	50000*	0	4	29	33 J	380 U	350 U	400 U	380 U
Pyrene	ug/kg	260	24.1%	50000*	0	7	29	56 J	380 U	350 U	400 U	380 U
Pesticides/PCB												
4,4'-DDE	ug/kg	12	17.2%	2100	0	5	29	4.2 U	3.8 U	3.5 U	4 U	3.7 U
4,4'-DDT	ug/kg	35	6.9%	2100	0	2	29	4.2 U	3.8 U	3.5 U	4 U	3.7 U
alpha-Chlordane	ug/kg	4.7	3.4%	540	0	1	29	2.2 U	2 U	1.8 U	2 U	1.9 U
Endosulfan I	ug/kg	2.3	10.3%	900	0	3	29	2.2 U	2 U	1.8 U	2 U	1.9 U
Endrin aldehyde	ug/kg	4.2	3.4%		0	1	29	4.2 U	3.8 U	3.5 U	4 U	3.7 U
gamma-Chlordane	ug/kg	6	3.4%	540	0	1	29	2.2 U	2 U	1.8 U	2 U	1.9 U
Metals												
Aluminum	mg/kg	25500	100.0%	19300	3	29	29	19300	15800	5820	**20700**	7470
Arsenic	mg/kg	56.8	100.0%	8.2	11	29	29	4.5	3.7	2.5	4.2	2.5
Barium	mg/kg	149	100.0%	300	0	29	29	132	76.2	40.5	115	73.8
Beryllium	mg/kg	1.2	100.0%	1.1	1	29	29	0.97 J	0.72 J	0.34 J	1.1	0.37 J
Cadmium	mg/kg	8.2	6.9%	2.3	1	2	29	0.72 U	0.56 U	0.63 U	0.45 U	0.52 U
Calcium	mg/kg	106000	100.0%	121000	0	29	29	3430	42100	106000	3660	81400
Chromium	mg/kg	35.1	100.0%	29.6	3	29	29	24.9	23.3	10.8	**31**	15.6
Cobalt	mg/kg	20.5	100.0%	30	0	29	29	11.6	11.2	6.7 J	20.5	5.7 J
Copper	mg/kg	324	100.0%	33	4	29	29	19	21.2	14.6	25.3	18.1
Iron	mg/kg	37700	100.0%	36500	2	29	29	25700	25300	14100	**37700**	14800

TABLE 1
SEAD-24 SOIL ANALYSIS RESULTS

SENECA ARMY DEPOT ACTIVITY
REMOVAL ACTION

	MATRIX							SOIL	SOIL	SOIL	SOIL	SOIL
	LOCATION							SEAD-24	SEAD-24	SEAD-24	SEAD-24	SEAD-24
	DEPTH (FEET)							0-2	4-6	8-10	0-2	6-8
	SAMPLE DATE							12/02/93	12/02/93	12/02/93	12/01/93	12/01/93
	ES ID		**FREQUENCY**		**NUMBER**	**NUMBER**	**NUMBER**	SB24-3.1	SB24-3.3	SB24-3.5	SB24-4.1	SB24-4.4
	LAB ID	**MAXIMUM**	**OF**	**CRITERIA**	**ABOVE**	**OF**	**OF**	206044	206045	206046	205953	205954
PARAMETER	**UNITS**	**DETECT**	**DETECTION**	**VALUE (a)**	**CRITERIA**	**DETECTS**	**SAMPLES**	Value (Q)	Value (Q)	Value (Q)	Value (Q)	Value (Q)
Lead	mg/kg	422	100.0%	400 (2)	1	29	29	81.7 J	13.3 J	33.8 J	31.4 J	7.6 J
Magnesium	mg/kg	43700	100.0%	21500	2	29	29	4280	11100	**36700**	6270	16800
Manganese	mg/kg	1770	100.0%	1060	2	29	29	837	581	349	802	409
Mercury	mg/kg	0.15	51.7%	0.1	1	15	29	0.09 JR	0.05 JR	0.03 J	0.07 JR	0.06 JR
Nickel	mg/kg	535	100.0%	49	2	29	29	29.6	31	23.9	43.6	19.3
Potassium	mg/kg	2510	100.0%	2380	1	29	29	1750	1830	1040	1520	1390
Selenium	mg/kg	0.3	10.3%	2	0	3	29	0.3 J	0.24 UJ	0.15 UJ	0.24 UJ	0.15 UJ
Sodium	mg/kg	161	100.0%	172	0	29	29	64.6 J	113 J	133 J	58.3 J	138 J
Thallium	mg/kg	0.14	3.4%	0.7	0	1	29	0.22 U	0.26 U	0.16 U	0.27 U	0.85 U
Vanadium	mg/kg	39.3	100.0%	150	0	29	29	31.1	23.6	10.7	32.6	13.4
Zinc	mg/kg	1180	100.0%	110	10	29	29	**112**	76.1	39.6	**209**	58.7
Other Analyses												
Nitrate/Nitrite-Nitrogen	mg/kg	2.1	100.0%		0	29	29	0.47	0.02	0.2	0.29	0.07
Total Solids	%W/W	93.2	100.0%		0	29	29	79.2	86.5	93.2	83.5	88.2
Total Petroleum Hydrocarbons	mg/kg	158	100.0%		0	29	29	119	58	81	89	116

Notes
1) NYSDEC Technical and Administrative Guidance Memorandum #4046, except as noted.
2) US EPA, OSWER Directive # 9200 4-27 Soil Lead Guidance, August 1998
* = As per proposed TAGM, total VOCs < 10ppm; total Semi-VOCs <500ppm; individual semi-VOCs < 50 ppm.
NA = Not Available
U = Compound was not detected
J = the reported value is an estimated concentration.
R = the data was rejected in the data validating process.
UJ = the compound was not detected; the associated reporting limit is approximate.

TABLE 1
SEAD-24 SOIL ANALYSIS RESULTS

SENECA ARMY DEPOT ACTIVITY
REMOVAL ACTION

PARAMETER	MATRIX LOCATION DEPTH (FEET) SAMPLE DATE ES ID LAB ID UNITS	MAXIMUM DETECT	FREQUENCY OF DETECTION	CRITERIA VALUE (a)	NUMBER ABOVE CRITERIA	NUMBER OF DETECTS	NUMBER OF SAMPLES	SOIL SEAD-24 12-14 12/02/93 SB24-4.7 205955 Value (Q)	SOIL SEAD-24 0-2 12/02/93 SB24-5.1 206047 Value (Q)	SOIL SEAD-24 4-6 12/02/93 SB24-5.3 206048 Value (Q)	SOIL SEAD-24 8-10 12/02/93 SB24-5.5 206049 Value (Q)
Volatile Organics											
Acetone	ug/kg	27	10.3%	200	0	3	29	6 J	12 U	11 U	11 U
Benzene	ug/kg	1	3.4%	60	0	1	29	11 UJ	12 U	11 U	1 J
Chlorobenzene	ug/kg	7	6.9%	1700	0	2	29	11 UJ	12 U	11 U	1 J
Chloroform	ug/kg	13	37.9%	300	0	11	29	3 J	12 U	2 J	11 U
Methylene Chloride	ug/kg	12	10.3%	100	0	3	29	9 J	12 U	11 U	2 J
Toluene	ug/kg	2	3.4%	1500	0	1	29	11 UJ	12 U	11 U	2 J
Trichloroethene	ug/kg	1	3.4%	700	0	1	29	11 UJ	12 U	11 U	1 J
Herbicides											
2,4,5-T	ug/kg	8	3.4%	1900	0	1	29	5.4 U	6.3 U	5.4 U	5.7 U
Dicamba	ug/kg	9.7	3.4%		0	1	29	5.4 U	6.3 U	5.4 U	5.7 U
MCPP	ug/kg	6600	3.4%		0	1	29	5400 U	6300 U	5400 U	5400 U
Nitroaromatics											
1,3-Dinitrobenzene	ug/kg	76	3.4%		0	1	29	130 U	130 U	130 U	130 U
2,4-Dinitrotoluene	ug/kg	4400	20.7%		0	6	29	130 U	130 U	130 U	130 U
Tetryl	ug/kg	120	6.9%		0	2	29	130 U	730 U	960 U	1700 U
Semivolatile Organics											
2,4-Dinitrotoluene	ug/kg	12000	27.6%		0	8	29	360 U	410 U	350 U	380 U
Acenaphthylene	ug/kg	54	3.4%	41000	0	1	29	360 U	410 U	350 U	380 U
Anthracene	ug/kg	19	3.4%	50000*	0	1	29	360 U	410 U	350 U	380 U
Benzo(a)anthracene	ug/kg	280	13.8%	220	1	4	29	360 U	410 U	350 U	380 U
Benzo(a)pyrene	ug/kg	420	13.8%	61	1	4	29	360 U	410 U	350 U	380 U
Benzo(b)fluoranthene	ug/kg	350	17.2%	1100	0	5	29	360 U	410 U	350 U	380 U
Benzo(g,h,i)perylene	ug/kg	170	6.9%	50000*	0	2	29	360 U	410 U	350 U	380 U
Benzo(k)fluoranthene	ug/kg	340	17.2%	1100	0	5	29	360 U	410 U	350 U	380 U
bis(2-Ethylhexyl)phthalate	ug/kg	1300	51.7%	50000*	0	15	29	69 J	53 J	350 U	120 J
Chrysene	ug/kg	320	24.1%	400	0	7	29	360 U	410 U	350 U	380 U
Dibenz(a,h)anthracene	ug/kg	28	3.4%	14	1	1	29	360 U	410 U	350 U	380 U
Di-n-butylphthalate	ug/kg	1100	24.1%	8100	0	7	29	360 U	67 J	350 U	380 U
Fluoranthene	ug/kg	210	24.1%	50000*	0	7	29	360 U	410 U	350 U	380 U
Indeno(1,2,3-cd)pyrene	ug/kg	220	6.9%	3200	0	2	29	360 U	410 U	350 U	380 U
N-Nitrosodiphenylamine	ug/kg	810	24.1%	50000*	0	7	29	360 U	410 U	350 U	380 U
Phenanthrene	ug/kg	44	13.8%	50000*	0	4	29	360 U	410 U	350 U	380 U
Pyrene	ug/kg	260	24.1%	50000*	0	7	29	360 U	410 U	350 U	380 U
Pesticides/PCB											
4,4'-DDE	ug/kg	12	17.2%	2100	0	5	29	3.6 U	4.1 U	3.5 U	3.7 U
4,4'-DDT	ug/kg	35	6.9%	2100	0	2	29	3.6 U	4.1 U	3.5 U	3.7 U
alpha-Chlordane	ug/kg	4.7	3.4%	540	0	1	29	1.8 U	2.1 U	1.8 U	1.9 U
Endosulfan I	ug/kg	2.3	10.3%	900	0	3	29	1.8 U	2.1 U	1.8 U	1.9 U
Endrin aldehyde	ug/kg	4.2	3.4%		0	1	29	3.6 U	4.1 U	3.5 U	3.7 U
gamma-Chlordane	ug/kg	6	3.4%	540	0	1	29	1.8 U	2.1 U	1.8 U	1.9 U
Metals											
Aluminum	mg/kg	25500	100.0%	19300	3	29	29	11300	16200	10100	13700
Arsenic	mg/kg	56.8	100.0%	8.2	11	29	29	2.7	4.2	3.3	5
Barium	mg/kg	149	100.0%	300	0	29	29	47	117	58.3	67.2
Beryllium	mg/kg	1.2	100.0%	1.1	1	29	29	0.53 J	0.98 J	0.48 J	0.62 J
Cadmium	mg/kg	8.2	6.9%	2.3	1	2	29	0.41 U	0.78 U	0.36 U	0.7 U
Calcium	mg/kg	106000	100.0%	121000	0	29	29	30500	4540	74200	49000
Chromium	mg/kg	35.1	100.0%	29.6	3	29	29	18.8	24.5	16.9	23.1
Cobalt	mg/kg	20.5	100.0%	30	0	29	29	10.3	16	8.2	12
Copper	mg/kg	324	100.0%	33	4	29	29	12.5	28.4	20.9	22.2
Iron	mg/kg	37700	100.0%	36500	2	29	29	22600	33600	21300	26700

TABLE 1
SEAD-24 SOIL ANALYSIS RESULTS

SENECA ARMY DEPOT ACTIVITY
REMOVAL ACTION

	MATRIX							SOIL	SOIL	SOIL	SOIL
	LOCATION							SEAD-24	SEAD-24	SEAD-24	SEAD-24
	DEPTH (FEET)							12-14	0-2	4-6	8-10
	SAMPLE DATE							12/02/93	12/02/93	12/02/93	12/02/93
	ES ID		**FREQUENCY**		**NUMBER**	**NUMBER**	**NUMBER**	SB24-4.7	SB24-5.1	SB24-5.3	SB24-5.5
	LAB ID	**MAXIMUM**	**OF**	**CRITERIA**	**ABOVE**	**OF**	**OF**	205955	206047	206048	206049
PARAMETER	**UNITS**	**DETECT**	**DETECTION**	**VALUE (a)**	**CRITERIA**	**DETECTS**	**SAMPLES**	Value (Q)	Value (Q)	Value (Q)	Value (Q)
Lead	mg/kg	422	100.0%	400 (2)	1	29	29	3.6 J	45.5 J	8.7 J	7.9 J
Magnesium	mg/kg	43700	100.0%	21500	2	29	29	7670	5150	12100	11400
Manganese	mg/kg	1770	100.0%	1060	2	29	29	400	**1080**	400	450
Mercury	mg/kg	0.15	51.7%	0.1	1	15	29	0.05 JR	0.07 JR	0.06 JR	0.04 JR
Nickel	mg/kg	535	100.0%	49	2	29	29	28.6	37.3	26.4	35.2
Potassium	mg/kg	2510	100.0%	2380	1	29	29	1140	1170 J	993	1660
Selenium	mg/kg	0.3	10.3%	2	0	3	29	0.12 UJ	0.15 UJ	0.23 UJ	0.22 UJ
Sodium	mg/kg	161	100.0%	172	0	29	29	131 J	50.9 J	153 J	139 J
Thallium	mg/kg	0.14	3.4%	0.7	0	1	29	0.14 J	0.16 U	0.25 U	0.24 U
Vanadium	mg/kg	39.3	100.0%	150	0	29	29	14.6	29.9	14.4	19.5
Zinc	mg/kg	1180	100.0%	110	10	29	29	30	85.7	62.8	63.2
Other Analyses											
Nitrate/Nitrite-Nitrogen	mg/kg	2.1	100.0%		0	29	29	0.13	0.27	0.15	0.33
Total Solids	%W/W	93.2	100.0%		0	29	29	92.1	80.5	92.7	87.7
Total Petroleum Hydrocarbons	mg/kg	158	100.0%		0	29	29	99	89	52	94

Notes

1) NYSDEC Technical and Administrative Guidance Memorandum #4046, except as noted.

2) US EPA, OSWER Directive # 9200.4-27 Soil Lead Guidance, August 1998

* = As per proposed TAGM, total VOCs < 10ppm; total Semi-VOCs <500ppm; individual semi-VOCs < 50 ppm.
NA = Not Available
U = Compound was not detected.
J = the reported value is an estimated concentration.
R = the data was rejected in the data validating process.
UJ = the compound was not detected; the associated reporting limit is approximate.

Fourteen metals were detected at concentrations above their respective criteria values. Two of these metals (i.e., arsenic and zinc) were found at concentrations above their respective criteria values in more than one-third of the soil samples collected and a majority of the high concentrations were found in surface soil samples. The 12 remaining metals were only found at concentrations above their respective criteria values in 1 to 4 samples. Seventeen of the metals found were detected in all of the soil samples collected from the area of SEAD-24.

Arsenic was detected above its TAGM value in 11 of the surface soil samples collected. The highest arsenic concentration measured was 56.8 mg/Kg, found in the surface soil sample, SS24-6. All arsenic concentrations reported for subsurface soils were below the TAGM concentration.

Lead concentrations exceeded its 24.8 mg/Kg TAGM value in 14 of the soil samples analyzed; however, only one lead concentration exceeded the US EPA guidance[1] for lead in residential soil on measured. The high lead concentrations were again limited primarily to the surface soil samples. The maximum concentration of lead found in samples was 422 mg/Kg and this was found in the surface sample SS24-5. This was the only sample found at a concentration that exceeded EPA's recommended soil clean-up level (400 mg/Kg). All other concentrations detected for lead were below 100 mg/Kg.

Zinc concentrations exceeded the TAGM value (110 mg/Kg) in 10 samples. As with all the other noted metals, the high concentrations were primarily in surface soil samples. The highest concentrations were 566 mg/Kg in SS24-5 and 1180 mg/Kg in sample SS24-12.

The results of the groundwater sampling program are presented in **Table 2**. These results suggest that the groundwater near the abandoned powder burning pit has not been adversely impacted by any of the constituents found in the soil or by those presumed to have been burned in the area. No organic compounds were detected in the samples of groundwater collected. Four metals (aluminum, arsenic, iron and manganese) were detected in the groundwater at levels exceeding their respective groundwater criteria values. Of the metals detected, arsenic, which was found at a maximum concentration of 10 ug/L and surpassed US EPA's maximum contaminant level[2] (MCL) in each of the three samples collected, is the only one that may pose a

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[1] US EPA, Office of Solid Waste and Emergency Response, Directive # 9200.4-27, "Clarification to the 1994 Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities," August 1998, EPA/540/F-98/030, PB98-963244.

[2] US EPA, Office of Water, Drinking Water Standards and Health Advisories, EPA 822-B-00-001, Summer 2000

TABLE 2
SEAD-24 GROUNDWATER ANALYSIS RESULTS

SENECA ARMY DEPOT ACTIVITY
REMOVAL ACTION

PARAMETER	MATRIX LOCATION SAMPLE DATE ES ID LAB ID **UNITS**	**MAXIMUM DETECT**	**FREQUENCY OF DETECTION**	**CRITERIA VALUE (a)**	**NUMBER ABOVE CRITERIA**	WATER SEAD-24 01/23/94 MW24-1 209254 Value	(Q)	WATER SEAD-24 11/16/93 MW24-2 204657 Value	(Q)	WATER SEAD-24 11/15/93 MW24-3 204632 Value	(Q)
METALS											
Aluminum	ug/L	19100	100.0%	50 (b)	3	**19100**		**9650**		**18700**	
Arsenic	ug/L	10	100.0%	5 (b)	3	**10**		**5.5**	J	**6.7**	J
Barium	ug/L	177	100.0%	1000	0	156	J	82.1	J	177	J
Beryllium	ug/L	0.89	100.0%	4 (b)	0	0.89	J	0.62	J	0.86	J
Calcium	ug/L	180000	100.0%	NA	NA	180000		176000		133000	
Chromium	ug/L	32.6	100.0%	50	0	29.8		18.1		32.6	
Cobalt	ug/L	18.7	100.0%	NA	NA	18.7	J	14.5	J	11.8	J
Copper	ug/L	32.5	100.0%	200	0	32.5		8.2	J	16.4	J
Iron	ug/L	32000	100.0%	300	3	**32000**		**19800**		**29800**	
Lead	ug/L	7	100.0%	15 (b)	0	7		3.1		3.9	
Magnesium	ug/L	47700	100.0%	NA	0	39800		47700		43300	
Manganese	ug/L	767	100.0%	50 (c)	3	**712**		**767**		**528**	
Mercury	ug/L	0.06	33.3%	0.7	0	0.06	J	0.07	UJ	0.07	UJ
Nickel	ug/L	41.4	100.0%	100	0	41.4		27.8	J	37.4	J
Potassium	ug/L	7550	100.0%	NA	NA	7220		6610		7550	
Selenium	ug/L	2.5	66.7%	10	0	2.5	J	1	J	0.8	U
Sodium	ug/L	9510	100.0%	20000	0	5950		6950		9510	
Vanadium	ug/L	30.9	100.0%	NA	NA	30.9	J	16.3	J	30.6	J
Zinc	ug/L	107	100.0%	5000 (c)	0	107		31.8		53	
OTHER ANALYSES											
Nitrate/Nitrite-Nitrogen	mg/L	0.11	100.0%	10	0	0.11		0.07		0.01	
pH	standard units	7.45	NA			7.26		7.45		6.95	
Specific Conductivity	umhos/cm	700	NA			435		700		560	
Turbidity	NTU	150	NA			150		NA(Cloudy)		NA(Cloudy)	

NOTES:

a) NY State Class GA Groundwater Standard (TOGS 1.1.1, June 1998), except as noted below.
b) US EPA Maximum Contaminant Limit (EPA 822-B-00-001, Summer 2000)
c) US EPA Secondary Drinking Water Regulation, non-enforceable (EPA 822-B-00-001, Summer 2000)
NA = Not Available
U = compound was not detected
J = the report value is an estimated concentration
UJ = the compound was not detected; the associated reporting limit is approximate
R = the data was rejected in the data validating process

threat if the groundwater is used as a source of drinking water. The highest concentration measured for arsenic in the samples was found in the upgradient well. All of the concentrations measured for arsenic in groundwater were less than NYSDEC's standards for GA groundwater[3] (25 ug/L).

1.2.2.2 SEAD-50 and 54

An Expanded Site Inspection of SEADs 50 and 54 was performed in 1993 to determine whether a release of hazardous constituents had occurred. The ESI included a geophysical survey and intrusive sampling operations.

A seismic refraction survey was performed, and the resulting data was used to determine the direction of groundwater flow.

Fifteen surface soil samples, three groundwater samples, three surface water, and three sediment samples were collected from SEADs 50 and 54. All of the samples were submitted to the laboratory for chemical analysis. The sample locations are shown in **Figure 2**. Collected samples were analyzed for Target Compound List volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides/polychlorinated biphenyls (PCBs), Target Analyte List metals and cyanide according to the NYSDEC Contract Laboratory Program Statement of Work. In addition, all of the surface soil samples were analyzed for asbestos.

The fifteen surface soil samples were collected at random locations around the historic tanks to assess potential releases from the tanks. Six of these samples were collected from the 0-2 inch depth horizon, while the remaining nine samples were collected from the 0-12 inch depth horizon.

Three groundwater monitoring wells were installed in the till/weathered shale aquifer at SEADs 50/54. One monitoring well was installed upgradient of SEADs and used to obtain background water quality data, while the remaining two wells were installed downgradient, between East Patrol Road and the SEDA perimeter fence, to determine if hazardous constituents have impacted groundwater from SEAD-50. Three samples, one sample from each well, was submitted to the laboratory for chemical analysis.

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[3] NYSDEC, Division of Water Technical and Operational Guidance Series (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limits, June 1998.

Three surface water and sediment samples were collected from the area of SEADs 50 and 54 and submitted for chemical analysis. One sample was collected from a drainage ditch that runs parallel to the unnamed road that bisects the SEADs, while the remaining two were collected from a downgradient drainage ditch that runs parallel to East Patrol Road.

Soil

The results of the soil sampling program are summarized and presented in **Tables 3** and **4**. Fifty-six TCL/TAL compounds plus asbestos were detected in one or more of the shallow soils collected during the ESI. Of the 56 TCL/TAL analytes detected, one was a volatile organic compound, 20 were semivolatile organics, 13 were pesticides or PCBs, and the remaining 22 were metals. These results indicate that shallow soil at the site has been impacted by semivolatile organic compounds, predominantly polynuclear aromatic hydrocarbons (PAHs), heavy metals, and asbestos.

Concentrations measured for seven semivolatile organic compounds (including six polynuclear aromatic hydrocarbons and phenol) surpassed their respective TAGM criteria values. A majority of the concentrations found above the TAGM levels were identified in three samples collected from locations SS50-11, SS50-14, and SS50-15. Each of these locations is in the northern part of the historic tank farm, north of the unnamed road that bisects the area.

Eight metals (i.e., antimony, arsenic, chromium, copper, lead, magnesium, mercury, and zinc) were found in soil samples at concentrations that surpassed their respective NYSDEC TAGM criteria levels. Although lead was found at concentrations that exceeded its TAGM level (i.e., 24.8 mg/Kg based on site background) in 13 of the 15 surface soil samples characterized, it was not found at a concentration that exceeded US EPA's recommended soil clean-up level for residential properties[4] of 400 mg/Kg.

The sample collected at location SS50-5 contained the maximum concentrations measured within SEADs 50/54 for chromium, lead, mercury, and zinc. Arsenic concentrations surpassed its criteria level in three of the 15 surface soil samples collected. However, only those samples collected from locations SS50-2 (57.4 mg/Kg) and SS50-6 (151 mg/Kg) contained arsenic at concentrations significantly above the criteria value. Concentrations surpassing TAGM values

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[4] US EPA, Office of Solid Waste and Emergency Response, Directive # 9200.4-27, "Clarification to the 1994 Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities," August 1998, EPA/540/F-98/030, PB98-963244.

TABLE 3
SEAD-50/SEAD-54 SOIL ANALYSIS RESULTS

SENECA ARMY DEPOT ACTIVITY
REMOVAL ACTION

	MATRIX							SOIL	SOIL	SOIL	SOIL	SOIL
	LOCATION							SEAD-50	SEAD-50	SEAD-50	SEAD-50	SEAD-50
	DEPTH (FEET)							0-1	0-0.2	0-1	0-1	0-0.2
	SAMPLE DATE							02/18/94	02/18/94	02/18/94	02/17/94	02/18/94
	ES ID							SS50-1	SS50-2	SS50-3	SS50-4	SS50-5
	LAB ID							211971	211972	211973	211728	211974
	SDG NUMBER							42493	42493	42493	42460	42493
PARAMETER	UNITS	MAXIMUM DETECT	FREQUENCY OF DETECTION	CRITERIA VALUE (a)	NUMBER ABOVE CRITERIA	NUMBER OF DETECTS	NUMBER OF SAMPLES	Value (Q)	Value (Q)	Value (Q)	Value (Q)	Value (Q)
Volatile Organics												
Acetone	ug/Kg	83	7%	200	0	1	15	14 U	83	13 U	72 U	16 U
Semivolatile Organics												
4-Methylphenol	ug/Kg	310	20%	900	0	3	15	490 U	100 J	480 U	410 U	95 J
Acenaphthene	ug/Kg	930	13%	50000 (*)	0	2	15	490 U	610 U	480 U	410 U	450 U
Anthracene	ug/Kg	1500	20%	50000 (*)	0	3	15	490 U	610 U	480 U	410 U	450 U
Benzo(a)anthracene	ug/Kg	5200	40%	220	3	6	15	490 U	81 J	480 U	410 U	450 U
Benzo(a)pyrene	ug/Kg	3700	40%	61	5	6	15	490 U	78 J	480 U	410 U	450 U
Benzo(b)fluoranthene	ug/Kg	4400	40%	1100	1	6	15	490 U	180 J	480 U	410 U	450 U
Benzo(g,h,i)perylene	ug/Kg	1800	27%	50000 (*)	0	4	15	490 U	56 J	480 U	410 U	450 U
Benzo(k)fluoranthene	ug/Kg	4000	40%	1100	1	6	15	490 U	610 UJ	480 U	410 U	450 U
bis(2-Ethylhexyl)phthalate	ug/Kg	1800	100%	50000 (*)	0	15	15	950	720	760	690	820
Carbazole	ug/Kg	1100	20%	50000 (*)	0	3	15	490 U	610 U	480 U	410 U	450 U
Chrysene	ug/Kg	5500	40%	400	3	6	15	490 U	100 J	480 U	410 U	450 U
Dibenz(a,h)anthracene	ug/Kg	840	20%	14	3	3	15	490 U	610 U	480 U	410 U	450 U
Dibenzofuran	ug/Kg	260	7%	6200	0	1	15	490 U	610 U	480 U	410 U	450 U
Di-n-butylphthalate	ug/Kg	56	80%	8100	0	12	15	35 J	56 J	33 J	410 U	34 J
Fluoranthene	ug/Kg	14000	80%	50000 (*)	0	12	15	33 J	230 J	480 U	32 J	37 J
Fluorene	ug/Kg	590	13%	50000 (*)	0	2	15	490 U	610 U	480 U	410 U	450 U
Indeno(1,2,3-cd)pyrene	ug/Kg	1800	33%	3200	0	5	15	490 U	69 J	480 U	410 U	450 U
Phenanthrene	ug/Kg	7800	67%	50000 (*)	0	10	15	490 U	150 J	480 U	20 J	27 J
Phenol	ug/Kg	31	7%	30	1	1	15	31 J	610 U	480 U	410 U	450 U
Pyrene	ug/Kg	12000	73%	50000 (*)	0	11	15	25 J	160 J	480 U	27 J	30 J
Pesticides/PCB												
4,4'-DDD	ug/Kg	2.2	7%	2900	0	1	15	4.8 U	6.1 U	4.8 U	4.1 U	4.4 U
4,4'-DDE	ug/Kg	4.8	27%	2100	0	4	15	4.8 U	6.1 U	4.8 U	4.1 U	3.1 J
4,4'-DDT	ug/Kg	4.1	27%	2100	0	4	15	4.8 U	6.1 U	4.8 U	4.1 U	2.2 J
Aldrin	ug/Kg	1.3	7%	41	0	1	15	2.5 U	3.1 U	2.5 U	2.1 U	1.3 J
alpha-Chlordane	ug/Kg	3.8	7%	540	0	1	15	2.5 U	3.1 U	2.5 U	2.1 U	2.3 U
Aroclor-1242	ug/Kg	75	20%	1000(c)	0	3	15	48 U	61 U	48 U	41 U	75
Aroclor-1254	ug/Kg	75	13%	1000(c)	0	2	15	48 U	61 U	48 U	41 U	44 U
Aroclor-1260	ug/Kg	25	7%	1000(c)	0	1	15	48 U	61 U	48 U	41 U	25 J
Dieldrin	ug/Kg	59	13%	440	0	2	15	4.8 U	6.1 U	4.8 U	4.1 U	4.4 U
Endosulfan I	ug/Kg	13	7%	900	0	1	15	2.5 U	3.1 U	2.5 U	2.1 U	2.3 U
Endrin	ug/Kg	2.8	7%	100	0	1	15	4.8 U	6.1 U	4.8 U	4.1 U	4.4 U
Heptachlor	ug/Kg	1.3	7%	100	0	1	15	2.5 U	3.1 U	2.5 U	2.1 U	2.3 U
Heptachlor epoxide	ug/Kg	2.4	13%	20	0	2	15	2.5 U	3.1 U	2.5 U	2.1 U	2.4
Metals												
Aluminum	mg/Kg	15300	100%	19300	0	15	15	14500	13500	12500	15100 J	9050
Antimony	mg/Kg	7.1	93%	5.9	1	14	15	1.4 J	1.6 J	2.9 J	7.1 J	2.7 J
Arsenic	mg/Kg	151	100%	8.2	3	15	15	4.9	57.4	5	5.1 J	3.7
Barium	mg/Kg	115	100%	300	0	15	15	95.6	115	87.5	96.8 J	66.2
Beryllium	mg/Kg	0.71	100%	1.1	0	15	15	0.61 J	0.59 J	0.59 J	0.68 J	0.38 J
Cadmium	mg/Kg	0.8	87%	2.3	0	13	15	0.17 J	0.22 J	0.12 J	0.46 U	0.25 J
Calcium	mg/Kg	120000	100%	121000	0	15	15	12500 J	4740 J	6220 J	3650 J	46800 J
Chromium	mg/Kg	60.7	100%	29.6	5	15	15	28.3	21.7	20.4	34.6	60.7
Cobalt	mg/Kg	12.6	100%	30	0	15	15	11 J	9 J	8.8 J	9.9 J	7.4 J
Copper	mg/Kg	35.2	100%	33	1	15	15	24.8	24.4	18.7	16.9	22.2

TABLE 3
SEAD-50/SEAD-54 SOIL ANALYSIS RESULTS

SENECA ARMY DEPOT ACTIVITY
REMOVAL ACTION

	MATRIX							SOIL	SOIL	SOIL	SOIL	SOIL
	LOCATION							SEAD-50	SEAD-50	SEAD-50	SEAD-50	SEAD-50
	DEPTH (FEET)							0-1	0-0.2	0-1	0-1	0-0.2
	SAMPLE DATE							02/18/94	02/18/94	02/18/94	02/17/94	02/18/94
	ES ID							SS50-1	SS50-2	SS50-3	SS50-4	SS50-5
	LAB ID							211971	211972	211973	211728	211974
	SDG NUMBER							42493	42493	42493	42460	42493
PARAMETER	UNITS	**MAXIMUM DETECT**	**FREQUENCY OF DETECTION**	**CRITERIA VALUE (a)**	**NUMBER ABOVE CRITERIA**	**NUMBER OF DETECTS**	**NUMBER OF SAMPLES**	Value (Q)	Value (Q)	Value (Q)	Value (Q)	Value (Q)
Volatile Organics												
Iron	mg/Kg	30000	100%	36500	0	15	15	25600	22800	22800	24400 J	18000
Lead	mg/Kg	398	100%	400 (b)	0	15	15	94.8	40.1	27	74	398
Magnesium	mg/Kg	48300	100%	21500	1	15	15	5300	3900	3930	3840 J	21100
Manganese	mg/Kg	722	87%	1060	0	13	15	569	630	490	539 R	350
Mercury	mg/Kg	0.37	100%	0.1	2	15	15	0.06 J	0.05 J	0.04 J	0.04 J	**0.37**
Nickel	mg/Kg	42.6	100%	498	0	15	15	35 J	25.2 J	22.8 J	24.3	22.9 J
Potassium	mg/Kg	2170	100%	2380	0	15	15	1780 J	2160 J	1040 J	1190	1430 J
Selenium	mg/Kg	1.1	93%	2	0	14	15	0.95 J	1.1 J	0.52 J	0.23 UJ	0.25 J
Silver	mg/Kg	0.34	13%	0.75	0	2	15	0.16 U	0.25 U	0.16 U	0.91 U	0.11 U
Sodium	mg/Kg	136	80%	172	0	12	15	64.7 J	55.6 U	42.5 J	43 U	86.1 J
Vanadium	mg/Kg	26.2	100%	150	0	15	15	23.8	24.9	22.6	26.1	15.6
Zinc	mg/Kg	152	100%	110	3	15	15	109	100	71.9	88.9 J	**152**
Other Analyses												
Total Solids	%W/W	88	100%		0	15	15	67.8	53.8	68.9	80.6	73.9

NOTES:

a) NYSDEC Technical and Administrative Guidance Memorandum #4046, except as noted below.

b) US EPA, OSWER Directive # 9200.4-27 Soil Lead Guidance, August 1998

c) The TAGM value for PCBs is 1000ug/Kg for surface soils and 10,000 ug/Kg for subsurface soils.

* = As per proposed TAGM, total VOCs < 10ppm; total Semi-VOCs <500ppm; individual semi-VOCs < 50 ppm.

NA = Not Available

U = Compound was not detected.

J = the reported value is an estimated concentration.

R = the data was rejected in the data validating process.

UJ = the compound was not detected; the associated reporting limit is approximate.

TABLE 3
SEAD-50/SEAD-54 SOIL ANALYSIS RESULTS

SENECA ARMY DEPOT ACTIVITY
REMOVAL ACTION

	MATRIX							SOIL	SOIL	SOIL	SOIL	SOIL
	LOCATION							SEAD-50	SEAD-50	SEAD-50	SEAD-50	SEAD-50
	DEPTH (FEET)							0-0.2	0-1	0-1	0-0.2	0-1
	SAMPLE DATE							02/18/94	02/18/94	02/18/94	02/18/94	02/19/94
	ES ID							SS50-6	SS50-7	SS50-8	SS50-9	SS50-10
	LAB ID		FREQUENCY		NUMBER	NUMBER	NUMBER	211975	211976	211977	211978	211979
	SDG NUMBER	MAXIMUM	OF	CRITERIA	ABOVE	OF	OF	42493	42493	42493	42493	42493
PARAMETER	**UNITS**	**DETECT**	**DETECTION**	**VALUE (a)**	**CRITERIA**	**DETECTS**	**SAMPLES**	Value (Q)	Value (Q)	Value (Q)	Value (Q)	Value (Q)
Volatile Organics												
Acetone	ug/Kg	83	7%	200	0	1	15	41 U	12 U	12 U	22 U	14 U
Semivolatile Organics												
4-Methylphenol	ug/Kg	310	20%	900	0	3	15	310 J	390 U	370 U	430 U	430 U
Acenaphthene	ug/Kg	930	13%	50000 (*)	0	2	15	610 UJ	390 U	370 U	430 U	430 U
Anthracene	ug/Kg	1500	20%	50000 (*)	0	3	15	610 UJ	390 U	370 U	430 U	430 U
Benzo(a)anthracene	ug/Kg	5200	40%	220	3	6	15	81 J	390 U	370 U	430 U	430 U
Benzo(a)pyrene	ug/Kg	3700	40%	61	5	6	15	**84** J	390 U	370 U	430 U	430 U
Benzo(b)fluoranthene	ug/Kg	4400	40%	1100	1	6	15	99 J	390 U	370 U	430 U	430 U
Benzo(g,h,i)perylene	ug/Kg	1800	27%	50000 (*)	0	4	15	610 UJ	390 U	370 U	430 U	430 U
Benzo(k)fluoranthene	ug/Kg	4000	40%	1100	1	6	15	80 J	390 U	370 U	30 J	430 U
bis(2-Ethylhexyl)phthalate	ug/Kg	1800	100%	50000 (*)	0	15	15	980 J	500	1300	330 J	150 J
Carbazole	ug/Kg	1100	20%	50000 (*)	0	3	15	610 UJ	390 U	370 U	430 U	430 U
Chrysene	ug/Kg	5500	40%	400	3	6	15	97 J	390 U	370 U	430 U	430 U
Dibenz(a,h)anthracene	ug/Kg	840	20%	14	3	3	15	610 UJ	390 U	370 U	430 U	430 U
Dibenzofuran	ug/Kg	260	7%	6200	0	1	15	610 UJ	390 U	370 U	430 U	430 U
Di-n-butylphthalate	ug/Kg	56	80%	8100	0	12	15	610 UJ	34 J	22 J	46 J	28 J
Fluoranthene	ug/Kg	14000	80%	50000 (*)	0	12	15	210 J	390 U	370 U	58 J	23 J
Fluorene	ug/Kg	590	13%	50000 (*)	0	2	15	610 UJ	390 U	370 U	430 U	430 U
Indeno(1,2,3-cd)pyrene	ug/Kg	1800	33%	3200	0	5	15	64 J	390 U	370 U	430 U	430 U
Phenanthrene	ug/Kg	7800	67%	50000 (*)	0	10	15	140 J	390 U	370 U	40 J	430 U
Phenol	ug/Kg	31	7%	30	1	1	15	610 UJ	390 U	370 U	430 U	430 U
Pyrene	ug/Kg	12000	73%	50000 (*)	0	11	15	140 J	390 U	370 U	47 J	430 U
Pesticides/PCB												
4,4'-DDD	ug/Kg	2.2	7%	2900	0	1	15	6.2 U	3.9 U	3.7 U	4.3 U	4.3 U
4,4'-DDE	ug/Kg	4.8	27%	2100	0	4	15	6.2 U	3.9 U	3.7 U	2.9 J	4.3 U
4,4'-DDT	ug/Kg	4.1	27%	2100	0	4	15	6.2 U	3.9 U	3.7 U	1.9 J	4.3 U
Aldrin	ug/Kg	1.3	7%	41	0	1	15	3.2 U	2 U	1.9 U	2.2 U	2.2 U
alpha-Chlordane	ug/Kg	3.8	7%	540	0	1	15	3.2 U	2 U	1.9 U	2.2 U	2.2 U
Aroclor-1242	ug/Kg	75	20%	1000(c)	0	3	15	62 U	39 U	49	43 U	43 U
Aroclor-1254	ug/Kg	75	13%	1000(c)	0	2	15	62 U	39 U	37 U	43 U	75
Aroclor-1260	ug/Kg	25	7%	1000(c)	0	1	15	62 U	39 U	37 U	43 U	43 U
Dieldrin	ug/Kg	59	13%	440	0	2	15	6.2 U	3.9 U	3.7 U	4.3 U	4.3 U
Endosulfan I	ug/Kg	13	7%	900	0	1	15	3.2 U	2 U	1.9 U	2.2 U	2.2 U
Endrin	ug/Kg	2.8	7%	100	0	1	15	6.2 U	3.9 U	3.7 U	4.3 U	4.3 U
Heptachlor	ug/Kg	1.3	7%	100	0	1	15	3.2 U	2 U	1.9 U	1.3 J	2.2 U
Heptachlor epoxide	ug/Kg	2.4	13%	20	0	2	15	2.1 J	2 U	1.9 U	2.2 U	2.2 U
Metals												
Aluminum	mg/Kg	15300	100%	19300	0	15	15	12500	13800	9150	12300	11300
Antimony	mg/Kg	7.1	93%	5.9	1	14	15	1.5 J	1.7 J	0.71 J	2.3 J	0.95 J
Arsenic	mg/Kg	151	100%	8.2	3	15	15	**151**	7.6	4.7	7.5	4.9
Barium	mg/Kg	115	100%	300	0	15	15	103	55.5	58.1	39 J	63.2
Beryllium	mg/Kg	0.71	100%	1.1	0	15	15	0.56 J	0.57 J	0.36 J	0.45 J	0.45 J
Cadmium	mg/Kg	0.8	87%	2.3	0	13	15	0.19 J	0.09 J	0.28 J	0.09 J	0.17 J
Calcium	mg/Kg	120000	100%	121000	0	15	15	4650 J	27300 J	120000 J	3480 J	24000 J
Chromium	mg/Kg	60.7	100%	29.6	5	15	15	19.9	28.1	**32.6**	**40.9**	23.5
Cobalt	mg/Kg	12.6	100%	30	0	15	15	7.3 J	12.6	6.4 J	11.2	8 J
Copper	mg/Kg	35.2	100%	33	1	15	15	18.5	**35.2**	13.9	18.4	18.9

TABLE 3
SEAD-50/SEAD-54 SOIL ANALYSIS RESULTS

SENECA ARMY DEPOT ACTIVITY
REMOVAL ACTION

	MATRIX							SOIL		SOIL		SOIL		SOIL		SOIL	
	LOCATION							SEAD-50		SEAD-50		SEAD-50		SEAD-50		SEAD-50	
	DEPTH (FEET)							0-0.2		0-1		0-1		0-0.2		0-1	
	SAMPLE DATE							02/18/94		02/18/94		02/18/94		02/18/94		02/19/94	
	ES ID							SS50-6		SS50-7		SS50-8		SS50-9		SS50-10	
	LAB ID							211975		211976		211977		211978		211979	
	SDG NUMBER							42493		42493		42493		42493		42493	
PARAMETER	**UNITS**	**MAXIMUM DETECT**	**FREQUENCY OF DETECTION**	**CRITERIA VALUE (a)**	**NUMBER ABOVE CRITERIA**	**NUMBER OF DETECTS**	**NUMBER OF SAMPLES**	Value	(Q)	Value	(Q)	Value	(Q)	Value	(Q)	Value	(Q)
Volatile Organics																	
Iron	mg/Kg	30000	100%	36500	0	15	15	21700		29400		18200		28600		26100	
Lead	mg/Kg	398	100%	400 (b)	0	15	15	25.2		52.7		242		181		48.4	
Magnesium	mg/Kg	48300	100%	21500	1	15	15	3550		6600		15700		5690		11200	
Manganese	mg/Kg	722	87%	1060	0	13	15	487		374		604		413		430	
Mercury	mg/Kg	0.37	100%	0.1	2	15	15	**0.22**		0.02	J	0.04	J	0.03	J	0.03	J
Nickel	mg/Kg	42.6	100%	498	0	15	15	20.8	J	42.6	J	15.4	J	30.2	J	22	J
Potassium	mg/Kg	2170	100%	2380	0	15	15	1550	J	1680	J	1540	J	1030	J	1490	J
Selenium	mg/Kg	1.1	93%	2	0	14	15	0.71	J	0.59	J	0.67	J	0.53	J	0.21	J
Silver	mg/Kg	0.34	13%	0.75	0	2	15	0.21	U	0.15	U	0.34	J	0.14	U	0.12	U
Sodium	mg/Kg	136	80%	172	0	12	15	66	J	81.6	J	89.3	J	53	J	60.7	J
Vanadium	mg/Kg	26.2	100%	150	0	15	15	23.2		21		17		16.4		19.2	
Zinc	mg/Kg	152	100%	110	3	15	15	101		81.2		104		**114**		87.4	
Other Analyses																	
Total Solids	%W/W	88	100%		0	15	15	53.3		84.9		88		76.8		77	

NOTES:

a) NYSDEC Technical and Administrative Guidance Memorandum #4046, except as noted below.

b) US EPA, OSWER Directive # 9200.4-27 Soil Lead Guidance, August 1998

c) The TAGM value for PCBs is 1000ug/Kg for surface soils and 10,000 ug/Kg for subsurface soils.

* = As per proposed TAGM, total VOCs < 10ppm; total Semi-VOCs <500ppm; individual semi-VOCs < 50 ppm.

NA = Not Available

U = Compound was not detected.

J = the reported value is an estimated concentration.

R = the data was rejected in the data validating process.

UJ = the compound was not detected; the associated reporting limit is approximate.

TABLE 3
SEAD-50/SEAD-54 SOIL ANALYSIS RESULTS

SENECA ARMY DEPOT ACTIVITY
REMOVAL ACTION

	MATRIX							SOIL	SOIL	SOIL	SOIL	SOIL
	LOCATION							SEAD-50	SEAD-50	SEAD-50	SEAD-50	SEAD-50
	DEPTH (FEET)							0-0.2	0-1	0-0.2	0-1	0-0.2
	SAMPLE DATE							02/19/94	02/19/94	02/19/94	02/19/94	02/19/94
	ES ID							SS50-11	SS50-12	SS50-13	SS50-14	SS50-15
	LAB ID		FREQUENCY		NUMBER	NUMBER	NUMBER	211965	211980	211981	211982	211983
	SDG NUMBER	MAXIMUM	OF	CRITERIA	ABOVE	OF	OF	42460	42493	42493	42493	42493
PARAMETER	UNITS	DETECT	DETECTION	VALUE (a)	CRITERIA	DETECTS	SAMPLES	Value (Q)	Value (Q)	Value (Q)	Value (Q)	Value (Q)
Volatile Organics												
Acetone	ug/Kg	83	7%	200	0	1	15	14 U	13 U	15 U	12 U	15 U
Semivolatile Organics												
4-Methylphenol	ug/Kg	310	20%	900	0	3	15	2300 U	420 U	480 U	420 U	520 U
Acenaphthene	ug/Kg	930	13%	50000 (*)	0	2	15	930 J	420 U	480 U	420 U	51 J
Anthracene	ug/Kg	1500	20%	50000 (*)	0	3	15	1500 J	420 U	480 U	81 J	100 J
Benzo(a)anthracene	ug/Kg	5200	40%	220	3	6	15	**5200**	420 U	35 J	**830**	**650**
Benzo(a)pyrene	ug/Kg	3700	40%	61	5	6	15	**3700**	420 U	40 J	**660**	**520**
Benzo(b)fluoranthene	ug/Kg	4400	40%	1100	1	6	15	**4400**	420 U	45 J	860	690
Benzo(g,h,i)perylene	ug/Kg	1800	27%	50000 (*)	0	4	15	1800 J	420 U	480 U	270 J	240 J
Benzo(k)fluoranthene	ug/Kg	4000	40%	1100	1	6	15	**4000**	420 U	43 J	600	410 J
bis(2-Ethylhexyl)phthalate	ug/Kg	1800	100%	50000 (*)	0	15	15	640 J	1800	960	610	1300
Carbazole	ug/Kg	1100	20%	50000 (*)	0	3	15	1100 J	420 U	480 U	71 J	67 J
Chrysene	ug/Kg	5500	40%	400	3	6	15	**5500**	420 U	53 J	**840**	**670**
Dibenz(a,h)anthracene	ug/Kg	840	20%	14	3	3	15	**840** J	420 U	480 U	**200** J	**190** J
Dibenzofuran	ug/Kg	260	7%	6200	0	1	15	260 J	420 U	480 U	420 U	520 U
Di-n-butylphthalate	ug/Kg	56	80%	8100	0	12	15	2300 U	51 J	51 J	36 J	30 J
Fluoranthene	ug/Kg	14000	80%	50000 (*)	0	12	15	14000	41 J	86 J	1300	1300
Fluorene	ug/Kg	590	13%	50000 (*)	0	2	15	590 J	420 U	480 U	420 U	36 J
Indeno(1,2,3-cd)pyrene	ug/Kg	1800	33%	3200	0	5	15	1800 J	420 U	480 U	400 J	360 J
Phenanthrene	ug/Kg	7800	67%	50000 (*)	0	10	15	7800	26 J	53 J	370 J	530
Phenol	ug/Kg	31	7%	30	1	1	15	2300 U	420 U	480 U	420 U	520 U
Pyrene	ug/Kg	12000	73%	50000 (*)	0	11	15	12000	31 J	73 J	1200	1000
Pesticides/PCB												
4,4'-DDD	ug/Kg	2.2	7%	2900	0	1	15	4.5 U	8.4 U	4.8 U	2.2 J	5.2 U
4,4'-DDE	ug/Kg	4.8	27%	2100	0	4	15	4.5 U	8.4 U	4.8 U	4.8 J	4 J
4,4'-DDT	ug/Kg	4.1	27%	2100	0	4	15	4.5 U	8.4 U	4.8 U	4.1 J	4.1 J
Aldrin	ug/Kg	1.3	7%	41	0	1	15	2.3 U	4.3 U	2.5 U	2.2 U	2.7 U
alpha-Chlordane	ug/Kg	3.8	7%	540	0	1	15	3.8 J	4.3 U	2.5 U	2.2 U	2.7 U
Aroclor-1242	ug/Kg	75	20%	1000(c)	0	3	15	45 U	84 U	48 U	37 J	52 U
Aroclor-1254	ug/Kg	75	13%	1000(c)	0	2	15	45 U	84 U	48 U	24 J	52 U
Aroclor-1260	ug/Kg	25	7%	1000(c)	0	1	15	45 U	84 U	48 U	42 U	52 U
Dieldrin	ug/Kg	59	13%	440	0	2	15	4.5 U	59 J	4.8 U	28 J	5.2 U
Endosulfan I	ug/Kg	13	7%	900	0	1	15	2.3 U	4.3 U	2.5 U	13	2.7 U
Endrin	ug/Kg	2.8	7%	100	0	1	15	2.8 J	8.4 U	4.8 U	4.2 U	5.2 U
Heptachlor	ug/Kg	1.3	7%	100	0	1	15	2.3 U	4.3 U	2.5 U	2.2 U	2.7 U
Heptachlor epoxide	ug/Kg	2.4	13%	20	0	2	15	2.3 U	4.3 U	2.5 U	2.2 U	2.7 U
Metals												
Aluminum	mg/Kg	15300	100%	19300	0	15	15	15300 J	15200	13800	10600	13300
Antimony	mg/Kg	7.1	93%	5.9	1	14	15	5.2 UJ	0.55 J	0.63 J	0.6 J	0.85 J
Arsenic	mg/Kg	151	100%	8.2	3	15	15	6 J	**37.6**	6.4	6.2	6.3
Barium	mg/Kg	115	100%	300	0	15	15	101 J	91.2	78	73.1	92.1
Beryllium	mg/Kg	0.71	100%	1.1	0	15	15	0.71 J	0.65 J	0.55 J	0.4 J	0.59 J
Cadmium	mg/Kg	0.8	87%	2.3	0	13	15	0.51 U	0.15 J	0.09 J	0.8 J	0.22 J
Calcium	mg/Kg	120000	100%	121000	0	15	15	15200 J	3870 J	10600 J	80100 J	18000 J
Chromium	mg/Kg	60.7	100%	29.6	5	15	15	**29.9**	22.7	21.1	21.8	25.7
Cobalt	mg/Kg	12.6	100%	30	0	15	15	10.3 J	11.6	10.4 J	9.2 J	12.6
Copper	mg/Kg	35.2	100%	33	1	15	15	23.6	19.6	22.2	20.9	28.1

TABLE 3
SEAD-50/SEAD-54 SOIL ANALYSIS RESULTS

SENECA ARMY DEPOT ACTIVITY
REMOVAL ACTION

	MATRIX							SOIL	SOIL	SOIL	SOIL	SOIL
	LOCATION							SEAD-50	SEAD-50	SEAD-50	SEAD-50	SEAD-50
	DEPTH (FEET)							0-0.2	0-1	0-0.2	0-1	0-0.2
	SAMPLE DATE							02/19/94	02/19/94	02/19/94	02/19/94	02/19/94
	ES ID							SS50-11	SS50-12	SS50-13	SS50-14	SS50-15
	LAB ID		**FREQUENCY**		**NUMBER**	**NUMBER**	**NUMBER**	211965	211980	211981	211982	211983
	SDG NUMBER	**MAXIMUM**	**OF**	**CRITERIA**	**ABOVE**	**OF**	**OF**	42460	42493	42493	42493	42493
PARAMETER	**UNITS**	**DETECT**	**DETECTION**	**VALUE (a)**	**CRITERIA**	**DETECTS**	**SAMPLES**	Value (Q)	Value (Q)	Value (Q)	Value (Q)	Value (Q)
Volatile Organics												
Iron	mg/Kg	30000	100%	36500	0	15	15	27000 J	29400	26200	19700	30000
Lead	mg/Kg	398	100%	400 (b)	0	15	15	25.7	18.5	22.6	61.4	45.3
Magnesium	mg/Kg	48300	100%	21500	1	15	15	7510 J	4570	6330	**48300**	6780
Manganese	mg/Kg	722	87%	1060	0	13	15	496 R	722	461	548	589
Mercury	mg/Kg	0.37	100%	0.1	2	15	15	0.05 J	0.05 J	0.05 J	0.03 J	0.03 J
Nickel	mg/Kg	42.6	100%	498	0	15	15	37.2	30.1 J	28.9 J	24.4 J	37 J
Potassium	mg/Kg	2170	100%	2380	0	15	15	2170	1600 J	1760 J	2140 J	1890 J
Selenium	mg/Kg	1.1	93%	2	0	14	15	0.41 J	0.41 J	0.33 J	0.55 J	0.44 J
Silver	mg/Kg	0.34	13%	0.75	0	2	15	1 U	0.16 J	0.18 U	0.16 U	0.14 U
Sodium	mg/Kg	136	80%	172	0	12	15	63.7 J	26.7 U	64.9 J	136 J	64.6 J
Vanadium	mg/Kg	26.2	100%	150	0	15	15	26.2	24.6	23.4	19.8	21.3
Zinc	mg/Kg	152	100%	110	3	15	15	110 J	93.7	87.9	102	**141**
Other Analyses												
Total Solids	%W/W	88	100%		0	15	15	72.9	78.2	69.3	78.8	63.9

NOTES:

a) NYSDEC Technical and Administrative Guidance Memorandum #4046, except as noted below.

b) US EPA, OSWER Directive # 9200.4-27 Soil Lead Guidance, August 1998

c) The TAGM value for PCBs is 1000ug/Kg for surface soils and 10,000 ug/Kg for subsurface soils.

* = As per proposed TAGM, total VOCs < 10ppm; total Semi-VOCs <500ppm; individual semi-VOCs < 50 ppm.
NA = Not Available
U = Compound was not detected.
J = the reported value is an estimated concentration.
R = the data was rejected in the data validating process.
UJ = the compound was not detected; the associated reporting limit is approximate.

TABLE 4
SEAD-50 / SEAD-54 SOIL SAMPLE ASBESTOS ANALYSIS RESULTS

SENECA ARMY DEPOT ACTIVITY
REMOVAL ACTION

ES Sample ID	Asbestos (% Type)	Other Material
SS50-1	10-15 % Chrysotile	Binder, Quartz, 3-5 % Organic Fiber
SS50-2	Not Detected	Binder, Quartz, 15-25 % Organic Fiber
SS50-3	Not Detected	Binder, Quartz, 10-15 % Organic Fiber
SS50-4	Not Detected	Binder, Quartz, 1-3 % Organic Fiber
SS50-5	Not Detected	Binder, Quartz, 15-25 % Organic Fiber
SS50-6	Not Detected	Binder, Quartz, 15-25 % Organic Fiber
SS50-7	Not Detected	Binder, Quartz, 15-25 % Organic Fiber
SS50-8	Not Detected	Binder, Quartz, 5-10 % Organic Fiber
SS50-9	Not Detected	Binder, Quartz, 35-45 % Organic Fiber
SS50-10	Not Detected	Binder, Quartz, 10-15 % Organic Fiber
SS50-11	Not Detected	Binder, Quartz, 10-15 % Organic Fiber
SS50-12	Not Detected	Binder, Quartz, 5-10 % Organic Fiber
SS50-13	Not Detected	Binder, Quartz, 10-15 % Organic Fiber
SS50-14	Not Detected	Binder, Quartz, 1-3 % Organic Fiber
SS50-15	Not Detected	Binder, Quartz, 5-10 % Organic Fiber
SS50-16	Not Detected	Binder, Quartz, 3-5 % Organic Fiber

for other metals were generally evenly distributed throughout the soil sampling locations and found at concentrations which did not significantly exceed their respective TAGMs.

Results for Asbestos in soil are provided in **Table 4**. Surface soil sample SS50-1 contained 10 to 15 percent Chrysotile asbestos. Asbestos was not found in any of the other surface soil samples collected from SEADs 50/54.

Groundwater

The results of the groundwater sampling program are presented in **Table 5**. Generally, the data indicate that groundwater at SEADs 50/54 has not been significantly impacted by the historic storage activities that were performed in this area. One semivolatile organic compound and 18 metals were detected in one or more of the groundwater samples collected. Concentrations measured for five of the metals (i.e., aluminum, iron, manganese, sodium and thallium) surpassed their respective groundwater criteria levels. Of these metals, only thallium, which was detected in one of the groundwater samples at a concentration of 3 ug/L and surpassed the US EPA's[5] MCL of 2 ug/L is of potential concern. However, thallium was not detected in soil samples collected from SEADs 50/54, and the groundwater in this area is not used as a source of drinking water. Also of note for the groundwater, is the finding that many of the highest concentrations reported were found in the sample collected from MW50-1, which is the upgradient well that was placed in the area.

Surface Water

The results of the ESI surface water sampling program are presented in **Table 6**. The results indicate that surface water at the site has not been significantly impacted by the historic storage activities that were conducted in SEADs 50/54. Only 15 metals were detected in the surface water samples collected, and only two of these metals (i.e., aluminum and iron) were found at a concentration that exceeded its NYS class C surface water criteria.

Sediment

Results from the sediment sampling program are presented in **Table 7**. These data indicate that sediment at SEADs 50/54 has been impacted by the historic activities conducted in the area.

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[5] US EPA, Office of Water, Drinking Water Standards and Advisories, EPA 822-B-00-001, Summer 2000.

TABLE 5
SEAD-50/54 GROUNDWATER ANALYSIS RESULTS

SENECA ARMY DEPOT ACTIVITY
REMOVAL ACTION

	MATRIX					WATER	WATER	WATER
	LOCATION					SEAD-50	SEAD-50	SEAD-50
	SAMPLE DATE					07/12/94	07/18/94	07/18/94
	ES ID					MW50-1	MW50-2	MW50-3
	LAB ID					226794	227267	227268
	SDG NUMBER					45332	45332	45332
PARAMETER	**UNITS**	**MAXIMUM DETECT**	**FREQUENCY OF DETECTION**	**CRITERIA VALUE (a)**	**NUMBER ABOVE CRITERIA**	Value (Q)	Value (Q)	Value (Q)
SEMIVOLATILE ORGANICS								
Di-n-octylphthalate	ug/L	5	100%	50	0	10 U	10 U	5 J
METALS								
Aluminum	ug/L	1790	100%	50 (b)	2	**1790** J	**137** J	19.6 J
Arsenic	ug/L	2.2	100%	5 (b)	0	2.2 J	2 U	2 U
Barium	ug/L	96.5	100%	1000	0	50.8 J	68.9 J	96.5 J
Calcium	ug/L	153000	100%	NA	NA	153000	113000	113000
Chromium	ug/L	3	100%	50	0	3 J	0.4 U	0.4 U
Cobalt	ug/L	4.9	100%	NA	NA	4.9 J	1.6 J	0.62 J
Copper	ug/L	1.4	100%	200	0	1.4 J	0.5 U	0.5 U
Iron	ug/L	5070	100%	300	2	**5070**	**1400**	206
Magnesium	ug/L	40200	100%	NA	NA	40200	20800	16900
Manganese	ug/L	1040	100%	50 (c)	3	**1040**	**791**	**317**
Mercury	ug/L	0.05	100%	0.7	0	0.05 J	0.04 U	0.04 U
Nickel	ug/L	8	100%	100	0	8 J	2 J	0.69 U
Potassium	ug/L	10400	100%	NA	NA	4460 J	5770 J	10400 J
Silver	ug/L	0.76	100%	50	0	0.5 U	0.75 J	0.76 J
Sodium	ug/L	91200	100%	20000	2	**22700**	**91200**	10000
Thallium	ug/L	3	100%	2 (b)	1	1.9 J	**3** J	1.9 U
Vanadium	ug/L	3	100%	NA	NA	3 J	0.5 U	0.54 J
Zinc	ug/L	20.2	100%	5000 (c)	0	20.2	2.4 J	2.2 U
OTHER ANALYSES								
pH	Standard Units					6.9	7	7.2
Conductivity	umhos/cm					820	900	580
Temperature	°C					17	17.9	18.7
Turbidity	NTU					160	27.7	1.5

NOTES:

a) NY State Class GA Groundwater Standard (TOGS 1.1.1, June 1998), except as noted below.
b) US EPA Maximum Contaminant Limit (EPA 822-B-00-001, Summer 2000)
c) US EPA Secondary Drinking Water Regulation, non-enforceable (EPA 822-B-00-001, Summer 2000)
NA = Not Available
U = compound was not detected
J = the report value is an estimated concentration
UJ = the compound was not detected; the associated reporting limit is approximate
R = the data was rejected in the data validating process

TABLE 6
SEAD-50 / SEAD-54 SURFACE WATER ANALYSIS RESULTS

SENECA ARMY DEPOT ACTIVITY
REMOVAL ACTION

	MATRIX					WATER	WATER	WATER
	LOCATION					SEAD-50	SEAD-50	SEAD-50
	SAMPLE DATE					04/19/94	04/19/94	04/19/94
	ES ID			NYS		SW50-1	SW50-2	SW50-3
	LAB ID		FREQUENCY	CRITERIA	NUMBER	218499	218500	218501
	SDG NUMBER	MAXIMUM	OF	VALUE	ABOVE	43626	43626	43626
PARAMETER	**UNITS**	**DETECT**	**DETECTION**	**(a,b)**	**CRITERIA**	Value (Q)	Value (Q)	Value (Q)
METALS								
Aluminum	ug/L	376	100%	100	1	**376**	63.1 J	68.2 J
Arsenic	ug/L	22.1	67%	150	0	22.1	4.5 J	1.5 U
Barium	ug/L	34.3	100%	NA	NA	33.4 J	34.3 J	21.9 J
Calcium	ug/L	85200	100%	NA	NA	82700	85200	43400
Chromium	ug/L	1.3	67%	139.5	0	0.88 J	0.4 U	1.3 J
Copper	ug/L	2.1	100%	17.3	0	2.1 J	1.1 J	1.8 J
Iron	ug/L	575	100%	300	1	**575**	91.8 J	121
Lead	ug/L	0.89	33%	1.46	0	0.89 J	0.8 U	0.8 U
Magnesium	ug/L	13200	100%	NA	NA	12300	13200	8660
Manganese	ug/L	67.9	100%	NA	NA	67.9	6.6 J	7.1 J
Nickel	ug/L	1.7	67%	99.9	0	1.7 J	0.6 U	0.83 J
Potassium	ug/L	3140	100%	NA	NA	3140 J	1210 J	822 J
Sodium	ug/L	11200	100%	NA	NA	1890 J	11000	11200
Vanadium	ug/L	1.1	33%	14	0	1.1 J	0.7 U	0.7 U
Zinc	ug/L	10.5	100%	159.2	0	10.5 J	8.1 J	1.5 J
OTHER ANALYSES								
pH	Standard Units						7.7	8.4
Conductivity	umhos/cm						450	260
Temperature	°C						15.7	16
Turbidity	NTU						5.1	1.6

NOTES:

a) The New York State Ambient Water Quality Standards and Guidance Values for Class C surface water (June 1998).
b) Hardness dependent values assume a hardness of 216.4 mg/L (depot site-wide average).
c) NA = Not Available
d) U = The compound was not detected below this concentration.
e) J = The reported value is an estimated concentration.

TABLE 7
SEAD-50 / SEAD-54 SEDIMENT ANALYSIS RESULTS

SENECA ARMY DEPOT ACTIVITY
REMOVAL ACTION

PARAMETER	MATRIX LOCATION DEPTH (FEET) SAMPLE DATE ES ID LAB ID SDG NUMBER UNITS	MAXIMUM DETECT	FREQUENCY OF DETECTION	CRITERIA VALUE (a)	CRITERIA TYPE (b,c)	NUMBER ABOVE CRITERIA	NUMBER OF DETECTS	NUMBER OF ANALYSES	SOIL SEAD-50 0-0.2 04/19/94 SD50-1 218502 43663 Value (Q)	SOIL SEAD-50 0-0.2 04/19/94 SD50-2 218503 43663 Value (Q)	SOIL SEAD-50 0-0.2 04/19/94 SD50-3 218504 43663 Value (Q)
VOLATILE ORGANICS											
2-Butanone	ug/Kg	11	33%				1	3	11 J	21 UJ	13 U
SEMIVOLATILE ORGANICS											
4-Methylphenol	ug/Kg	110	67%				2	3	44 J	110 J	420 U
Acenaphthene	ug/Kg	160	33%	5475	BALCT	0	1	3	160 J	690 UJ	420 U
Anthracene	ug/Kg	480	33%	4184	BALCT	0	1	3	480 J	690 UJ	420 U
Benzo(a)anthracene	ug/Kg	1400	100%	50.8	HHBC	2	3	3	**1400**	**120** J	44 J
Benzo(a)pyrene	ug/Kg	1200	100%	50.8	HHBC	3	3	3	**1200**	**160** J	**58** J
Benzo(b)fluoranthene	ug/Kg	1300	100%	50.8	HHBC	3	3	3	**1300**	**160** J	**51** J
Benzo(g,h,i)perylene	ug/Kg	790	100%				3	3	790	120 J	42 J
Benzo(k)fluoranthene	ug/Kg	1200	100%	50.8	HHBC	3	3	3	**1200**	**160** J	**69** J
Carbazole	ug/Kg	250	33%				1	3	250 J	690 UJ	420 U
Chrysene	ug/Kg	1500	100%	50.8	HHBC	3	3	3	**1500**	**170** J	**60** J
Dibenz(a,h)anthracene	ug/Kg	260	33%				1	3	260 J	690 UJ	420 U
Dibenzofuran	ug/Kg	97	33%				1	3	97 J	690 UJ	420 U
Fluoranthene	ug/Kg	3500	100%	39887	BALCT	0	3	3	3500	310 J	94 J
Fluorene	ug/Kg	310	33%	312.8	BALCT	0	1	3	310 J	690 UJ	420 U
Indeno(1,2,3-cd)pyrene	ug/Kg	770	100%	50.83	HHBC	2	3	3	**770**	**120** J	38 J
Phenanthrene	ug/Kg	2700	100%	4693	BALCT	0	3	3	2700	140 J	35 J
Pyrene	ug/Kg	4000	100%	37580	BALCT	0	3	3	4000	300 J	83 J
PESTICIDES/PCB											
4,4'-DDE	ug/Kg	4.3	33%	0.39	HHBC	1	1	3	**4.3** J	6.9 UJ	4.2 U
Aldrin	ug/Kg	2.2	33%	3.9	HHBC	0	1	3	2.2 J	3.5 UJ	2.2 U
alpha-Chlordane	ug/Kg	8	33%	0.039	HHBC	1	1	3	**8** J	3.5 UJ	2.2 U
Aroclor-1242	ug/Kg	120	33%	0.031	HHBC	1	1	3	**120**	69 UJ	42 U
Aroclor-1260	ug/Kg	56	33%	0.031	HHBC	1	1	3	**56** J	69 UJ	42 U
Endosulfan I	ug/Kg	15	67%	1.17	HHBC	2	2	3	**15** J	**3** J	2.2 U
METALS											
Aluminum	mg/Kg	16300	100%				3	3	16300	11000 J	10300
Antimony	mg/Kg	3.3	100%	2	LEL	1	3	3	**3.3** J	0.55 J	0.24 J
Arsenic	mg/Kg	62.7	100%	6	LEL	2	3	3	**62.7**	**27.5** J	4.1
Barium	mg/Kg	117	100%				3	3	108	117 J	62.9
Beryllium	mg/Kg	0.75	100%				3	3	0.75 J	0.53 J	0.48 J
Cadmium	mg/Kg	0.8	100%	0.6	LEL	1	3	3	0.57 J	**0.8** J	0.23 J
Calcium	mg/Kg	31400	100%				3	3	7570	14800 J	31400
Chromium	mg/Kg	25.1	100%	26	LEL	0	3	3	25.1	23.3 J	15.9
Cobalt	mg/Kg	9.3	100%				3	3	9.3 J	8.7 J	8.1
Copper	mg/Kg	25.5	100%	16	LEL	3	3	3	**25.5**	**18.9** J	**19.9**
Iron	mg/Kg	26800	100%	20000	LEL	2	3	3	**26800**	**20500** J	19700
Lead	mg/Kg	49.6	100%	31	LEL	1	3	3	**49.6**	25.5 J	10.8
Magnesium	mg/Kg	6400	100%				3	3	4980	3780 J	6400
Manganese	mg/Kg	1380	100%	460	LEL	1	3	3	284 J	**1380** J	390 J
Mercury	mg/Kg	0.02	100%	0.15	LEL	0	1	1	0.05 JR	0.08 JR	0.02 J

TABLE 7
SEAD-50 / SEAD-54 SEDIMENT ANALYSIS RESULTS

SENECA ARMY DEPOT ACTIVITY
REMOVAL ACTION

	MATRIX								SOIL		SOIL		SOIL	
	LOCATION								SEAD-50		SEAD-50		SEAD-50	
	DEPTH (FEET)								0-0.2		0-0.2		0-0.2	
	SAMPLE DATE								04/19/94		04/19/94		04/19/94	
	ES ID								SD50-1		SD50-2		SD50-3	
	LAB ID		**FREQUENCY**			**NUMBER**	**NUMBER**	**NUMBER**	218502		218503		218504	
	SDG NUMBER	**MAXIMUM**	**OF**	**CRITERIA**	**CRITERIA**	**ABOVE**	**OF**	**OF**	43663		43663		43663	
PARAMETER	**UNITS**	**DETECT**	**DETECTION**	**VALUE (a)**	**TYPE (b,c)**	**CRITERIA**	**DETECTS**	**ANALYSES**	Value	(Q)	Value	(Q)	Value	(Q)
Nickel	mg/Kg	29.4	100%	16	LEL	3	3	3	**29.4**		**27.4**	J	**24.4**	
Potassium	mg/Kg	2530	100%				3	3	2530		1680	J	1580	
Sodium	mg/Kg	121	67%				2	3	45.1	U	121	J	69.7	J
Vanadium	mg/Kg	28.8	100%				3	3	28.8		20.3	J	17.3	
Zinc	mg/Kg	243	100%	120	LEL	2	2	3	**202**		**243**	J	63.9	
OTHER ANALYSES														
Total Solids	%W/W	78.7						3	54.5		48		78.7	

NOTES:

a) NYSDEC Technical Guidance for Screeing Contaminated Sediments - January 1999

b) BALCT = Benthic Aquatic Life Chronic Toxicity Criteria; HHBC = Human Health Bioaccumulation Criteria; LEL = Lowest Effect Level

c) All organic criteria values derived based on assumed Total Organic Carbon content of 39,105 mg/Kg (depot average value)

U = The compound was not detected below this concentration.

J = The reported value is an estimated concentration.

UJ = The compound may have been present above this concentration,
but was not detected dut to problems with the analysis.

R = The data was rejected during the data validation process.

Forty-four TCL/TAL, including one volatile organic compound, 17 semivolatile organic compounds, six pesticides and PCBs and 20 metals were detected in samples collected. Of the compounds detected, 20 were detected at concentrations that exceeded their respective NYSDEC sediment criteria levels.

The PAH compounds benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and chrysene were found at concentrations above their respective sediment criteria values in all three of the sediment samples collected from SEADs 50/54. Two additional PAH compounds, benzo(a)pyrene and indeno(1,2,3-cd)pyrene, were detected in two of the three samples at concentrations above their respective criteria levels.

All six pesticides/PCB compounds were detected in the sediment sample collected from location SD50-1, and of the six detect, five (i.e., endosulfan I, 4,4'-DDE, alpha-Chlordane, aroclor-1242 and aroclor-1260) were found at concentrations that exceeded their respective sediment criteria (i.e., human health bioaccumulation criteria) values. The concentration of endosulfan I measured as sampling location SD50-2 also was found to exceed the human health bioaccumulation criteria. None of the other pesticides/PCBs were detected in other sediment samples.

Nine metals (i.e., antimony, arsenic, cadmium, copper, iron, lead manganese, nickel and zinc) were detected in sediment samples at concentrations that exceeded NYSDEC sediment criteria values. Seven (i.e., excluding cadmium and manganese) of the listed metals were found at concentrations that exceeded their sediment criteria levels at sampling location SD50-1, while seven (excluding antimony and lead) were found at concentration above criteria levels at location SD50-2. Generally, a majority (i.e., 12 of the 20) of the metals detected were found at their highest concentration in the sediment sample collected from location SD50-1.

1.2.2.3 SEAD-67

An Expanded Site Inspection of SEAD-67 was performed in 1993 to determine whether a release of hazardous constituents had occurred. The survey combined non-intrusive and intrusive sampling operations.

Non-intrusive investigations included seismic refraction, electromagnetic, and ground penetrating radar surveys. The seismic refraction survey was performed to determine the direction of groundwater flow. EM-31 and ground penetrating radar surveys were performed to

TABLE 8
SEAD-67 SOIL ANALYSIS RESULTS

SENECA ARMY DEPOT ACTIVITY
REMOVAL ACTION

	MATRIX							SOIL	SOIL	SOIL	SOIL
	LOCATION							SEAD-67	SEAD-67	SEAD-67	SEAD-67
	DEPTH (FEET)							0-0.2	2-4	4-5	2-3
	SAMPLE DATE							03/30/94	03/30/94	03/30/94	06/06/94
	ES ID							MW67-2.00	MW67-2.02	MW67-2.03	TP67-1
	LAB ID		FREQUENCY		NUMBER	NUMBER	NUMBER	216109	216112	216113	223303
	SDG NUMBER	MAXIMUM	OF	CRITERIA	ABOVE	OF	OF	43257	43257	43257	44410
PARAMETER	**UNITS**	**DETECT**	**DETECTION**	**VALUE (a)**	**CRITERIA**	**DETECTS**	**SAMPLES**	Value (Q)	Value (Q)	Value (Q)	Value (Q)
Semivolatile Organics											
2-Methylnaphthalene	ug/Kg	44	25%	36400	0	2	8	480 U	380 U	370 U	44 J
Acenaphthene	ug/Kg	50	13%	50000*	0	1	8	480 U	380 U	370 U	50 J
Acenaphthylene	ug/Kg	210	50%	41000	0	4	8	480 U	380 U	370 U	38 J
Anthracene	ug/Kg	140	50%	50000*	0	4	8	480 U	380 U	370 U	97 J
Benzo(a)anthracene	ug/Kg	610	63%	220	4	5	8	480 U	380 U	370 U	**280** J
Benzo(a)pyrene	ug/Kg	830	63%	61	4	5	8	480 U	380 U	370 U	**210** J
Benzo(b)fluoranthene	ug/Kg	1300	63%	1100	1	5	8	480 U	380 U	370 U	440 J
Benzo(g,h,i)perylene	ug/Kg	620	63%	50000*	0	5	8	480 U	380 U	370 U	64 J
Benzo(k)fluoranthene	ug/Kg	28	13%	1100	0	1	8	480 U	380 U	370 U	390 UJ
bis(2-Ethylhexyl)phthalate	ug/Kg	250	38%	50000*	0	3	8	480 U	250 J	230 J	29 J
Carbazole	ug/Kg	80	38%	50000*	0	3	8	480 U	380 U	370 U	80 J
Chrysene	ug/Kg	690	63%	400	1	5	8	480 U	380 U	370 U	300 J
Dibenz(a,h)anthracene	ug/Kg	310	50%	14	4	4	8	480 U	380 U	370 U	**70** J
Dibenzofuran	ug/Kg	50	13%	6200	0	1	8	480 U	380 U	370 U	50 J
Di-n-butylphthalate	ug/Kg	47	13%	8100	0	1	8	480 U	47 J	370 U	390 U
Fluoranthene	ug/Kg	860	75%	50000*	0	6	8	36 J	380 U	370 U	760
Fluorene	ug/Kg	110	38%	50000*	0	3	8	480 U	380 U	370 U	110 J
Indeno(1,2,3-cd)pyrene	ug/Kg	620	63%	3200	0	5	8	480 U	380 U	370 U	96 J
Naphthalene	ug/Kg	34	25%	13000	0	2	8	480 U	380 U	370 U	34 J
Phenanthrene	ug/Kg	740	63%	50000*	0	5	8	480 U	380 U	370 U	740
Pyrene	ug/Kg	950	75%	50000*	0	6	8	31 J	380 U	370 U	520
Pesticides/PCB											
4,4'-DDE	ug/Kg	4.8	50%	2100	0	4	8	4.8 U	3.8 U	3.7 U	2.3 J
4,4'-DDT	ug/Kg	9.4	38%	2100	0	3	8	4.8 U	3.8 U	3.7 U	3.9 U
alpha-Chlordane	ug/Kg	2.1	38%	540	0	3	8	2.5 U	2 U	1.9 U	2 U
Aroclor-1254	ug/Kg	72	13%	1000	0	1	8	48 U	38 U	37 U	39 U
Endosulfan I	ug/Kg	25	75%	900	0	6	8	4	2 U	1.9 U	3.2 J
Endosulfan sulfate	ug/Kg	2.1	13%	1000	0	1	8	4.8 U	3.8 U	3.7 U	3.9 U
Heptachlor epoxide	ug/Kg	5.5	25%	20	0	2	8	5.5	2 U	1.9 U	2 U
Metals											
Aluminum	mg/Kg	19100	100%	19300	0	8	8	16700	14900	9460	16100
Antimony	mg/Kg	0.44	63%	5.9	0	5	8	0.27 J	0.22 J	0.2 UJ	0.26 UJ
Arsenic	mg/Kg	6	100%	8.2	0	8	8	4.4	4.5	4.2	4.8
Barium	mg/Kg	182	100%	300	0	8	8	114	105	80.8	96.7
Beryllium	mg/Kg	0.87	100%	1.1	0	8	8	0.67 J	0.61 J	0.4 J	0.74 J
Cadmium	mg/Kg	0.73	100%	2.3	0	8	8	0.2 J	0.11 J	0.12 J	0.46 J
Calcium	mg/Kg	139000	100%	121000	1	8	8	3580	79000	77800	6810
Chromium	mg/Kg	24.8	100%	29.6	0	8	8	19.5	22.5	14.8	22.2
Cobalt	mg/Kg	12.8	100%	30	0	8	8	7.5 J	10.4 J	9.7 J	10.7
Copper	mg/Kg	29.7	100%	33	0	8	8	16.5	20.3	20.5	22
Iron	mg/Kg	27300	100%	36500	0	8	8	20500	24400	18700	26000
Lead	mg/Kg	40.9	100%	400 (b)	0	8	8	17.5	9.3	8.5	12.8
Magnesium	mg/Kg	20900	100%	21500	0	8	8	3590	15600	20900	4760
Manganese	mg/Kg	1380	100%	1060	1	8	8	438	528	411	594
Mercury	mg/Kg	4	100%	0.1	3	8	8	0.04	0.01 J	0.02 J	4 J

TABLE 8
SEAD-67 SOIL ANALYSIS RESULTS

SENECA ARMY DEPOT ACTIVITY
REMOVAL ACTION

	MATRIX							SOIL	SOIL	SOIL	SOIL
	LOCATION							SEAD-67	SEAD-67	SEAD-67	SEAD-67
	DEPTH (FEET)							0-0.2	2-4	4-5	2-3
	SAMPLE DATE							03/30/94	03/30/94	03/30/94	06/06/94
	ES ID							MW67-2.00	MW67-2.02	MW67-2.03	TP67-1
	LAB ID		FREQUENCY		NUMBER	NUMBER	NUMBER	216109	216112	216113	223303
	SDG NUMBER	MAXIMUM	OF	CRITERIA	ABOVE	OF	OF	43257	43257	43257	44410
PARAMETER	**UNITS**	**DETECT**	**DETECTION**	**VALUE (a)**	**CRITERIA**	**DETECTS**	**SAMPLES**	Value (Q)	Value (Q)	Value (Q)	Value (Q)
Nickel	mg/Kg	32.3	100%	49	0	8	8	18.7	32.3	25.9	27.8
Potassium	mg/Kg	3160	100%	2380	2	8	8	1780 J	**3160** J	1970 J	1620 J
Selenium	mg/Kg	2	75%	2	0	6	8	0.81	0.36 U	0.34 U	1
Sodium	mg/Kg	112	75%	172	0	6	8	25.1 U	112 J	107 J	19.9 U
Thallium	mg/Kg	0.48	13%	0.7	0	1	8	0.48 J	0.34 U	0.32 U	0.38 U
Vanadium	mg/Kg	31.8	100%	150	0	8	8	28.2	24.8	16.5	26.5
Zinc	mg/Kg	100	100%	110	0	8	8	64.8	62	60.1	70.5
Other Analyses											
Total Solids	%W/W	90.2	1		0	8	8	68.9	85.5	90.2	83.8

NOTES:

a) NYSDEC Technical and Administrative Guidance Memorandum #4046, except as noted below.

b) US EPA, OSWER Directive # 9200.4-27 Soil Lead Guidance, August 1998

* = As per proposed TAGM, total VOCs < 10ppm; total Semi-VOCs <500ppm; individual semi-VOCs < 50 ppm.

NA = Not Available

U = Compound was not detected.

J = the reported value is an estimated concentration.

R = the data was rejected in the data validating process.

UJ = the compound was not detected; the associated reporting limit is approximate.

TABLE 8
SEAD-67 SOIL ANALYSIS RESULTS

SENECA ARMY DEPOT ACTIVITY
REMOVAL ACTION

	MATRIX							SOIL	SOIL	SOIL	SOIL
	LOCATION							SEAD-67	SEAD-67	SEAD-67	SEAD-67
	DEPTH (FEET)							2-3	2-3	2-3	2-3
	SAMPLE DATE							06/06/94	06/06/94	06/06/94	06/06/94
	ES ID							TP67-2	TP67-3	TP67-4	TP67-5
	LAB ID		FREQUENCY		NUMBER	NUMBER	NUMBER	223305	223306	223307	223308
	SDG NUMBER	MAXIMUM	OF	CRITERIA	ABOVE	OF	OF	44410	44410	44410	44410
PARAMETER	UNITS	DETECT	DETECTION	VALUE (a)	CRITERIA	DETECTS	SAMPLES	Value (Q)	Value (Q)	Value (Q)	Value (Q)
Semivolatile Organics											
2-Methylnaphthalene	ug/Kg	44	25%	36400	0	2	8	380 U	25 J	400 U	450 U
Acenaphthene	ug/Kg	50	13%	50000*	0	1	8	380 U	380 U	400 U	450 U
Acenaphthylene	ug/Kg	210	50%	41000	0	4	8	33 J	210 J	400 U	26 J
Anthracene	ug/Kg	140	50%	50000*	0	4	8	44 J	140 J	400 U	43 J
Benzo(a)anthracene	ug/Kg	610	63%	220	4	5	8	**250** J	**610**	24 J	**240** J
Benzo(a)pyrene	ug/Kg	830	63%	61	4	5	8	**220** J	**830**	28 J	**220** J
Benzo(b)fluoranthene	ug/Kg	1300	63%	1100	1	5	8	470 J	**1300** J	26 J	430 J
Benzo(g,h,i)perylene	ug/Kg	620	63%	50000*	0	5	8	93 J	620	40 J	97 J
Benzo(k)fluoranthene	ug/Kg	28	13%	1100	0	1	8	380 UJ	380 UJ	28 J	450 UJ
bis(2-Ethylhexyl)phthalate	ug/Kg	250	38%	50000*	0	3	8	380 U	380 U	400 U	450 U
Carbazole	ug/Kg	80	38%	50000*	0	3	8	23 J	380 U	400 U	32 J
Chrysene	ug/Kg	690	63%	400	1	5	8	290 J	**690**	29 J	230 J
Dibenz(a,h)anthracene	ug/Kg	310	50%	14	4	4	8	**53** J	**310** J	400 U	**65** J
Dibenzofuran	ug/Kg	50	13%	6200	0	1	8	380 U	380 U	400 U	450 U
Di-n-butylphthalate	ug/Kg	47	13%	8100	0	1	8	380 U	380 U	400 U	450 U
Fluoranthene	ug/Kg	860	75%	50000*	0	6	8	610	860	55 J	510
Fluorene	ug/Kg	110	38%	50000*	0	3	8	31 J	380 U	400 U	27 J
Indeno(1,2,3-cd)pyrene	ug/Kg	620	63%	3200	0	5	8	120 J	620	25 J	130 J
Naphthalene	ug/Kg	34	25%	13000	0	2	8	380 U	34 J	400 U	450 U
Phenanthrene	ug/Kg	740	63%	50000*	0	5	8	340 J	180 J	32 J	280 J
Pyrene	ug/Kg	950	75%	50000*	0	6	8	500	950	43 J	450
Pesticides/PCB											
4,4'-DDE	ug/Kg	4.8	50%	2100	0	4	8	4.5 J	4.8 J	4 U	3 J
4,4'-DDT	ug/Kg	9.4	38%	2100	0	3	8	6.3 J	9.4	4 U	4.2 J
alpha-Chlordane	ug/Kg	2.1	38%	540	0	3	8	1.4 J	2.1 J	2.1 U	1.9 J
Aroclor-1254	ug/Kg	72	13%	1000	0	1	8	72 J	38 U	40 U	45 U
Endosulfan I	ug/Kg	25	75%	900	0	6	8	11 J	25 J	1.2 J	15 J
Endosulfan sulfate	ug/Kg	2.1	13%	1000	0	1	8	3.8 U	2.1 J	4 U	4.5 U
Heptachlor epoxide	ug/Kg	5.5	25%	20	0	2	8	2 U	1.2 J	2.1 U	2.3 U
Metals											
Aluminum	mg/Kg	19100	100%	19300	0	8	8	12200	9870	19100	17200
Antimony	mg/Kg	0.44	63%	5.9	0	5	8	0.27 J	0.44 J	0.39 J	0.32 UJ
Arsenic	mg/Kg	6	100%	8.2	0	8	8	5.4	5	6	4.9
Barium	mg/Kg	182	100%	300	0	8	8	105	82.2	158	182
Beryllium	mg/Kg	0.87	100%	1.1	0	8	8	0.62 J	0.49 J	0.87 J	0.83 J
Cadmium	mg/Kg	0.73	100%	2.3	0	8	8	0.5 J	0.69 J	0.69 J	0.73 J
Calcium	mg/Kg	139000	100%	121000	1	8	8	5940	**139000**	12000	20100
Chromium	mg/Kg	24.8	100%	29.6	0	8	8	18.7	15.1	24.8	23.2
Cobalt	mg/Kg	12.8	100%	30	0	8	8	9.5	7.5	11	12.8
Copper	mg/Kg	29.7	100%	33	0	8	8	21.3	21.5	29.7	24.5
Iron	mg/Kg	27300	100%	36500	0	8	8	24000	16800	27300	27300
Lead	mg/Kg	40.9	100%	400 (b)	0	8	8	21.3	40.9	19.1	12
Magnesium	mg/Kg	20900	100%	21500	0	8	8	4730	12900	6660	5010
Manganese	mg/Kg	1380	100%	1060	1	8	8	624	627	863	**1380**
Mercury	mg/Kg	4	100%	0.1	3	8	8	0.05 J	**0.62** J	**0.13** J	0.06 J

TABLE 8
SEAD-67 SOIL ANALYSIS RESULTS

SENECA ARMY DEPOT ACTIVITY
REMOVAL ACTION

	MATRIX							SOIL	SOIL	SOIL	SOIL
	LOCATION							SEAD-67	SEAD-67	SEAD-67	SEAD-67
	DEPTH (FEET)							2-3	2-3	2-3	2-3
	SAMPLE DATE							06/06/94	06/06/94	06/06/94	06/06/94
	ES ID							TP67-2	TP67-3	TP67-4	TP67-5
	LAB ID		FREQUENCY		NUMBER	NUMBER	NUMBER	223305	223306	223307	223308
	SDG NUMBER	**MAXIMUM**	OF	CRITERIA	ABOVE	OF	OF	44410	44410	44410	44410
PARAMETER	**UNITS**	**DETECT**	**DETECTION**	**VALUE (a)**	**CRITERIA**	**DETECTS**	**SAMPLES**	Value (Q)	Value (Q)	Value (Q)	Value (Q)
Nickel	mg/Kg	32.3	100%	49	0	8	8	27.2	22	30.1	30.2
Potassium	mg/Kg	3160	100%	2380	2	8	8	1390 J	2090 J	**2520** J	2040 J
Selenium	mg/Kg	2	75%	2	0	6	8	1.1	0.41 J	1.2	2
Sodium	mg/Kg	112	75%	172	0	6	8	26.4 J	111 J	39.4 J	26.1 J
Thallium	mg/Kg	0.48	13%	0.7	0	1	8	0.34 U	0.28 U	0.41 U	0.47 U
Vanadium	mg/Kg	31.8	100%	150	0	8	8	22.7	20.9	31.8	27.8
Zinc	mg/Kg	100	100%	110	0	8	8	70.5	72.8	100	86.6
Other Analyses											
Total Solids	%W/W	90.2	1		0	8	8	86.4	86.3	82	73.5

NOTES:

a) NYSDEC Technical and Administrative Guidance Memorandum #4046, except as noted below.

b) US EPA, OSWER Directive # 9200.4-27 Soil Lead Guidance, August 1998

* = As per proposed TAGM, total VOCs < 10ppm; total Semi-VOCs <500ppm; individual semi-VOCs < 50 ppm.

NA = Not Available

U = Compound was not detected.

J = the reported value is an estimated concentration.

R = the data was rejected in the data validating process.

UJ = the compound was not detected; the associated reporting limit is approximate.

(PAHs), and the metal, mercury. A total of 50 TCL/TAL compounds were detected in soil samples that were submitted for analysis, and of this total, 10 were detected at concentrations that exceeded their respective TAGM criteria levels. None of the recorded TAGM exceedences were found for pesticides or PCBs.

Five semivolatile organic compounds, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(a)pyrene, and dibenz(a,h)anthracene, were found at concentrations above their respective TAGM values. All of the noted PAH exceedences were found in samples collected from the test pits, and the majority of these occurred in samples recovered from the northern and central portions of the berm structure. However, soil samples collected from the two waste piles also showed results for PAHs that surpassed their respective TAGM levels.

Four metals (i.e., calcium, manganese, mercury, and potassium) were also detected at concentrations exceeding their respective criteria values. Most of the samples that contained metals concentrations that surpassed criteria levels were collected from the test pits that were advanced through the berm structure and the two waste piles. Of further note, is the finding that the majority of individual metal concentrations found above their respective criteria value were located in the excavation advanced through the central and southern end of the berm structure.

The only concentration found for a metal that is of particular note is the level reported for mercury in the sample recovered from TP67-1 (4 mg/kg). This value is 40 times above the TAGM value for mercury which is 0.1 mg/kg. The next highest mercury concentration was 0.62 mg/kg found in sample TP67-3.

Groundwater

The results of the groundwater sampling program are presented in **Table 9**. These data indicate that groundwater has not been significantly impacted by historic operations at SEAD-67. Nineteen metals were the only analytes detected in the groundwater samples, and of these, only aluminum, iron, and manganese were detected at concentrations exceeding their criteria values. Aluminum, iron and magnesium are not considered to pose significant health risks.

Surface Water

The results of the surface water sampling program are presented in **Table 10**. These data indicate that surface water has not been significantly impacted by any of the constituents of concern in the investigation at SEAD-67. Again, metals were the only analytes detected in the

TABLE 9
SEAD-67 GROUNDWATER ANALYSIS RESULTS

SENECA ARMY DEPOT ACTIVITY
REMOVAL ACTION

	MATRIX					WATER	WATER	WATER
	LOCATION					SEAD-67	SEAD-67	SEAD-67
	SAMPLE DATE					07/07/94	07/10/94	07/08/94
	ES ID					MW67-1	MW67-2	MW67-3
	LAB ID					226307	226488	226308
	SDG NUMBER					45257	45282	45257
PARAMETER	**UNITS**	**MAXIMUM DETECT**	**FREQUENCY OF DETECTION**	**CRITERIA VALUE (a)**	**NUMBER ABOVE CRITERIA**	Value (Q)	Value (Q)	Value (Q)
METALS								
Aluminum	ug/L	5790	100%	50 (b)	3	**5790**	**1240**	**448**
Arsenic	ug/L	2.5	33%	5 (b)	0	2.5 J	2 U	2 U
Barium	ug/L	203	100%	1000	0	203	100 J	98.9 J
Beryllium	ug/L	0.72	33%	4 (b)	0	0.72 J	0.1 U	0.1 U
Calcium	ug/L	351000	100%	NA	NA	351000	119000	122000
Chromium	ug/L	10	100%	50	0	10	2 J	0.9 J
Cobalt	ug/L	12.3	100%	NA	NA	12.3 J	1.4 J	1.3 J
Copper	ug/L	13.1	100%	200	0	13.1 J	1.5 J	2 J
Iron	ug/L	10800	100%	300	3	**10800**	**2270**	**689**
Lead	ug/L	8.3	33%	15 (b)	0	8.3	0.9 U	0.9 U
Magnesium	ug/L	51800	100%	NA	NA	51800	24200	24000
Manganese	ug/L	1710	100%	50 (c)	3	**1710**	**153**	**194**
Mercury	ug/L	0.09	67%	0.7	0	0.09 J	0.04 U	0.06 J
Nickel	ug/L	15.9	100%	100	0	15.9 J	2.9 J	2.2 J
Potassium	ug/L	5740	100%	NA	NA	5740	1870 J	1670 J
Sodium	ug/L	13700	100%	20000	0	4240 J	13700	4970 J
Thallium	ug/L	2	33%	2 (b)	0	2 J	1.9 U	1.9 U
Vanadium	ug/L	9.2	100%	NA	NA	9.2 J	2.1 J	0.86 J
Zinc	ug/L	29.6	100%	5000 (c)	0	29.6	6.5 J	6.7 J
OTHER ANALYSES								
pH	Standard Units					7.2	7	7
Conductivity	umhos/cm					520	490	440
Temperature	°C					14.9	12	11.9
Turbidity	NTU					>1000	90	NR

NOTES:

a) NY State Class GA Groundwater Standard (TOGS 1.1.1, June 1998), except as noted below.
b) US EPA Maximum Contaminant Limit (EPA 822-B-00-001, Summer 2000)
c) US EPA Secondary Drinking Water Regulation, non-enforceable (EPA 822-B-00-001, Summer 2000)
NA = Not Available
U = compound was not detected
J = the report value is an estimated concentration
UJ = the compound was not detected; the associated reporting limit is approximate
R = the data was rejected in the data validating process

TABLE 10
SEAD-67 SURFACE WATER ANALYSIS RESULTS

SENECA ARMY DEPOT ACTIVITY
REMOVAL ACTION

	MATRIX					WATER	WATER
	LOCATION					SEAD-67	SEAD-67
	SAMPLE DATE					04/26/94	04/26/94
	ES ID			NYS		SW67-1	SW67-2
	LAB ID		FREQUENCY	CRITERIA	NUMBER	219464	219465
	SDG NUMBER	MAXIMUM	OF	VALUE	ABOVE	43810	43810
PARAMETER	**UNITS**	**DETECT**	**DETECTION**	**(a,b)**	**CRITERIA**	Value (Q)	Value (Q)
METALS							
Aluminum	ug/L	129	100%	100	1	**129** J	38.1 J
Barium	ug/L	45.8	100%	NA	NA	45.8 J	45.6 J
Calcium	ug/L	77100	100%	NA	NA	77100	75900
Copper	ug/L	1.1	100%	17.3	0	1.1 J	0.86 J
Iron	ug/L	369	100%	300	1	**369**	84.6 J
Magnesium	ug/L	14700	100%	NA	NA	14100	14700
Manganese	ug/L	161	100%	NA	NA	161	37.7
Potassium	ug/L	1160	100%	NA	NA	1160 J	1120 J
Sodium	ug/L	7860	100%	NA	NA	5830	7860
Thallium	ug/L	2.1	50%	8	0	1.6 U	2.1 J
Zinc	ug/L	3.3	100%	159.2	0	2.4 J	3.3 J
OTHER ANALYSES							
pH	Standard Units			6.5 - 9	0	7.9	7.5
Conductivity	umhos/cm					445	440
Temperature	°C					21.4	22.7
Turbidity	NTU					1.4	1.6

NOTES:

a) The New York State Ambient Water Quality Standards and Guidance Values for Class C surface water (June 1998).
b) Hardness dependent values assume a hardness of 216.4 mg/L (depot site-wide average).
NA = Not Available
U = The compound was not detected below this concentration.
J = The reported value is an estimated concentration.
UJ = The compound may have been present above this concentration,
but was not detected due to problems with the analysis.
R = The data was rejected during the data validation process.

surface water samples, and of the detected metals, only aluminum and iron were detected at a concentration above their NYS surface water criteria value. All of the other metals were detected at low concentrations.

Sediments

The results of the sediment sampling program are presented in **Table 11**. Sediment at SEAD-67 has been impacted by SVOCs (mostly PAHs), pesticides, and a few metals. Six PAH compounds (i.e., benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, and indeno(1,2,3-cd)pyrene) were detected above their respective criteria values in both sediment samples collected.

Three pesticides were also found at levels above their sediment criteria values. Alpha-chlordane was found above its TAGM value in both sediment samples, while endosulfan I and 4,4`-DDT were detected at a level exceeding their respective criteria values in the downgradient sediment sample.

Four metals (i.e., copper, manganese, nickel, and silver) exceeded their respective sediment criteria values in one or both samples. Copper, nickel, and silver exceeded their respective sediment criteria values in both sediment samples collected, while manganese was seen to exceed its criteria value in only the downgradient sample. It should be noted however, the concentrations measured for copper, manganese and nickel in the sediment closely approximate the levels measured in the soil surrounding the stream bed.

1.2.3 Description of Affected Media

1.2.3.1 Soils and Sediments

The extent of the soil and sediments to be excavated during the proposed removal actions is shown on Figures 4 through 6. Approximately 7,700 cubic yards (10,500 tons) of soils and sediments will be excavated and transported to an off-site landfill.

TABLE 11
SEAD-67 SEDIMENT ANALYSIS RESULTS

SENECA ARMY DEPOT ACTIVITY
REMOVAL ACTION

PARAMETER	MATRIX LOCATION DEPTH (FEET) SAMPLE DATE ES ID LAB ID SDG NUMBER UNITS	MAXIMUM DETECT	FREQUENCY OF DETECTION	CRITERIA VALUE (a)	CRITERIA TYPE (b,c)	NUMBER ABOVE CRITERIA	NUMBER OF DETECTS	NUMBER OF ANALYSES	SOIL SEAD-67 0-0.2 04/26/94 SD67-1 219450 43663		SOIL SEAD-67 0-0.2 04/26/94 SD67-2 219451 43663	
VOLATILE ORGANICS									Value	(Q)	Value	(Q)
2-Butanone	ug/Kg	21	50%			NA	1	2	21	J	20	UJ
Acetone	ug/Kg	53	50%			NA	1	2	53	J	28	UJ
SEMIVOLATILE ORGANICS												
Acenaphthene	ug/Kg	120	50%	5474	BALCT	0	1	2	820	UJ	120	J
Acenaphthylene	ug/Kg	54	50%				1	2	820	UJ	54	J
Anthracene	ug/Kg	600	50%	4184	BALCT	0	1	2	820	UJ	600	J
Benzo(a)anthracene	ug/Kg	1400	100%	50.83	HHBC	2	2	2	**180**	J	**1400**	
Benzo(a)pyrene	ug/Kg	970	100%	50.83	HHBC	2	2	2	**170**	J	**970**	
Benzo(b)fluoranthene	ug/Kg	880	100%	50.83	HHBC	2	2	2	**180**	J	**880**	
Benzo(g,h,i)perylene	ug/Kg	370	100%				2	2	87	J	370	J
Benzo(k)fluoranthene	ug/Kg	930	100%	50.83	HHBC	2	2	2	**160**	J	**930**	
Carbazole	ug/Kg	78	50%				1	2	820	UJ	78	J
Chrysene	ug/Kg	1300	100%	50.83	HHBC	2	2	2	**220**	J	**1300**	
Dibenz(a,h)anthracene	ug/Kg	230	50%				1	2	820	UJ	230	J
Dibenzofuran	ug/Kg	83	50%				1	2	820	UJ	83	J
Fluoranthene	ug/Kg	3400	100%	39887	BALCT	0	2	2	440	J	3400	
Fluorene	ug/Kg	280	50%	312.8	BALCT	0	1	2	820	UJ	270	J
Indeno(1,2,3-cd)pyrene	ug/Kg	460	100%	50.83	HHBC	2	2	2	**98**	J	**460**	J
Phenanthrene	ug/Kg	2400	100%	4692	BALCT	0	2	2	260	J	2400	
Pyrene	ug/Kg	3000	100%	37580	BALCT	0	2	2	370	J	3000	
PESTICIDES/PCB												
4,4'-DDT	ug/Kg	4.1	50%	0.39	HHBC	1	1	2	8.2	UJ	**4.1**	J
alpha-Chlordane	ug/Kg	4.8	100%	0.039	HHBC	2	2	2	**4.8**	J	**3.6**	J
Endosulfan I	ug/Kg	20	50%	1.17	BALCT	1	1	2	4.2	UJ	**20**	J
METALS												
Aluminum	mg/Kg	12000	100%				2	2	12000	J	10700	J
Arsenic	mg/Kg	4.2	100%	6	LEL	0	2	2	3.7	J	4.2	J
Barium	mg/Kg	95.8	100%				2	2	95.8	J	92.7	J
Beryllium	mg/Kg	0.58	100%				2	2	0.58	J	0.56	J
Cadmium	mg/Kg	0.37	100%	0.6	LEL	0	2	2	0.37	J	0.34	J
Calcium	mg/Kg	13200	100%				2	2	6620	J	13200	J
Chromium	mg/Kg	18	100%	26	LEL	0	2	2	18	J	16.4	J
Cobalt	mg/Kg	8.3	100%				2	2	8	J	8.3	J
Copper	mg/Kg	37.7	100%	16	LEL	2	2	2	**37.7**	J	**22.6**	J
Iron	mg/Kg	19800	100%	20000	LEL	0	2	2	18900	J	19800	J
Lead	mg/Kg	17.8	100%	31	LEL	0	2	2	15.4	J	17.8	J

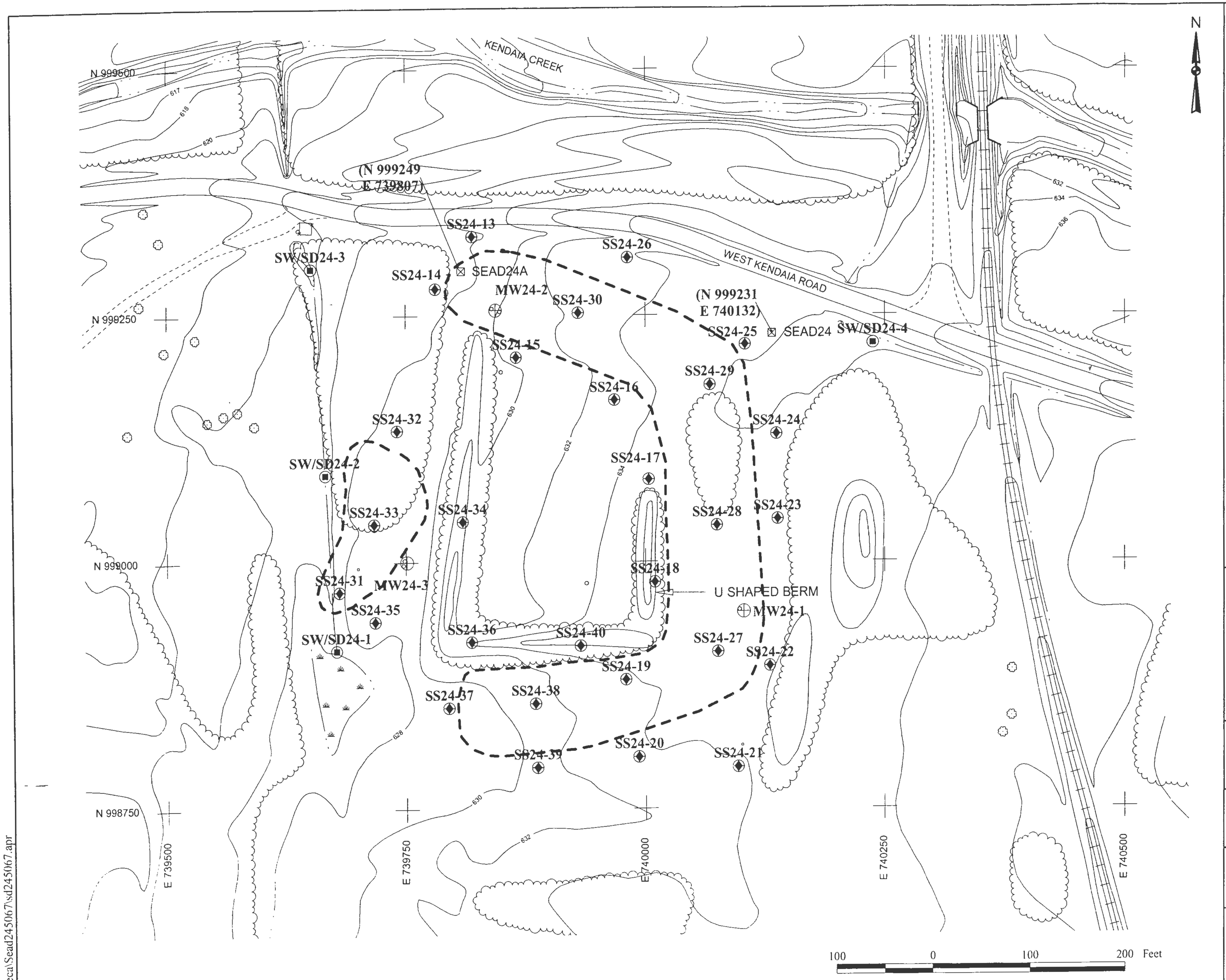
TABLE 11
SEAD-67 SEDIMENT ANALYSIS RESULTS

SENECA ARMY DEPOT ACTIVITY
REMOVAL ACTION

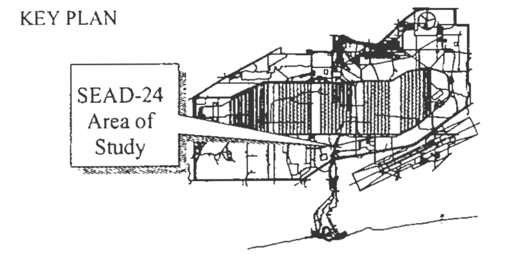
	MATRIX								SOIL	SOIL
	LOCATION								SEAD-67	SEAD-67
	DEPTH (FEET)								0-0.2	0-0.2
	SAMPLE DATE								04/26/94	04/26/94
	ES ID								SD67-1	SD67-2
	LAB ID		FREQUENCY			NUMBER	NUMBER	NUMBER	219450	219451
	SDG NUMBER	MAXIMUM	OF	CRITERIA	CRITERIA	ABOVE	OF	OF	43663	43663
PARAMETER	UNITS	DETECT	DETECTION	VALUE (a)	TYPE (b,c)	CRITERIA	DETECTS	ANALYSES		
Magnesium	mg/Kg	5030	100%				2	2	4160 J	5030 J
Manganese	mg/Kg	731	100%	460	LEL	1	2	2	413 J	**731** J
Nickel	mg/Kg	23.2	100%	16	LEL	2	2	2	**22.6** J	**23.2** J
Potassium	mg/Kg	1650	100%				2	2	1650 J	1330 J
Silver	mg/Kg	1.7	100%	1	LEL	2	2	2	**1.7** J	**1.1** J
Sodium	mg/Kg	107	100%				2	2	84.5 J	107 J
Vanadium	mg/Kg	20.4	100%				2	2	20.4 J	18.8 J
Zinc	mg/Kg	85.4	100%	120	LEL	0	2	2	85.4 J	76.5 J
OTHER ANALYSES										
Total Solids	%W/W						2	2	40.1	48.9

NOTES:
a) NYSDEC Technical Guidance for Screeing Contaminated Sediments - January 1999
b) BALCT = Benthic Aquatic Life Chronic Toxicity Criteria; HHBC = Human Health Bioaccumulation Criteria; LEL = Lowest Effect Level
c) All organic criteria values derived based on assumed Total Organic Carbon content of 39,105 mg/Kg (depot average value)

U = The compound was not detected below this concentration.
J = The reported value is an estimated concentration.
UJ = The compound may have been present above this concentration, but was not detected due to problems with the analysis.
R = The data was rejected during the data validation process.



KEY PLAN



PARSONS

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SENECA ARMY DEPOT ACTIVITY
ABANDONED POWDER BURNING PIT
SEAD-24

FIGURE 4

PROPOSED EXTENT OF
REMOVAL ACTION

JOB NUMBER: 734530-01001	DATE: MARCH 2001

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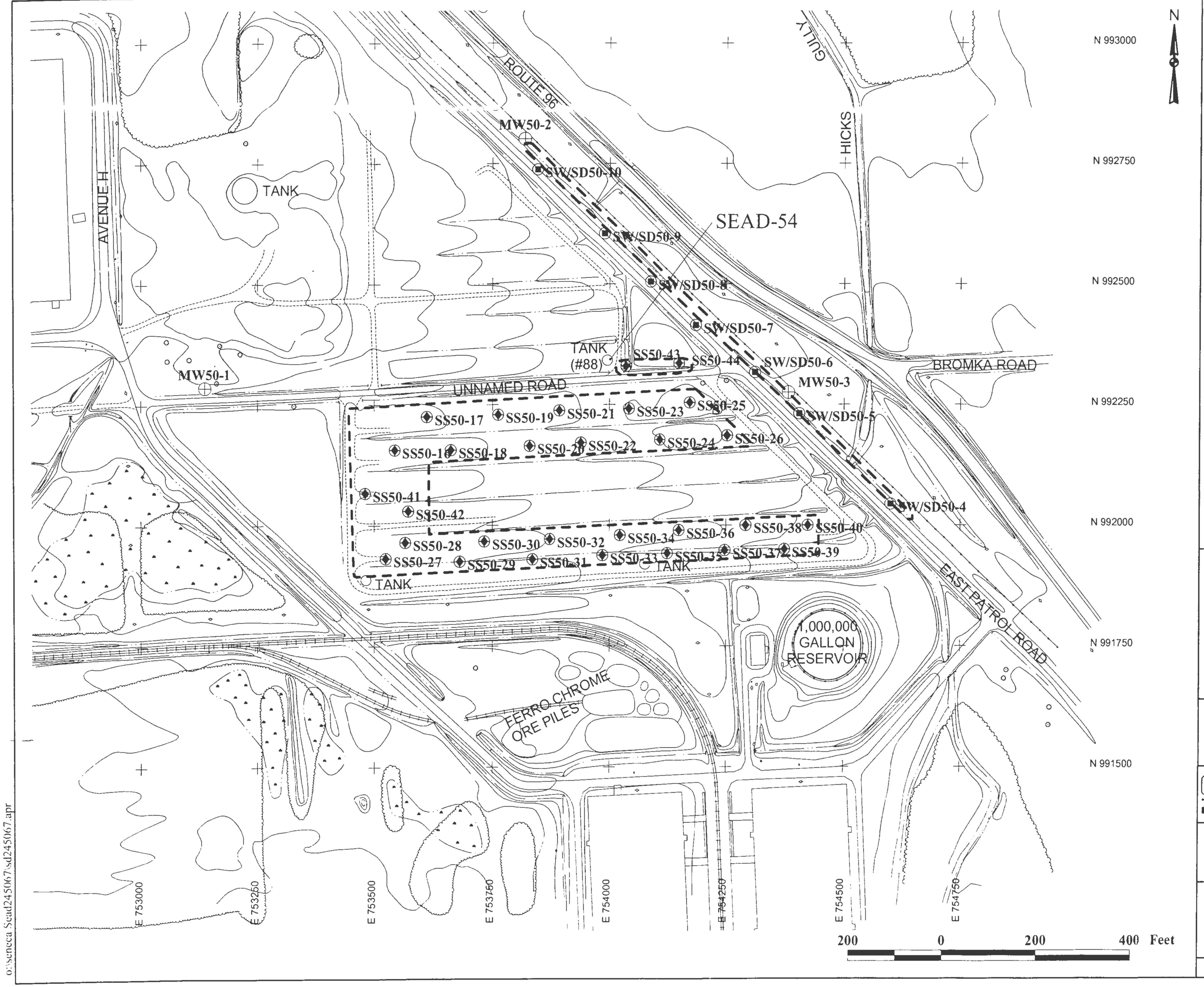

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LEGEND

PAVED ROAD

680 GROUND CONTOUR AND ELEVATION

WETLAND

BRUSH

CHAIN LINK FENCE

UTILITY POLE

APPROXIMATE LOCATION OF FIRE HYDRANT

RAILROAD

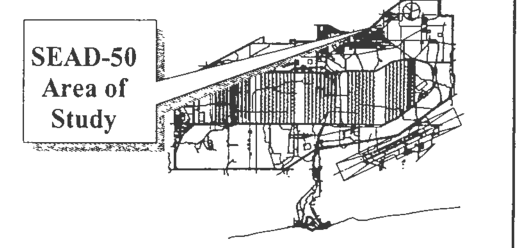
⊕ Monitoring Well

SS50-16 ◈ Post-Removal Verification Surface Soil Sample

SW/SD50-4 ▣ Post-Removal Verification Surface Water and Sediment Sample

Area to be Remediated

KEY PLAN



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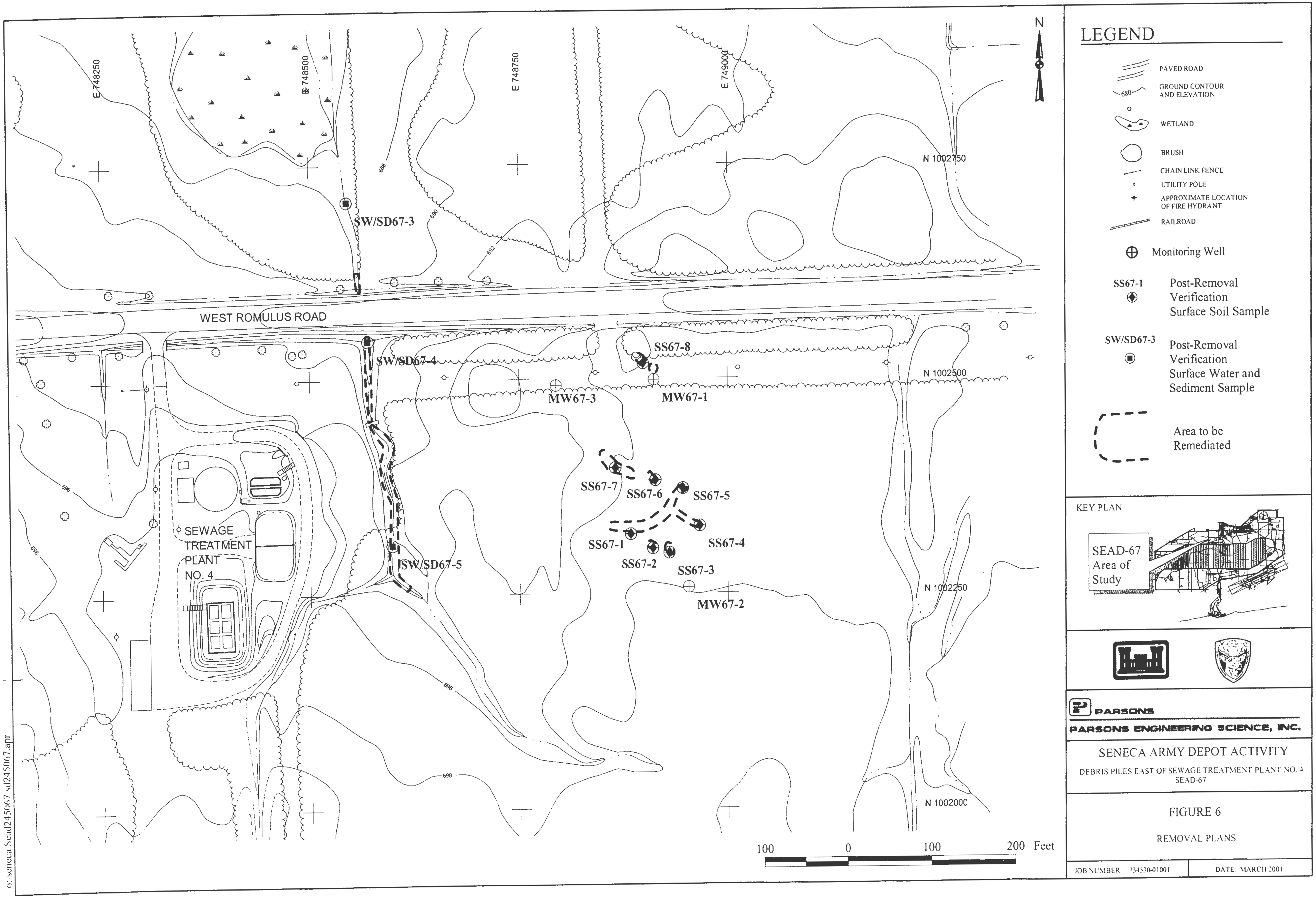
SENECA ARMY DEPOT ACTIVITY
TANK FARM
SEAD-50 AND SEAD-54

FIGURE 5

REMOVAL PLANS

JOB NUMBER. 734530-01001

DATE: MARCH 2001



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SENECA ARMY DEPOT ACTIVITY

DEBRIS PILES EAST OF SEWAGE TREATMENT PLANT NO. 4
SEAD-67

FIGURE 6

REMOVAL PLANS

JOB NUMBER 734530-01001

DATE: MARCH 2001

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SECTION 2
OBJECTIVES

2.0 OBJECTIVES

2.0.1 The overall objective of this time critical removal action project is the excavation, management, and disposal of contaminated soil and sediment that has been identified at the Seneca Army Depot Activity (SEDA). Soil and sediment contaminated with metals, pesticides, and semivolatile organic compounds has been identified at four historic solid waste management units (SWMUs), designated as SEADs 24, 50, 54 and 67. The contaminated soil and sediment identified at each of the SEADs represents a source of a potential threat to human health.

2.0.2 This document presents and describes the technical requirements needed within a service contract that is intended to implement and complete the removal, disposal, and backfill actions at four sites at the Seneca Army Depot Activity where soil and sediment contamination has been identified. The service contract will encompass all aspects of the design and implementation of the removal action including:

- the establishment and maintenance of necessary site security in the area of the planned excavation;
- the definition and implementation of dust suppression procedures to minimize air borne releases during the excavation operations;
- the excavation and removal of the contaminated soil and sediment from the site;
- the collection and analysis of any required air samples to document that the removal action has been completed in accordance with prevailing environmental requirements;
- the collection and analysis of samples needed for waste disposal purposes;
- the collection and analysis of samples to confirm that the extent of the excavation and removal action is adequate to eliminate the potential threat;
- the handling and on-site management of excavated soil and sediment prior to transport off-site;
- the transportation of the excavated soil and sediment to the selected off-site disposal site;
- the off-site disposal of the contaminated soil and sediment;
- backfilling of soils and sediment at four solid waste management units (SWMUs), designated as SEADs 24, 50, 54 and 67; and
- regrading, compacting, and as necessary, reseeding excavated areas to return them to their pre-excavation condition.

2.0.2 Cleanup goals established for the excavated soils and sediments are based on and derived from the following documents:

- US EPA, Office of Solid Waste and Emergency Response, "Clarification to the 1994 Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities," OSWER Directive # 9200.4-27, EPA/540/F-98/030, PB98-963244, (August 1998)
- NYSDEC, Technical and Administrative Guidance Memorandum #4046 "Determination of Soil Clean-up Objectives and Cleanup Levels" (January 1994)
- NYSDEC, Technical Guidance for Screening Contaminated Sediments (January 1999)

The Contractor will be required to excavate and dispose off-site at an appropriate landfill the extracted soils and sediments.

All soil and sediment contamination identified at a SEAD will not be addressed under the proposed actions. Instead, this program focuses on the removal of large, contiguous areas of contamination, or upon areas where particular analytes have been found in soil or sediment at sufficient concentrations to warrant immediate action. Residual soil and sediment contamination remaining at a site (if such does exist) will be handled under separate actions that may be required by subsequent determinations. Site-specific factors used as the basis of the proposed actions are identified below:

SEAD-24 Removal of soil that has been contaminated by arsenic and zinc at concentrations above NYSDEC TAGMs.

SEAD-50/54 Removal of soil that has been contaminated with arsenic, mercury, and zinc at concentrations above NYSDEC TAGMs. Also, removal of sediments that have been contaminated with pesticides and polynuclear aromatic hydrocarbons at concentrations above NYSDEC criteria limits.

SEAD-67 Removal of soil that has been contaminated with mercury and polynuclear aromatic hydrocarbons at concentrations above NYSDEC TAGMs. Also, removal of sediments that have been contaminated with pesticides, polynuclear aromatic hydrocarbons, and metals at concentrations above NYSDEC criteria limits.

2.0.3 Cleanup requirements for soils and sediments have been established for the principle metals and organic compound contaminants of concern. These levels are as follows:

	Proposed Soil Cleanup Levels (mg/Kg)	Proposed Sediment Cleanup Levels (mg/Kg)
METALS		
Arsenic	8.2 *	6 (c)
Mercury	0.1 (a)	0.15 (c)
Lead	400 (b)	31 (c)
Zinc	110 *	120 (c)
Asbestos	1% or less	
PESTICIDES		
4,4`-DDE	NA	0.39 (d)
4,4`-DDT	NA	0.39 (d)
alpha-Chlordane	NA	0.039 (d)
Aroclor-1242	NA	0.031 (d)
Aroclor-1260	NA	0.031 (d)
Endosulfan I	NA	1.17 (d)

(a) TAGM value
(b) EPA residential soil lead cleanup level
(c) NYSDEC Sediment Criteria Lowest Effect Level
(d) Lowest NYSDEC Sediment Criteria based on site TOC of 39105 mg/Kg (depot average)
* TAGM based on site background: 95th upper confidence limit (UCL) of average background concentrations of metals in soils at SEDA.
NA = Not Applicable

Proposed Soil	Proposed Sediment	
	Cleanup Levels (mg/Kg)	Cleanup Levels (mg/Kg)
POLYNUCLEAR AROMATIC HYDROCARBONS		
Benzo(a)anthracene	0.224 (a)	0.051 (d)
Benzo(a)pyrene	0.061 (a)	0.051 (d)
Chrysene	0.4 (a)	0.051 (d)
Dibenzo(a,h)anthracene	0.014 (a)	0.051 (d)
Fluoranthene	50 (a)	NA
Indeno(1,2,3-cd)pyrene	3.2 (a)	0.051 (d)
Phenanthrene	50 (a)	NA
Pyrene	50 (a)	NA

(a) TAGM value
(b) EPA residential soil lead cleanup level
(c) NYSDEC Sediment Criteria Lowest Effect Level
(d) Lowest NYSDEC Sediment Criteria based on site TOC of 39,105 mg/Kg (depot average)
NA = Not Applicable

SECTION 3
SCOPE OF WORK

A time-critical removal action program including all operations needed to remove and dispose of contaminated soil and sediment, that provides clean replacement backfill to replace the removed contaminated soil and sediment, and that backfills, compacts, and regrades each completed excavation to pre-existing conditions at four sites (i.e., SEADs 24, 50, 54, and 67) at the Seneca Army Depot Activity (SEDA) in Romulus, New York shall be designed, implemented, conducted, evaluated, and certified by a Remedial Action (RA) Contractor, and where necessary (i.e., a portion of SEAD-50/54), by a State of New York licensed and certified Asbestos Contractor. A portion of the proposed removal action at SEAD-50/54 involves the removal and disposal of soil that contains asbestos. Additionally, the program involves all operations and activities that are needed to recover, store, manage, treat and discharge or dispose of wastewater (e.g., stormwater run-off, groundwater infiltration volumes, decontamination waters, etc.) that result from excavation operations. All removal actions will be completed with supervision and oversight being provided by the Army and their designated Oversight Contractor.

3.0 GENERAL REQUIREMENTS

The RA Contractor and, where necessary, the Asbestos Contractor, shall:

- establish and maintain site control at each of the affected sites for the full period of time during which the excavation remains open and during which temporary piles may be staged at the site;
- establish and maintain dust suppression (including asbestos at SEAD-50/54 only) and vapor control procedures for the full duration of all excavation and soil handling operations;
- design, perform and record data from an ambient air monitoring program for metals and organic compounds (all sites) and asbestos (SEAD-50/54 only);
- obtain site-specific variances from the New York State Department of Labor (NYSDOL), Asbestos Control Bureau for work activities associated with the excavation of asbestos containing soils at SEAD-50/54 which may be needed to complete the work;
- collect, procure analytic services, and provide the Army, the Oversight Contractor and oversight agencies with data resulting from environmental samples that will be used to further delineate the extent of the asbestos removal operation required at SEAD-50/54;
- excavate contaminated soil and sediment from the ground at four SEADs (i.e., SEADs 24, 50, 54, and 67);
- maintain all asbestos containing soil in a suitably wetted condition during excavation,

transport and disposal operations;

- containerize and package all excavated, friable asbestos containing soil and sediment in appropriate outer packaging materials or devices;
- collect and analyze samples that are needed and required by potential disposal sites to characterize the waste;
- assist the Oversight Contractor during the collection and analysis of samples that are needed to confirm that the required volumes of contaminated soil and sediment have been removed;
- handle and manage the excavated materials (i.e., soil and sediment) pending their transport from the four sites to the off-site disposal site;
- develop and maintain the necessary documentation to describe the excavation, shipment and disposal of all excavated soil and sediment and other debris and material from SEDA to the final disposal sites;
- transport the excavated materials (i.e., soil and sediment) from the four sites to the off-site disposal site;
- dispose of contaminated soil and sediment from the four sites at an authorized disposal site;
- obtain and deliver clean backfill to the each of the excavation sites;
- re-grade, compact, and seed, as necessary, all backfilled excavations to re-establish pre-existing conditions; and
- recover, store, manage, treat and discharge or dispose of wastewater that results from excavation site operations.

The RA Contractor, and where necessary the Asbestos Contractor, shall continually evaluate the effectiveness and completeness of the removal action to achieve the required level of soil and sediment remediation and restoration. All work performed under this contract pertaining to the removal of asbestos shall be completed by a State of New York licensed and certified Asbestos Contractor. All work performed under this contract shall be under the supervision of a Professional Engineer registered in the State of New York.

The following activities are included in the RA Contractor's, and where necessary, the Asbestos Contractor's scope of work:

- obtain all required environmental permits and authorizations for the identified excavation and disposal activity;
- comply with applicable state and federal environmental statues and laws;
- comply with applicable state and federal statutes and laws pertaining to asbestos removal operations;
- negotiate the scope of the required removal operations with oversight agencies;

- develop a site-specific health and safety plan that complies with federal, state and Army guidelines and requirements governing removal actions;
- provide institutional control devices to ensure that the excavation and any stockpiled materials are properly secured to eliminate potential danger to surrounding populations;
- identify and mark areas to be excavated;
- identify and mark areas where temporary stockpiles will be established;
- define and mark additional areas where soil excavation is required based on the results of the confirmatory sampling;
- implementation of necessary ambient air monitoring and the collection and retention of resulting data;
- excavation of contaminated soil and sediment;
- coordinate the extent of excavation of contaminated soils and sediment at the four SEADs with NYSDEC and NYSDOL representatives to ensure that all affected media are removed during the program;
- stockpile, manage, and handle the excavated soil and sediment pending transport and disposal;
- collect samples from soil and sediment stockpiles, arrange for necessary waste disposal chemical and physical analyses, and summarize and provide results of all waste disposal analyses to the Army, the Oversight Contractor and the disposal site;
- maintain records describing sampling that is performed during the excavation and the results that are obtained including sampling locations and sampling results;
- using developed analytical results, classify and segregate excavated soil according to the lowest level of hazard allowable by applicable environmental laws and regulations;
- load the excavated soils and sediments onto trucks and transport, in accordance with applicable laws and regulations, the contaminated soil and sediment to the selected disposal facility;
- obtain, maintain, and provide copies of all records resulting from the excavation, transport and disposal of the contaminated soil and sediment at the off-site locations;
- identify an off-site or on-site borrow pit that can be used to provide clean fill to refill the excavations;
- obtain and provide clean fill to the excavation sites as required;
- backfill, compact, and regrade the excavations to original grade using the clean fill; and,
- prepare and submit a draft and a final report detailing the scope and results of the excavation/disposal/closure activities at each of the SEADs.

3.0.1 PROGRAM ORGANIZATION

The required program will be completed under a contract issued by the Army. The RA Contractor, and where necessary, the Asbestos Contractor shall conduct all removal action operations and activities in accordance with procedures and requirements that are approved by the Army. All removal action operations and activities shall be conducted under the oversight and review of a third party Oversight Contractor designated and independently contracted by the Army. All removal action operations will be completed in accordance with provisions and requirements of prevailing federal, state and municipal laws governing the environment and the transport, storage and disposal of hazardous or contaminated materials.

3.0.2 SCOPE OF THE BID

Under the base bid, the RA Contractor, and where necessary, the Asbestos Contractor shall be required to excavate, manage, transport and dispose of, and to replace and install clean fill to replace, up to 7,700 cubic yards of contaminated soil and sediment from SEADs 24, 50, 54 and 67 to acceptable levels. Acceptable levels are limits identified in **Section 2.03** of this specification that are consistent with US EPA and NYSDEC guidance for soils and sediments.

The RA Contractor will also compact and regrade the excavation sites and remove all temporary measures used during the work.

3.0.3 LABOR, MATERIAL AND EQUIPMENT

The RA Contractor, and where necessary, the Asbestos Contractor shall furnish all labor, material, equipment, quality control (QC) measures, and health and safety provisions necessary to complete the work described in these specifications for final acceptance by the Army, the Oversight Contractor and federal, state and municipal governments. The work includes the RA Contractor's and the Asbestos Contractor's design, mobilization, demobilization, construction, and operation and maintenance of the excavation, materials handling, and disposal operations. The RA Contractor will also be responsible for site restoration.

3.0.3.1 All materials and equipment used to complete the work described in these specifications shall be adequate in capacity for its intended use; shall not create unsafe conditions; and shall meet the requirements of all applicable codes and standards.

3.0.3.2 All equipment and material brought onto the SEDA site shall be decontaminated and in proper working condition at the time of arrival at the SEDA site. All equipment may be inspected by the Army or the Army's representative before it is used at the site. Equipment found to be contaminated or in need of repair shall be removed from the SEDA site by the RA Contractor immediately. Additional mobilizations of materials or equipment to the SEDA site caused by rejection of faulty or contaminated equipment will be at the RA Contractor's expense.

3.0.3.3 The RA and Asbestos Contractors shall be responsible for maintaining the environment in its natural state to the greatest extent possible during the removal action. The RA Contractor will consider air, surface water, groundwater, and land resources. In order to prevent, and provide for abatement and control of any environmental pollution arising from the removal action, the RA and Asbestos Contractor, and any subcontractors, shall comply with all applicable federal, state, and local regulations.

3.0.3.4 Assuring compliance with the provisions of this section by subcontractors shall be the responsibility of the RA and the Asbestos Contractors.

3.0.3.5 The RA and Asbestos Contractors shall be responsible for protecting and maintaining existing structures, roads and fences. The RA and Asbestos Contractor shall be responsible for locating and protecting any existing utilities within the work area.

3.0.3.6 The land resources within the project boundary and outside the limits of permanent work performed as part of this removal action shall be preserved in their present condition or restored to a condition that will appear to be natural after completion of the removal action. The RA and Asbestos Contractors shall confine all construction activities to the areas defined by the plans and specifications.

3.0.3.7 The RA and Asbestos Contractors shall not pollute any streams or wetlands with any hazardous constituents. The RA and Asbestos Contractors shall comply with all federal, state, and local regulations regarding pollution of surface waters and an emergency response plan is required to prevent pollution caused by inadvertent releases.

3.0.3.8 The RA and Asbestos Contractor shall take all necessary measures, in addition to those required by federal, state, and local regulations, to minimize the migration of dust, vapors, fumes, mists, etc. off-site. Dust control requirements and air monitoring requirements are described in these specifications.

3.0.3.9 All construction and excavation activities shall be conducted to minimize erosion.

The RA and Asbestos Contractors shall prevent surface water from running onto and entering the excavation, and shall prevent contaminated surface water from running off and leaving the excavation site. Drainage control requirements are described later in these specifications.

3.0.3.10 The RA and Asbestos Contractor shall provide temporary site utilities as may be needed. All utilities provided at the site by the RA and Asbestos Contractor shall be removed at the completion of the project. Such utilities may include telephone, electricity, natural gas or propane (if required), water and sanitation.

3.0.3.11 No on-site work will be permitted until required submittals, if applicable, for that activity has been approved by the Army as provided in the individual sections of these specifications. Work conducted during this removal action by the RA and Asbestos Contractor shall be limited to execution of the activities defined by these specifications. The RA Contractor shall employ a professional engineer of the discipline required for specific service on this project licensed in the State of New York. The RA and Asbestos Contractor shall assume full responsibility for the health and safety of all on-site personnel and the protection of all equipment and materials.

3.0.4 SUPPORT REQUIREMENTS

The RA and Asbestos Contractor shall provide essential contract support services as part of this contract. Support services include attendance at meetings at which the removal actions are discussed and the preparation of meeting minutes.

3.0.4.1 Meetings

The RA and Asbestos Contractor shall attend all meetings specified in this section and any other meetings called by the Army Contracting Officer or his representatives. Subcontractors shall attend when involved in the matter to be discussed, or when requested by the Contracting Officer or his representatives or the RA and Asbestos Contractor.

3.0.4.1.1 Pre-Construction Conference

A pre-construction conference shall be held prior to RA and Asbestos Contractor mobilization to SEDA. In addition to the Army and the RA and Asbestos Contractor, the meeting may be attended by representatives of the third-party Oversight Contractor, and by personnel of the regulatory agencies having jurisdiction over this project. The agenda for this meeting will be determined prior to the meeting.

3.0.4.1.2 Post-Construction Conference

A post-construction conference shall be held prior to final inspection of the work to discuss and resolve all unsettled matters.

3.0.4.1.3 Progress Meetings

Progress meetings shall be held at a frequency of once per month during the performance of the work to review operating performance and to discuss any problems that may arise during performance of the work.

3.0.4.2 Meeting Minutes

The RA Contractor shall record minutes of each meeting and shall furnish copies to the Contracting Officer or his representatives within 10 working days following the meeting.

3.0.4.3 Meeting Schedule

All meetings shall be held at SEDA, at dates and times to be agreed upon during the pre-construction conference. Changes to the meeting schedule shall be by agreement between the Contracting Officer or his representatives and the RA Contractor, with appropriate written notice to all parties involved.

3.0.5 DEFINITIONS AND ACRONYMS

This sections contains the definitions of words, phrases, acronyms, and abbreviations used in the text of these specifications and requiring special interpretation.

3.0.5.1 Definitions

Abatement – Procedures to control fiber release from asbestos material. This includes removal, encapsulation, enclosure and repair, disturbance of friable asbestos or any handling of asbestos material that may result in the release of asbestos fiber.

Army – This term refers to the United States Department of the Army, including, but not limited to, United States Army Corps of Engineers and Seneca Army Depot Activity personnel and authorized representatives of these groups.

Asbestos – Any naturally occurring hydrated mineral silicate separable into commercially usable fibers, including chrysotile (serpentine), amosite (cumingtonite-grunerite), crocidolite (riebeckite), tremolite, anthophyllite and actinolite.

Asbestos Contractor - The Contractor selected and contracted by the Army or the Remedial Action Contractor to perform the Remedial Actions of asbestos required in SEAD-50/54, described in this work specification. This contractor shall be licensed and certified to perform asbestos removal actions in the State of New York.

Asbestos Handler – Any person who performs the duties described in NYSDOL Industrial Code Part 56, Section 56-2.2(c)(1).

Asbestos Handling Certificate - A certificate issued by the commissioner in any of the categories set forth in NYSDOL Industrial Code Part 56, Section 56-2.2(c).

Asbestos Handling License – A license issued by the commissioner pursuant to the provisions of NYSDOL to a contractor engaged in an asbestos project.

Asbestos Material – Any material containing more than one percent by weight of asbestos.

Asbestos Project – Work undertaken by a contractor which at any time involves any aspect of the removal, encapsulation, enclosure or disturbance of friable asbestos, or any handling of asbestos material that may result in the release of asbestos fiber, except work in an owner-occupied single family dwelling performed by the owner of such dwelling. An asbestos project shall include the planning, design, monitoring, inspection and air sampling of abatement work, as well as the supervising of such activities.

(1) Where all asbestos work on a project is subcontracted to a contractor with an asbestos handling license, only that part of the work involving asbestos shall be deemed to be an asbestos project.

(2) Asbestos projects include large asbestos projects, small asbestos projects, minor asbestos projects, repairs and emergency projects as defined elsewhere in the Part (rule). For purposes

of licensing, certification, notification, and air monitoring, asbestos project shall include in-plant operations.

Asbestos Waste – Asbestos material or asbestos contaminated objects requiring disposal pursuant to any applicable state or federal law or regulation.

Contaminated Soil or Sediment – The soil or sediment that contains concentrations of volatile organic, semivolatile organic, pesticide/PCB, or metals compounds in excess of the treatment criteria contained in these specifications.

Exclusion Zone – This is the portion of the project sites where contamination exists or where remedial activities are or will occur. The boundaries of the exclusion zone may vary during the Removal Action.

Hazardous Waste – A substance determined to be a hazardous waste by application of the criteria listed in Title 40 Code of Federal Regulations Part 261.

Nonasbestos Material – Any material containing one percent or less by weight of asbestos.

Oversight Contractor – The Contractor selected and contracted by the Army to oversee the specified Remedial Action work. The Oversight Contractor will provide contract management and quality control services needed to ensure the objectives and the requirements of the proposed actions are met and the work is completed in a manner that safeguards the environment and surrounding populations.

Project Sites - The sites consists of all areas within the five SWMU boundaries as shown on the drawings.

RA Contractor – The Contractor selected and contracted by the Army to perform the Remedial Actions described in this work specification.

Regulators – This term refers to all authorized representatives of the United States Environmental Protection Agency, United States Occupational Safety and Health Administration, New York State Department of Environmental Conservation, New York State Department of Health, New York State Department of Labor, and any other federal, state, or local government agency with jurisdiction over the site.

Removal Action – The removal action describes this entire project from the notice to proceed until completion, and includes the initial plan preparation, all field work, and final report preparation.

Subcontractor – A subcontractor is any firm or individual contracted by the RA Contractor to perform a portion of the removal action.

TSD Facility – A hazardous waste treatment, storage, or disposal facility permitted pursuant to the requirements of Title 40 Code of Federal Regulations Parts 260 through 270.

Work Areas – The work areas includes all portions of the project sites affected by the Removal Action. This includes the excavation area, staging area, and decontamination area.

3.0.5.2 Acronyms

ANSI	American National Standards Institute
API	American Petroleum Institute
ASP	Analytical Services Protocols
ASTM	American Society for Testing of Materials
CDAP	Chemical Data Acquisition Plan
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
EE/CA	Engineering Evaluation/Cost Analysis
EPA	United States Environmental Protection Agency
ES	Engineering Science, Inc.
FS	Feasibility Study
HDPE	High-density polyethylene
IEEE	The Institute of Electrical and Electronic Engineers
IPCEA	Insulated Power Cable Engineers Association
µg/kg	micrograms per kilogram
LTTD	Low Temperature Thermal Desorption
mil	0.001 inch
mm	millimeter
MRD	United States Army Corps of Engineers, Missouri River Division
NEC	National Electrical Code

NEMA	National Electrical Manufacturers Code
NESC	National Electrical Safety Code
NESHAPS	National Emissions Standards for Hazardous Air Pollutants
NYCRR	New York Codes, Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDOL	New York State Department of Labor
NYSDOH	New York State Department of Health
OSHA	Occupational Safety and Health Administration
PAH	Polynuclear Aromatic Hydrocarbons
PID	Photo-ionization Detector
QA	Quality Assurance
QC	Quality Control
RI	Remedial Investigation
SARA	Superfund Amendments and Reauthorization Act
SEDA	Seneca Army Depot Activity
SHSO	Site Health and Safety Officer
SOP	Standard Operating Procedure
SV	Semi-Volatile Organic Compound
SWMU	Solid Waste Management Unit
TAGM	Technical and Administrative Guidance Memorandum
TCLP	Toxicity Characteristic Leaching Procedure
TSD	Treatment, Storage, or Disposal
VOA	Volatile Organic Compound

3.1 ENVIRONMENTAL STATUTES AND REGULATIONS

CERCLA, as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) is the controlling legislation in the performance of the identified removal actions. In addition to any other applicable federal, state, and local regulations, the following regulations also form a part of this specification:

3.1.1 FEDERAL ENVIRONMENTAL REGULATIONS

40 CFR 50	Ambient air quality standards
40 CFR 58	Ambient air quality surveillance
40 CFR 61	National emissions standards for hazardous air pollutants (NESHAPS)

40 CFR 260	Hazardous waste management system - general
40 CFR 261	Identification and listing of hazardous waste
40 CFR 262	Standards applicable to generators of hazardous waste
40 CFR 263	Standards applicable to transporters of hazardous waste
40 CFR 264	Standards for owners and operators of hazardous waste treatment, storage, and disposal facilities
40 CFR 265	Interim status standards for owners and operators of hazardous waste treatment, storage, and disposal facilities
40 CFR 300 - 310	National Oil and Hazardous Substances Pollution Contingency Plan

3.1.2 NEW YORK STATE ENVIRONMENTAL REGULATIONS

6 NYCRR 360	NYSDEC rules for solid waste management facilities
6 NYCRR 364	NYSDEC rules for transport of regulated waste
6 NYCRR 375	NYSDEC rules for inactive hazardous waste sites

3.1.3 UNITED STATES ARMY CORPS OF ENGINEERS ENVIRONMENTAL REQUIREMENTS

ER-1110-1-263	Chemical Data Quality for Hazardous Waste Remedial Activities

3.1.4 OTHER REGULATORY REQUIREMENTS

- Federal Facility Agreement under CERCLA Section 120 in the matter of Seneca Army Depot, Romulus, New York Docket No. II-CERCLA-FFA-00202
- 29 CFR 1910 and 1926 — Occupational safety and health standards
- 49 CFR 171-177 — Hazardous material transportation regulations
- New York State Department of Labor, Division of Labor, Industrial Code Rule Part 56, Asbestos
- All other relevant New York State Regulations
- All local regulations regarding transport of hazardous materials

3.1.5 OTHER APPLICABLE STANDARDS AND CODES

The RA and Asbestos Contractor shall comply with all applicable codes and standards. At a minimum, the RA and Asbestos Contractor will comply with the following codes and standards:

- National Fire Protection Association (NFPA) Standards.
- National Electrical Manufacturers Association (NEMA).
- The American National Standards Institute (ANSI).
- The Institute of Electrical and Electronic Engineers (IEEE).
- Insulated Power Cable Engineers Association (IPCEA).
- National Electrical Code (NEC).
- National Electrical Safety Code (NESC).

3.2 PROJECT PLANNING

These specification provide basic information regarding the scope of the work that the RA and Asbestos Contractor is to perform and the procedures and requirements that must be used during the completion of the requested work. Nevertheless, the RA and Asbestos Contractor shall prepare the following documents that will serve as the basis of the work that will be conducted.

3.2.1 DOCUMENT FORMATS

All work plans, documents and deliverables prepared for the identified scope of work shall be prepared in a neat, clear, legible, and concise manner. Consistent formats shall be developed and used for all presentations.

3.2.1.1 All project documents (e.g., work plans and final report) shall be produced using 8.5 by 11 inch pages with oversized drawings and tables folded, if necessary, to meet this size specification.

3.2.1.2 All project documents shall be provided to the Army, and other receiving parties, as bound documents. The preferred binding method is contained within a vinyl, three-ringed binder, but other means including staples, binder clips, or GBC binding may be used with prior approval of the Contracting Officer.

3.2.1.3 All large project documents (e.g., work plans, final reports, etc) shall include a document cover and a title page that shall identify the RA Contractor, the Corps of Engineers, Huntsville Division, and the data. The RA Contractor's name and any corporate logo or emblem shall not dominate the cover or the title page.

3.2.1.4 All large project documents (e.g., work plans, final reports, etc.) shall include a table of contents, a list of tables, a list of figures, a list of appendices, and a list of attachments, as are appropriate and applicable.

3.2.1.5 A decimal paragraphing system shall be used for the test of each document, with each section or paragraph of the report having a unique decimal designation.

3.2.1.6 All pages of reports shall be stamped either with the word "DRAFT" or "FINAL" to indicate the version of the document.

3.2.1.7 Submittals shall include all previous review comments accepted by the RA and Asbestos Contractor as well as a section describing the disposition of each comment. Disposition of comments submitted with the final report shall be separate from the report document.

3.2.1.8 Each report shall identify the members and title of the RA and Asbestos Contractor's staff that had significant, specific input into the report's preparation or review.

3.2.1.9 All final drawings shall be of engineering quality in drafted form with sufficient details to show interrelations of major features on the installation site map. When drawings are required, data may be combined to reduce the number of drawings.

3.2.1.10 All final submittals shall be sealed by the registered Professional Engineer-In-Charge.

3.2.2 WORK PLAN

The RA and Asbestos Contractor shall prepare and submit for approval a Work Plan under which all required work shall be performed. The Work Plan shall fully describe the work to be conducted for the removal actions. The contents of the work plan are described below. At a minimum, the Work Plan will discuss the following items:

Title Page with approval signatures,
Organization chart and description of roles of key personnel,
Project Schedule,
Excavation, backfilling, compaction, and grading plan,
Erosion/dust control plan,

Site control and security (including exclusion zone) plan,
Air monitoring plan,
Mobilization (including decontamination procedures)/demobilization,
Excavated soil sampling plan, and a
Site layout.

The Work Plan shall identify all provisions and measures that are necessary to comply with state and federal regulations pertinent to the performance of an Asbestos Project.

The dates for submission and requirements are described in the Contract Data Requirements List shown in Appendix D and the Data Items Description shown in Appendix E.

3.2.2.1 Excavation, Backfill, Compaction, and Grading Plan

Prior to commencement of excavation, the RA and Asbestos Contractor shall submit an Excavation, Backfill, Compaction, and Grading Plan as part of the Work Plan describing the excavations that will be accomplished. The plan shall include the following:

- the proposed sequence of operations;
- the type, rated capacity, and quantity of equipment to be used in the excavation phase;
- the proposed operations that will be used to wet and maintain the moisture of Asbestos containing soil prior to excavation;
- the proposed manner that will be used to manage and contain Asbestos material once it is excavated;
- plans showing locations and configuration of proposed temporary stockpiles;
- the drainage and dewatering plans, which show the control and removal of surface water and groundwater flowing toward and tending to collect in excavations;
- provisions for controlling the amount of air emissions at the down-wind air monitoring station by controlling the size of the open excavations;
- equipment and personnel decontamination procedures; and
- borrow source and haul routes.

3.2.2.2 Erosion/Dust Control Plan

The RA and Asbestos Contractor shall discuss proposed erosion/dust controls including run-on and run-off control and management of stockpiled soil.

3.2.2.3 Site Control and Security Plan

The RA and Asbestos Contractor shall describe and discuss procedures that will be used to secure and control access to the work areas and that will comply with all SEDA security requirements. The plan shall describe all site security measures that will be implemented to control personnel, wildlife and vehicular traffic to and through the excavation site and any associated stockpiles.

3.2.2.4 Air Monitoring Plan

The RA and Asbestos Contractor shall discuss the proposed air monitoring program and how the results of the program will be assessed and evaluated. The program shall indicate how the RA Contractor intends to comply with NYSDEC's TAGM HWR-89-4031 "Fugitive Dust Suppression and Particulate Monitoring Program at Inactive Hazardous Waste Sites" (October 1989), and is separate from the air monitoring and action level requirements for the site-specific health and safety plan. For work in SEAD-50/54, the program shall also indicate how the licensed and certified Asbestos Contractor shall implement and comply with air monitoring requirements identified in NYSDOL's Industrial Code Part 56.

3.2.2.5 Mobilization/Demobilization and Site Restoration Plan

The RA and Asbestos Contractor shall discuss his proposed mobilization procedures including temporary site utility and decontamination facilities. The demobilization plan shall discuss site cleanup and site restoration activities.

3.2.2.6 Excavated Soil Sampling Plan

The RA Contractor shall provide its plan to sample and analyze excavated soils and to determine how these samples shall be evaluated for disposal at off-site facilities. The number of samples that will be collected and the analyses that will be completed on each sample will be specified and explained.

For excavations in SEAD-50/54, the licensed and certified Asbestos Contractor shall provide its plan to sample and analyze excavated soils for asbestos and to determine how these samples shall be evaluated for disposal at off-site facilities. The number of samples that will be collected and the analyses that will be completed on each sample will be specified and explained.

3.2.2.7 Project Drawings

The RA Contractor shall provide the following drawings as required by these specifications.

- Overall site plan showing stockpile areas, equipment storage areas, and decontamination areas.
- Final project record drawings showing the limits of soil excavated by type and the locations of all in-situ confirmatory sampling. The RA Contractor shall be responsible for collecting all surveying data and developing the project record drawings.

All drawings shall be a minimum of 11 inches x 17 inches.

3.2.2.8 Site Specific Health and Safety Plan (HASP)

The RA and Asbestos Contractor shall prepare and submit a site-specific Health and Safety Plan (HASP) that describes the safety, health and emergency response procedures that will be implemented, as needed, during the proposed removal action. The RA and Asbestos Contractor shall maintain a copy of the site-specific Health and Safety Plan on-site at all times.

Protocols necessary for protecting workers and potential on-site and off-site receptors from hazards posed by the removal action activities shall be specified. The dates for submission and requirements are described in the Contract Data Requirements List shown in Appendix D and the Data Items Description shown in Appendix E.

3.2.2.8.1 The Health and Safety Plan shall contain discussions of the following minimal subject areas.

- Health and safety organization
- Hazard assessment
- Training
- Medical surveillance
- Site control
- Standard operating procedures
- Personal protective equipment
- Personal hygiene and decontamination
- Equipment decontamination
- Air monitoring

- Emergency equipment and first aid requirements
- Emergency response/contingency plans and procedures
- Heat/cold stress monitoring
- Fall protection
- Trenching and shoring
- Confined space entry
- Logs, reports, and record keeping
- Site description and evaluation.

3.2.2.8.2 The Health and Safety Plan developed by the RA and Asbestos Contractor shall comply with the requirements specified in ER 385-1-92 entitled "Safety and Health Elements for HTRW Documents" as presented in Appendix B. These requirements do not supersede, but are in addition to, any federal, state, or local regulations. These requirements are in accordance with the Occupational Health and Safety Administration (OSHA) guidelines established in 29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response." If a conflict occurs between these requirements and the current regulations, the more stringent shall apply. The completed Health and Safety Plan will be submitted to NYSDEC and New York State Department of Health (NYSDOH) for review.

3.2.2.9 Health and Safety Program Certification

The RA and Asbestos Contractor shall prepare and submit a written certification that a Health and Safety Program (HSP) has been developed, implemented and maintained.

3.2.2.10 Chemical Data Acquisition Plan (CDAP)

The RA and Asbestos Contractor shall prepare and submit a Chemical Data Acquisition Plan (CDAP). This plan shall address soil sampling, wastewater sampling and air sampling. The plan shall be submitted for Army approval.

3.2.2.10.1 At a minimum, the RA and Asbestos Contractor shall comply with all applicable US EPA and NYSDEC quality assurance (QA) requirements, and with the United States Army Corps of Engineers document: "Chemical Data Quality for Hazardous Waste Remedial Activities," ER 1110-1-263 as presented in Appendix C. Additionally, the RA and Asbestos Contractor shall document compliance with all QC requirements identified in these specifications.

3.2.2.10.2 The CDAP shall include, at a minimum, the following sections and discussions.

- Title page with approval signatures
- Site background information
- Data quality objectives
- Sample parameters, locations, types, preservation, holding times, containers, collection procedures, and decontamination techniques
- Field quality control samples including duplicates, trip blanks (VOA analyses only), matrix spike samples, and equipment rinsates
- Analytical methods (only EPA or NYSDEC approved methods shall be used)
- Laboratory information
- Chain-of-custody procedures
- Data validation protocols
- Proof of approval by NYSDOH or USEPA

The above outline is presented in Appendix D of ER 1110-1-263. The dates for submission and requirements are described in the Contract Data Requirements List shown in Appendix D and the Data Items Description shown in Appendix E.

3.2.2.10.3 The RA and Asbestos Contractor shall identify the important project personnel that are responsible monitoring and assessing project quality control (QC) requirements. At a minimum, the RA Contractor shall designate a site quality control manager who will be responsible for, and have authority for all QC matters at the site. The site quality control manager shall be responsible for ensuring that all RA Contractor and subcontractor personnel at the work site have been properly trained in the site-specific QC procedures. The site quality control manager shall have no duties other than QC.

3.2.2.10.4 The RA and Asbestos Contractor shall maintain accurate records of all QC activities performed during the removal actions. These records shall be legible and prepared in an easily understood form, and shall be made available to the Army and the regulators upon request.

3.2.2.10.5 The RA and Asbestos Contractor shall not conceal any work containing uncorrected defects. If deficiencies indicate that the RA and Asbestos Contractor's quality control system is inadequate or does not produce the desired results, corrective action in both the work and the quality control system shall be taken by the RA and Asbestos Contractor.

3.3 INSTITUTIONAL REQUIREMENTS

3.3.1 The RA and Asbestos Contractor must and shall comply with federal, state, and local safety codes and regulations at all times. The RA and Asbestos Contractor is responsible for training his supervisors and employees of the safety requirements and practices to be followed during the course of the work.

3.3.2 The RA and Asbestos Contractor shall be solely and completely responsible for conditions of the job site, including safety of all persons and property during the performance of the work. This requirement shall apply continuously and not be limited to normal working hours.

3.3.3 If at any time the NYSDOH Community Air Monitoring Guidelines are exceeded, the RA Contractor shall notify NYSDEC, NYSDOH, and the Army. The RA Contractor shall comply with all SEDA health and safety and emergency response requirements.

If at any time provisions in the NYSDOL Air Sampling, Monitoring and Analysis Requirements are exceeded, the RA and Asbestos Contractor shall notify NYSDOL and the Army.

3.3.4 The RA and Asbestos Contractor shall train all employees and subcontractors aware of SEDA policy and procedures. The RA and Asbestos Contractor shall coordinate activities with SEDA personnel.

3.3.5 Odor, dust and noise control shall be limited in accordance with State and local regulations and ordinances. It shall be the RA and Asbestos Contractor's responsibility to meet these requirements.

3.3.6 The RA and Asbestos Contractor shall assure that all facilities that receive hazardous wastes from this site meet the requirements of 40 CFR 260 through 268. The RA and Asbestos Contractor shall assure that all facilities that receive nonhazardous solid waste from this site meet the requirements of 6 NYCRR 360.

3.3.7 The RA and Asbestos Contractor shall provide supporting documentation to complete hazardous waste manifests and to obtain services of permitted treatment, storage and disposal facilities if, during the performance of this work, off-site disposal of any hazardous waste is performed. With regard to disposal of wastes from this site, the Army will be the Waste Generator as defined in 40 CFR 262.

3.4 SITE CONTROL AND SECURITY REQUIREMENTS

3.4.1 SITE CONTROL

The RA and Asbestos Contractor shall establish a system to control access to the work areas. At a minimum, these areas will include an exclusion zone (defined as the area where contamination exists), a stockpile area, and a staging area. The RA and Asbestos Contractor will establish a decontamination area in compliance with these specifications.

3.4.2 SEDA REQUIREMENTS

The RA and Asbestos Contractor shall be responsible for complying with all SEDA requirements, including, but not limited to, access control, site security, and work permit requirements. The RA and Asbestos Contractor shall be responsible for determining the applicable SEDA requirements. At a minimum, the RA and Asbestos Contractor shall meet the SEDA requirements of this subsection. The following requirements must be followed by the RA and Asbestos Contractor at Seneca Army Depot Activity to facilitate entry and exit of RA and Asbestos Contractor employees and to maintain security.

3.4.2.1 A list of all RA and Asbestos Contractor employees, subcontractors and suppliers indicating firm name and address shall be furnished through POC/COR to the Counterintelligence Division, Building 710. A confirmation of employment SDSSE-SC Form 268 shall be executed by the RA and Asbestos Contractor concerning each employee, to include all subcontractors and their personnel. No forms will be transferred from another file if the RA and Asbestos Contractor has other on-going contracts at SEDA. The RA and Asbestos Contractor shall provide a list of personnel who are authorized to sign Form 268 for the firm. A sample of each signature is required. Counterintelligence Division must be notified, in writing, of any changes to this list. All completed forms shall be provided through COR/POC to the Counterintelligence Division 72 hours prior to commencement of work. Failure to complete Form 268 correctly will result in employee's denial of access to Seneca. The Counterintelligence Division must be notified, in writing through POC/COR to Counterintelligence, at least 72 hours prior to requesting any action. The chain of command for all contractor actions will be through POC/COR to Counterintelligence Division. There will be no exceptions.

3.4.2.2 Camera permits require written notice from the POC/COR prior to access. Open camera permits will not be issued. The following information is required:

- Camera make, model and serial number.
- Contract name and name of individual responsible for the camera.
- Dates camera will be used.
- Where it will be used.
- What will be photographed and why.

3.4.2.3 If a rental, leased or privately-owned vehicle is required in place of a company vehicle, the following information is required:

- Name of individual driving.
- Year, make, model, color and license plate of the vehicle.
- Typed letter on company letterhead indicating that the company assumes responsibility for rental, leased or privately owned vehicles.

3.4.2.4 All access media will be destroyed upon expiration data of contract. If an extension is required, a list of employee names and new expiration data must be furnished to the Counterintelligence Division. Contract extensions must be made prior to the contract expiration data or new Form 268s will be required for each individual that requires an extension.

3.4.2.5 Traffic laws of the State of New York apply with emphasis on the following regulations. All are subject to change with road conditions or as otherwise posted.

- Speed Limit: Controlled Area as posted
- Ammo Area - 5 mph
- Limited/Exclusion Area - 25 mph

3.4.2.6 RA and Asbestos Contractor vehicles (trucks, rigs, etc.) shall be parked in areas designated by the director of Law Enforcement and Security. Usually parking will be permitted within close proximity to the work site. No parking is allowed within 30 feet of a depot fence, as these are clear zones.

3.4.2.7 Available entrance/exits gates are Post 1, Main Gate (NY Highway 96, Romulus, New York; open for personnel entrance and exit 24 hours daily, 7 days a week) and Post 3, (entrance to North Depot Troop Area, located at end of access road from Route 96-A is open 7 days a week for personnel and vehicle entrance and exit).

3.4.2.8 The following restriction apply to all RA and Asbestos Contractor personnel:

- Cameras, binoculars, weapons and intoxicating beverages will not be introduced to the installation, except by written permission of the Director/Deputy Director of Law Enforcement and Security.

- Matches or other spark producing devices will not be introduced into the Limited/Exclusion or Ammo Area except when the processor of such items is covered by a properly validated match or flame producing device permit.

- All vehicles and personal parcels, lunch pails, etc. are subject to routine security inspections at any time while on depot property.

- All building materials, equipment and machinery must be cleared by the Director of Engineering and Housing who will issue a property pass for outgoing equipment and materials.

3.4.2.9 RA and Asbestos Contractor employees are cleared for entrance to the location of contract work only. Sight-seeing tours or wandering from the work site is NOT AUTHORIZED. The following items must be adhered to in order to obtain access to the facility:

- Written notification will be provided to the Counterintelligence Division (Ext. 30202) at least 72 hours prior to overtime work or prior to working on non-operating days.

- Security Police (Ext. 30448/30366) will be notified at least two hours in advance of any installation or movement of slow moving heavy equipment that may interfere with normal traffic flow, parking or security.

3.4.2.10 All RA and Asbestos Contractor/subcontractor employees on-site shall be aware of potential violations of law or regulations, including:

- Minor. Offenses committed by a RA and Asbestos Contractor personnel which are minor in nature will be reported by the Director of Law Enforcement and Security to the Contracting Officer who in turn will report such incidents to the RA and Asbestos Contractor for appropriate disciplinary action.

- Major. Serious offenses committed while on the installation will be reported to the FBI.

Violators may be subject to trial in Federal Court.

3.4.2.11 The following rules shall be observed with regard to explosives-laden vehicles. Vehicles such as vans, cargo trucks, etc., carrying explosives will display placards or signs stating "EXPLOSIVES". Explosive ladened vehicles will not be passed. When an explosive laden vehicle is approaching, pull over to the side and stop. When catching up with an explosive laden vehicle, slow down and allow that vehicle to remain at least 100 feet ahead. When approaching an intersection where an explosive laden vehicle is crossing - STOP - do not enter the intersection until such time as the explosive carrier has passed through and cleared the intersection. When passing a vehicle that is parked and displaying "Explosive" signs, slow down to 10 miles per hour and take every precaution to allow more than ample clearance.

3.4.2.12 All RA and Asbestos Contractor employees are required to return all identification badges and passed on the last day of employment on the depot. The RA and Asbestos Contractor is responsible for the completion of all turn-ins by his employees and informing the Counterintelligence Division and the depot organization administering the contract, for termination of any employee's access to the depot.

3.5 MOBILIZATION

3.5.1 OFF SITE OR ON SITE BORROW PIT

Prior to starting the removal actions, the RA Contractor shall locate an off-site or on-site borrow pit that will be used to provide clean backfill. The RA Contractor shall be responsible for evaluating and certifying alternative borrow pit sites to ensure that the borrow material used for site backfill operations is clean. The borrow soil must be sampled and analyzed, and the results of the analyses must be provided to the Army prior to its use at the site. There must be enough borrow material available to meet the project requirements. The RA Contractor shall estimate the amount of borrow available prior to the initiation of the work. The RA Contractor shall submit a report that presents the data collected from the potential borrow pit(s) evaluated. This report shall include a site plan of the alternative sites along with an estimate of the quantity of borrow material available. The report shall present chemical and physical laboratory analysis results.

3.5.2 UTILITIES

The RA and Asbestos Contractor shall be responsible for the mobilization of necessary temporary site facilities for the performance of this removal action. The RA and Asbestos Contractor shall provide and maintain all temporary site utilities needed. Temporary site utilities may include telephone, electricity, natural gas (if required), potable water and sanitation facilities. Non-potable water, telephone and electric services are available in the area for tie-in by the RA and Asbestos Contractor. The RA and Asbestos Contractor shall furnish portable sanitary facilities, communications equipment, and potable water. Payment for telephone, electricity and water will be through SEDA.

3.5.3 SITE CLEARANCE

The RA and Asbestos Contractor shall locate, identify, mark, and protect site structures and utilities from damage. The RA and Asbestos Contractor shall protect survey benchmarks from damage or displacement. The RA and Asbestos Contractor shall remove surface debris and clear areas required for site access and excavation.

3.5.4 SITE SECURITY

The RA and Asbestos Contractor shall be responsible for limiting and controlling personnel and wildlife entry into the exclusion zone, excavation, and any other potentially hazardous locations. The RA and Asbestos Contractor shall construct a security fence around the work areas.

3.5.5 DECONTAMINATION FACILITY

This section describes the basic requirements for decontamination activities that must be completed during, and the facilities that must be developed for, each removal action site.

3.5.5.1 The RA and Asbestos Contractor shall supply all labor, materials, and equipment needed to design, construct, and equip decontamination facilities in accordance with these specifications.

3.5.5.2 The RA and Asbestos Contractor shall decontaminate all excavation and transport equipment prior to its:

- use at a new site,
- removal from SEDA,
- use for handling of clean borrow materials intended for backfilling.

3.5.5.3 The RA and Asbestos Contractor shall design and operate decontamination facilities in a manner that ensures that all of the debris resulting from, and the materials used during the decontamination process are captured and recovered prior to their release to the surrounding environment.

3.5.5.4 Fluids and solids generated during decontamination activities will be segregated, and recovered. Fluids and solids may be separated by allowing the mixed wastes to flow into a lined sump where they are allowed to settle. The top layer of liquids will be decanted from sump and placed into appropriate containers for transport to storage, treatment, and disposal facilities. Recovered solids will be added to the excavated soils stockpiled for disposal, or placed in other suitable transport containers for subsequent transport and disposal at off-site facilities.

3.5.5.5 All personnel protective equipment used during site operations will be segregated from other removal action debris and collected as a separate stream for off-site disposal at approved facilities.

3.6 SITE OPERATIONS

3.6.1 STAGING AREAS

The RA and Asbestos Contractor shall construct, operate and maintain separate staging areas for the temporary storage and stockpiling of clean and contaminated soil. Additional requirements for the staging areas are provided below

3.6.1.1 The locations of the staging areas established for clean and contaminated soil shall be clearly marked and identified on the site plan. Each staging area shall have sufficient capacity for up to 6 days volume of soil.

3.6.1.2 The RA Contractor shall underline all staging areas with 2 to 3 inches of sand covered by a 40-mil HDPE (or equivalent) liner.

3.6.1.3 The RA Contractor shall use berms or equivalent means to prevent surface water run-on and run-off from the designated staging areas.

3.6.1.4 The RA Contractor shall cover all soil stockpiles with a tarp that is weighted appropriately to prevent erosion of the pile by wind, rain, snow, or stormwater. All soil stockpiles shall be covered to the fullest extent possible. Storage piles shall be covered at all times when they are not being actively worked.

3.6.1.5 The RA and Asbestos Contractor shall minimize vehicular traffic on staging area liners to prevent damage to the liner. The RA and Asbestos Contractor shall use only rubber-tired loaders in the staging area to minimize damage to the liner.

3.6.1.6 The RA Contractor shall inspect storage pile liners and covering tarps at least once per work day. If the integrity of the liner or the covering tarp is breached, the breach shall be immediately repaired or the contents of the stockpile shall be moved to another location that is constructed per the specifications defined above.

3.6.1.7 If a stockpile is relocated due to a failure of the liner or covering tarp, the new location will be marked on the site plan and reported to the Army.

3.6.2 PREPARATION FOR EXCAVATION

The RA and Asbestos Contractor shall survey and mark each site to delineate the proposed extent of the excavation. The RA and Asbestos Contractor shall identify the required excavation lines, levels, contours, and datum used to delineate the extent of the proposed excavation. The RA and Asbestos Contractor shall identify and protect existing structures, utilities and existing benchmarks from damage during the site operations.

3.6.2.1 Surveying

Two survey monuments are available in the area of SEAD-24 (i.e., Monument SEAD-24 and Monument SEAD-24A) as shown on **Figure 1**. There are no permanent survey markers at the other SWMUs.

There are also three monitoring wells with known coordinates located in the areas of each of the planned excavations described herein. The location of the monitoring wells are shown on **Figure 1**, **2**, and **3** for SEADs 24, 50/54, and 67, respectively. Known coordinates for all of these locations are provided in **Table 12**.

Tasks that require surveying are layout of the soil excavations, sampling locations, and preparation of the project record drawings. All surveying shall be done under the supervision of a New York licensed and registered surveyor.

Table 12
Survey Coordinates for Site Features

Area	Location Identification	Northing (ft NAD 83)	Easting (ft NAD 83)
SEAD-24	SEAD-24	999,231.00	740,132.00
SEAD-24	SEAD-24A	999,249.00	739,807.00
SEAD-24	MW24-1	998,948.83	740,101.57
SEAD-24	MW24-2	999,255.17	739,843.61
SEAD-24	MW24-3	998,999.77	739,750.62
SEAD-50	MW50-1	992,284.94	753,133.56
SEAD-50	MW50-2	992,801.00	753,818.00
SEAD-50	MW50-3	992,274.88	754,379.75
SEAD-67	MW67-1	1,002,498.40	748,911.69
SEAD-67	MW67-2	1,002,256.70	748,953.25
SEAD-67	MW67-3	1,002,492.10	748,794.94

3.6.2.2 Pre-Excavation Sampling

The Asbestos Contractor will design, implement and assess the results of a pre-excavation sampling event in SEAD-50/54. The sampling event will be used to further delineate the extent of soil containing Asbestos that will be excavated during the planned removal action. The results of the sampling and analysis event will be provided to the Army, the Oversight Contractor, the RA Contractor and the regulatory agencies prior to the implementation of the remeoval; the prior to the initiation of excavation in SEAD-50/54.

3.6.3 EXCAVATION

The RA Contractor shall be responsible for excavation of areas contaminated with semivolatile organic compounds, pesticides/PCBs or metals as are described in **Sections 3.5.3.1.1** through **3.5.3.1.3** below, and as are shown on **Figures 1** through **3**. The Asbestos Contractor shall be responsible for excavation of areas contaminated with asbestos as are described in **Sections 3.5.3.1.2** below, and as are shown on **Figure 2**. Additional specifications pertinent to the excavation of contaminated soil are provided below.

3.6.3.1 The extent of the proposed excavations may be modified as are required to comply with other parts of this subsection, which are provided subsequently.

3.6.3.1.1 SEAD-24

As is indicated above, the shallow soil contamination identified is predominated by two chemical species: arsenic and zinc. Of these two analytes, arsenic is found in the greatest number of samples (i.e., 11) at concentrations that exceed its TAGM criteria value, followed by zinc (10 times). Further review of the data indicates that generally two, and sometimes all three, of these analytes are detected at concentrations exceeding their respective TAGM criteria value in each sample collected. Of further note is the finding that a majority of the other analytes found at concentrations exceeding their respective criteria values are also found in samples that contain one or more of the three metals at concentrations above their criteria levels.

Therefore, the Army proposes to use arsenic and zinc as indicator compounds that define the extent of contamination at SEAD-24. The extent of the soil contamination indicated by these analytes is shown on **Figure 1**.

Surface soil in the limited area to the west of the Abandoned Powder Burn Pit, defined by sample locations SS24-10, SS24-11 and SS24-12, should be remediated to a depth of 6 inches. In addition, the shallow soil contained in the area to the north, east and south and exterior of the abandoned burn pit and measuring approximately 50 to 150 feet wide should be remediated to a depth of 6 inches. The total quantity of soil to be remediated is initially estimated as 2,500 cubic yards (CY or approximately 3,800 tons). The actual amount of soil that will be remediated under this action will be determined based on the results of confirmational samples that will be collected from the proposed excavations and characterized for arsenic and zinc content.

3.6.3.1.2 SEAD-50/54

The Army is proposing to address shallow soil contamination by metals and asbestos that has been identified in the southern portion of the Tank Farm, SEADs 50/54. The identified soil contamination is evidenced by the discovery of elevated concentrations of arsenic, lead, mercury and asbestos within collected soil samples.

To reduce the threat from metal and asbestos impacted soil, the surface soil between surface soil sample location SS50-5 and SS50-1 (150 feet by 1,000 feet); between surface soil sample location SS50-6 and SS50-8 (150 feet by 800 feet), and between sample locations SS50-5, SS50-6, and SS50-7 (150 feet by 200 feet) should be remediated to a depth of 6 inches. The volume of soil to be removed at SEAD-50 and 54 is approximately 5,000 cubic yards (CY or 7,500 tons). These areas are shown as shaded areas on **Figure 2**.

Additionally, to reduce the threat from PAH and pesticide-impacted sediments, the roadside drainage ditches that run nest to East Patrol Road and the unnamed east-west road that transects the site should be remediated to a depth of six inches. The volume of sediment to be removed from SEAD-50 and 54 is approximately 150 CY (225 tons).

3.6.3.1.3 SEAD-67

Analytical results described in **Section 1** indicate that sediment and soil found near SEAD-67 are impacted by chemical materials. Sediment located in a drainage ditch that runs east of the sewage treatment plant has been impacted by pesticides, polynuclear aromatic hydrocarbons (PAHs), and a few metal species. Additionally, soils contained in waste piles and berm structures that are to the east of SEAD-67 are contaminated by PAHs and the metal, mercury. The extent of the identified impacts to soil appears to be limited. The extent of the sediment contamination is less well known.

The Army is proposing to conduct a removal action to remove or reduce the threat that appears to exist due to the identified shallow soil and sediment contamination that exists at the Dump Site east of Sewage Treatment Plant No.: 4. The potential threat associated with the PAH and mercury-impacted soil at SEAD-67 will be addressed by removing all of the soil that is contained in the waste piles and berm structures. Comparably, the threat from PAH, pesticide and metal impacted sediments will be addressed by removing the top six inches of the sediment in the small stream to the east of SEAD-67. The removal of sediment will also be performed for a short distance north of West Romulus Road but south of the wetlands. The areas to be remediated are indicated on the shaded areas of **Figure 3**. The volume of soil and sediment to be remediated from the area of SEAD-67 is approximately 160 cubic yards (240 tons).

3.6.3.2 The RA Contractor shall excavate and manage all contaminated soil from each of the removal action sites, exclusive of the area found to contain asbestos. The minimum extent of the required excavation in each area is defined above in **Section 3.5.3.1** and in **Figures 1** through **3**. The Asbestos Contractor shall excavate and manage all contaminated soil from SEAD-50/54 which is contaminated with asbestos. The minimum extent of the required excavation in each area is defined above in **Section 3.5.3.1** and in **Figures 1** through **3**. The excavation limits shown in **Figures 1** through **3** should be considered as initial. The RA and Asbestos Contractor shall collect soil samples along the perimeter and bottoms of the areas excavated, and analyze the samples to confirm that the proposed limits of excavation meet the specified performance standards. These samples shall be analyzed for semivolatile organic compounds, pesticides, metals and asbestos (as needed and appropriate) via US EPA SW-846 Methods 8270 (semivolatile organic compounds), 8081 (pesticides/PCBs), 6010 et. al. (metals) and polarized light microscopy (PLM – asbestos), respectively, or other approved methods. The resulting data will be compared to tabulated criteria levels provided in NYSDEC's Technical and Administrative Guidance Memorandum #4046, "Determination of Soil Cleanup Objectives and Cleanup Levels," January 1994. Compliance with the requirements of the excavation via this means will be based on the determination that all resulting analytical data is less than or equal to the tabulated concentrations identified in **Section 2.0.3** of this specification.

3.6.3.3 The RA and Asbestos Contractor shall collect samples of the excavated soil and submit them for analysis to develop source characterization data needed by the disposal facility.

3.6.3.4 Backfill of the excavation shall not begin until the confirmational samples laboratory results are reviewed and the final limits of excavation are defined. If the laboratory results indicate that additional soils must be excavated, the RA and Asbestos Contractor shall notify the

Contracting Officer and await further instructions.

3.6.3.5 Excavations shall be made and maintained in accordance with the Grading and Excavation Plan submitted by the RA Contractor and approved by the Army. The RA Contractor shall grade the upper perimeter edge of the excavation to prevent surface water inflow into the open excavation.

3.6.3.6 The RA and Asbestos Contractor shall use appropriate dust suppression and vapor control measures to minimize emissions from the excavation. The RA Contractor shall conduct air monitoring in accordance with the NYSDOH "Community Air Monitoring Plan" as presented in Appendix A. The Asbestos Contractor shall conduct air monitoring in accordance with the NYSDOL's requirements as they are presented Industrial Code Part 56. Should the air monitoring action levels be exceeded, work will be stopped until appropriate air emission control measures can be instituted.

3.6.3.7 All areas in SEAD-50/54 that are excavated to removed asbestos will be wetted prior to the beginning of excavation activities, and will be maintained in a wetted condition to minimize the potential release of asbestos to the environment.

3.6.3.8 The RA and Asbestos Contractor shall notify the Army of any unexpected subsurface conditions and discontinue work in the affected area until notified to resume work. Work is to continue in unaffected portions of the site.

3.6.3.9 Excavation shall not be conducted during periods of inclement weather (i.e., rain or snow events).

3.6.3.10 All soil excavated from the portion of SEAD-50/54 that is found to be contaminated with asbestos at concentrations in excess of 1 percent will be immediately double bagged in suitable outer protective layers to prevent the spread of asbestos fibers.

3.6.3.11 The RA Contractor shall stockpile all excavated soils in accordance with these specifications pending off-site transport and disposal.

3.6.3.12 The RA and Asbestos Contractor shall record the volume of material excavated and report this volume to the Army as part of the weekly reports required in these specifications.

3.6.3.13 The RA Contractor shall carefully set the excavation rate in areas with high concentration of volatile organics in order to control the volatile organic emissions. The RA Contractor shall include excavation procedures for the high concentration areas in the workplan.

3.6.3.14 The RA Contractor shall prepare a drawing that documents the extent of the excavations.

3.6.4 Backfilling

The RA Contractor will provide all labor, material and equipment needed to backfill the completed excavations. Additional details pertinent to the completion of the backfill operations are provided below.

3.6.4.1 The RA Contractor shall backfill excavation with certified, clean backfill. The backfill shall come either from an off-site facility or from a location on-site. The RA Contractor shall provide documentation that certifies that the material used as backfill is clean and free of undesirable substances including debris, rubble, wood, chemicals, etc. The documentation shall include laboratory testing results of soil samples collected from the borrow pit and a description of the location of the borrow pit.

3.6.4.2 Testing results of the soil samples from each borrow pit must be submitted and approval prior to the use of any material as backfill. At least one sample shall be collected from each borrow pit and analyzed for the following parameters:

- TAL Metals
- Explosives
- TCL Organic compounds (volatile and semi-volatile organic compounds)
- PCB/Pesticides

Analytical results shall be compared to the NYSDEC TAGMs to determine whether the backfill is clean, and suitable for use as backfill.

3.6.4.3 The RA Contractor shall visually inspect each load of backfill to assure that the material is similar to the material that was sampled in the borrow pit and tested. Also, the RA Contractor shall collect grab samples from three truck of fill each day and check the head space of the samples for volatile organic compounds. The material from the truck may not be backfill until the results of the headspace analysis is complete.

3.6.4.4 Satisfactory borrow materials for use as backfill shall be selected from materials designated as GW – Gravel, well graded; GM – Gravels, mixed, non plastic, fines; GC – Gravels, clayey-plastic, fines; SW – Sands, well graded; SM – Sands, mixed-plastic, fines; or SC – Sands, clayey-plastic, fines in ASTM D 2487 "Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)". The selected backfill shall be free of roots and other organic matter, trash, debris, frozen materials, and stones larger than 3 inches in any dimension. Any material classified as SM shall not have more than 25 percent by weight passing the No. 200 sieve.

3.6.4.5 The RA Contractor shall not backfill an excavation if standing water is present in the excavation. The water either shall be allowed to naturally infiltrate through the base of the excavation or shall be pumped from the excavation and treated prior to disposal.

3.6.4.6 All material backfilled into the excavation shall be compacted enough to support the construction traffic. The final grading plan shall allow for proper drainage after any estimated subsidence of the backfilled material has taken place.

3.7 DISPOSAL

3.7.1 DISPOSAL OF CONTAMINATED SOIL

The RA and Asbestos Contractor shall provide all labor, material, and equipment necessary to dispose of the contaminated soil. All disposal operations will be completed in accordance with prevailing environmental statues, laws, and regulations. This section describes the disposal requirements for all soils residue, and decontamination residuals generated as part of this removal action.

3.7.1.1 SEDA and the Army shall be identified as the Generator of all project-derived wastes (i.e., excavated soil, wastewater, PPE and miscellaneous debris – e.g., tarps and plastic sheeting). The RA and Asbestos Contractor shall be identified as the Generator of any waste resulting due to the release of a hazardous material from his equipment or resulting from improper use of chemical materials at the site.

3.7.1.2 The RA and Asbestos Contractor shall comply with all applicable federal, state, and local regulations. At a minimum, the RA and Asbestos Contractor shall identify and comply with all hazardous and solid waste, and transportation requirements.

3.7.1.3 The RA and Asbestos Contractor shall be responsible for determining whether the waste residuals generated from the excavation processes are hazardous wastes. Wastes include any excavated soil, waste oils or lubricants, hydraulic fluids, coolants, plastic sheeting, used personnel protection equipment and other miscellaneous debris.

3.7.1.4 The RA Contractor shall specify analytical determinations that shall be performed to assess the nature of the contamination contained in all excavated soils and other wastes generated during the identified removal actions. The Asbestos Contractor shall specify analytical determinations that shall be performed to assess the nature of the asbestos contained in all excavated soils and other wastes generated during the identified removal actions.

3.7.1.5 The RA and Asbestos Contractor shall collect, secure analytical services and obtain results from a state certified laboratory identifying the contents of all generated waste streams resulting from the removal action. The RA and Asbestos Contractor shall provide the generated data to the Army and to the proposed disposal facility for review.

3.7.1.6 The RA and Asbestos Contractor shall obtain approval from the Army of all off-site disposal facilities that are selected to receive wastes from SEDA.

3.7.1.7 All waste shall be disposed off-site at a permitted waste treatment storage and disposal facility.

3.7.1.8 The RA and Asbestos Contractor shall transport all generated waste materials from the removal actions from the site of the excavation and on-site stockpiles to the selected disposal site. All waste transportation will be completed following procedures that are necessary to document the transfer of the waste from SEDA, over public roads, to the approved disposal site.

3.7.1.9 At a minimum, the RA and Asbestos Contractor will document the quantity and type of waste materials moved from SEDA each day to an approved disposal site. At a minimum, collected records shall include a listing of all quantities and types of wastes transported. If necessary, bills of lading and hazardous waste manifests will be prepared and entered into the project files to document the transportation to and disposal of materials at off-site licensed and approved landfills.

3.7.2 TREATMENT OF WATER

3.7.2.1 The RA Contractor shall store all wastewater in portable tanks appropriate for managing wastewater. The RA Contractor shall ensure that the tanks used have been constructed in accordance with all applicable codes and standards. The RA Contractor shall visually inspect all tanks for leaks and shall replace all leaking tanks.

3.7.2.2 The RA Contractor shall treat all wastewater on site using either an air stripper column or an activated charcoal system and shall discharge the treated water in accordance with the approved discharge permit.

3.7.2.3 Following treatment of wastewater, the RA Contractor shall discharge all treated waters from this removal action including groundwater to a nearby drainage ditch. The RA Contractor shall include in the site plans all specific testing requirements for this discharge permit, and shall be responsible for meeting these testing requirements.

3.8 DRAINAGE CONTROL

3.8.1 RUNON CONTROL

The RA Contractor shall implement and maintain, for the duration of the removal action, run on control measures to prevent non-excavation related and non-contaminated surface water from entering the work areas of the site. These measures shall consist of berms and ditches, as are necessary, that redirect the flow of surface water around the excavation site to the historic surface water discharge points.

3.8.2 RUNOFF CONTROL

The RA Contractor shall implement and maintain, for the duration of the removal action, measures to prevent surface water from leaving the area of the excavation sites or stockpiles. These measures shall include berms or ditches that capture surface water in the work area for subsequent testing and disposal. The RA Contractor shall construct berms around all staging areas to prevent runoff from the stockpiled materials. Any collected runoff from the staging areas shall be collected and disposed of in accordance with the requirements of these specifications.

3.8.3 EXCAVATION DRAINAGE

The RA and Asbestos Contractor shall provide pumps, hoses, and any other equipment necessary to remove accumulated water from the open excavation. The RA and Asbestos Contractor shall be required to remove water from the excavation when necessary to continue excavation activities, or if a safety threat exists. The water from the excavation shall be collected and treated in accordance with the requirements of these specifications.

3.9 EROSION/DUST CONTROL

3.9.1 EROSION CONTROL

The RA and Asbestos Contractor shall provide the materials and labor required to control erosion of soils originating from the site. These measures may include limiting the exposure area, placement of hay bales and silt fences or berms.

3.9.2 DUST CONTROL

The RA and Asbestos Contractor shall take necessary measures, in addition to those required by federal, state, and local regulations, to eliminate or minimize the migration of dust off site due to site activities. At a minimum, the RA and Asbestos Contractor shall follow the requirements of the NYSDEC TAGM HWR-89-4031, "Fugitive Dust Suppression and Particulate Monitoring Program at Inactive Hazardous Waste Sites," October, 27, 1989 (or most recent version) and the monitoring requirements in these specifications.

3.10 AIR MONITORING AND ACTION LEVELS

3.10.1 GENERAL

The RA Contractor shall monitor the emissions from the excavations and soil staging areas to assure compliance with all federal, state, and local regulations. Monitoring shall be conducted in accordance with the NYSDEC TAGM, "Fugitive Dust Suppression and Particulate Monitoring at Inactive Hazardous Waste Sites," October 27, 1989 (or most recent version), and with the New York State Department of Health "Community Air Monitoring Plan."

3.10.2 CALIBRATION

The RA and Asbestos Contractor shall calibrate all air monitoring equipment weekly in accordance with the manufacturer's instructions, and shall maintain records of all calibrations. These records shall be made available to the Army's representative or to the regulators upon request.

3.11 CONFIRMATORY SAMPLING AND ANALYSIS

3.11.1 GENERAL

Confirmatory sampling shall be performed by the Oversight Contractor and the RA Contractor to verify the successful removal of soil and sediment containing semivolatile organic compound, pesticide/PCB, or metal contaminants. The Asbestos Contractor shall perform confirmational sampling to verify the successful removal of soil and sediment containing asbestos. The Oversight Contractor shall be responsible for confirmatory sampling and analysis in the excavations. This section describes the requirements for confirmatory sampling and analysis.

3.11.2 SAMPLING LOCATIONS

3.11.2.1 Soil

The Oversight Contractor shall collect confirmatory soil samples from the perimeter of excavations and the bottom of the excavations to confirm that the performance standards have been met. These samples shall be analyzed for the volatile and semivolatile organic compounds, pesticides and PCBs, and metals as are appropriate. The Asbestos Contractor shall collect confirmatory soil samples from the perimeter and bottom of excavations made for asbestos removal in SEAD-50/54. These samples shall be analyzed for asbestos and metals.

3.11.2.2 Wastewater

The RA Contractor shall collect samples of the wastewater resulting from all site operations, including excavation dewatering, precipitation onto contaminated soil stockpiles, and spent washwater to ensure proper treatment and disposal.

3.11.3 SAMPLING AND ANALYSIS

3.11.3.1 Sample Locations, Frequency, and Types

3.11.3.1.1 Soil

The excavation limits shown in **Figures 1** through 3 shall be considered as preliminary and subject to change. Confirmatory samples shall be collected from the perimeters and bottoms of the excavations. One sample will be collected for every 500 square feet of excavation bottom or at least one per excavation and one sample from every 200 feet of excavation perimeter or at least one per wall. These samples shall be analyzed for semi-volatile organic compounds, pesticides and PCBs, metals and asbestos as necessary and appropriate (e.g., asbestos analyses need in area of SEAD-50/54, but not elsewhere; pesticides needed at SEADs 50/54 and 67 but not SEAD-24). If these samples indicate that additional contaminated soil or sediment remains at the site then additional soil and sediment will be excavated until subsequent testing confirms that all impacted material has been excavated.

3.11.3.1.2 Wastewater

Samples of wastewater shall be collected as necessary to ensure proper treatment and discharge of the wastewater.

3.11.3.2 Sampling Equipment Decontamination

The RA and Asbestos Contractor shall use disposable sampling equipment wherever possible to minimize decontamination requirements. When reusable equipment is used, the RA and Asbestos Contractor shall decontaminate all equipment prior to use in sampling. The decontamination procedure shall consist of successive washes in the following order:

- Potable water rinse
- Wash with laboratory grade detergent (Alconox or equivalent)
- Distilled water rinse
- Methanol rinse
- Hexane rinse
- Distilled water rinse

If samples are to be analyzed for metals, a nitric acid rinse and an additional distilled water rinse will be added between steps 3 and 4. All decontamination wastes shall be disposed of off-site as hazardous waste.

3.11.3.3 Sample Volumes, Containers, and Preservation

The RA Contractor shall ensure that all sample containers, preservation, packaging, and holding times are in accordance with EPA Region 2 and NYSDEC protocols. All samples collected shall be properly logged, labeled, packaged, and stored in an iced cooler immediately after collection and until arrival at the laboratory. All samples will be accompanied by a completed chain-of-custody form that can be used to document sample custody.

3.11.3.4 Laboratory Analyses

All soil samples shall be analyzed for volatile and semi-volatile organic compounds using NYSDEC Analytical Services Protocols (ASP). Soil samples shall be analyzed for toxicity characteristic by TCLP using EPA SW-846 Method 1311. The RA Contractor shall ensure that the laboratory is capable of providing reporting limits below the soil cleanup levels so that reported non-detect values may be compared to the cleanup levels. The RA Contractor shall ensure that the selected laboratory has been approved by NYSDEC and the Corps of Engineers, Missouri River Division.

3.12 DEMOBILIZATION AND SITE RESTORATION

3.12.1 DEMOBILIZATION

Following completion and acceptance of the work by the Contracting Officer, the RA and Asbestos Contractors shall provide all Contractor and subcontractor labor and materials required to decontaminate, dismantle, package, and transport from the site all Contractor or subcontractor equipment, materials, and personnel. Demobilization will not be complete until site restoration is complete.

3.12.2 REMOVAL

At the completion of the removal actions, the RA and Asbestos Contractor shall remove all temporary facilities, utility services, and debris, unless otherwise directed by the Army's representative. The RA and Asbestos Contractor shall restore the area in accordance with these specifications.

3.12.3 SITE RESTORATION

3.12.3.1 General

The RA Contractor shall restore the sites to their original condition except as described in these specifications or as directed by the Army.

3.12.3.2 Regrading

The RA Contractor shall grade the excavation sites to approximate the original site conditions. As necessary, the RA Contractor shall bring in documented clean fill to make up for any volume losses. The RA Contractor shall also grade the sites to minimize erosion during the revegetation period.

3.12.3.3 Revegetation

The RA Contractor shall revegetate the sites using grass seed upon completion of the backfill operations and demobilization. The RA Contractor shall revegetate the backfilled excavations and all work areas in which site work has killed off the vegetation.

3.12.3.4 Materials

3.12.3.4.1 Fill

Satisfactory materials for use as fill shall be materials classified in ASTM D 2487 as GW, GM, GC, SW, SM, SC and shall be free from roots and other organic matter, trash, debris, frozen materials, and stores larger than 3 inches in any dimension. Any material classified as SM shall have not more than 25 percent by weight passing the No. 200 sieve.

3.12.3.4.2 Topsoil

Topsoil shall be fertile, natural friable, silty soil, with characteristics of typical soil in the vicinity that produces heavy crops, grass and other vegetation, obtained from naturally well-drained areas. The topsoil shall be reasonably free from subsoil, weeds and other vegetation and from clay lumps or stones. Soil shall have a pH between 5.5 to 7.6. The RA Contractor shall have representative topsoil samples test by a soil-test chemist and a copy of the test and recommendations for additives shall be furnished to the site representative prior to commencing work. Quantity given for the following materials used for conditioning and seeding will be adjusted as required by the soil chemist recommendations.

3.12.3.4.3 Limestone

Limestone shall consist of ground calcareous or dolomitic limestone, 95% to pass a No. 20 sieve and at least 50% to pass a No. 100 sieve. Limestone shall conform to the standards of the

American Association of Analytical Chemists, and be marked in accordance with the appropriate Federal and state laws relating to commercial fertilizers.

3.12.3.4.4 Fertilizer

Fertilizer shall be applied in granular dry form and shall be a slow-release type product specifically designed for starting grass seed. The chemical analysis shall be (approximately) 15-10-10 applied at the rate designated by the soil-test chemist. The fertilizer shall conform to the requirements of the appropriate Federal and sate laws relating to commercial fertilizers, and be delivered dry in original, unopened containers bearing the manufacturer's guaranteed analysis.

3.12.3.4.5 Grass Seed

Grass seed shall meet the requirements of the appropriate state and Federal agricultural and vegetable seed laws. Grass seed shall contain Kentucky Blue, Red Top, Fescue and Creeping Bent. Red Top shall not exceed 20% of the mixture. Alternate types of permanent seed mixtures of equal quality may be used, if in the opinion of the RA Contractor's soil-chemist they are more suitable to the local climate and conditions provided that 80% of permanent grasses and not clover is used in any traffic areas. Weeds and inert material shall not exceed 2%.

3.12.3.4.6 Mulch

Mulch shall consist of hay mulch or straw mulch.

3.12.3.5 Application

3.12.3.5.1 Topsoil

The areas to be covered with topsoil shall be rough graded to the appropriate required sub-grades and shall be maintained in a true and even condition. Finish grading shall include any necessary repairs to previously rough graded areas. Immediately prior to dumping and spreading the topsoil, the sub-grade, wherever compacted by traffic or other causes, shall be loosened by disking or scarifying to a depth of at least two inches to permit bonding of the topsoil to the sub-grade. Topsoil shall be spread evenly to a compacted thickness of 6 inches over all required areas and shall be rolled and raked until it is clean and free from irregularities, and is at the finished grades. Topsoil shall not be placed on frozen, excessively wet or dry sub-grade.

3.12.3.5.2 Fertilizer and Limestone

After the topsoil has been spread to the required thickness, ground limestone shall be distributed uniformly over the topsoil at a rate of 5 pounds per 100 square feet. After disking in of the ground limestone, fertilizer shall be spread at a rate of 2 pounds per 100 square feet or as recommended by the soil chemist. Subsequent to liming and fertilization, the topsoil areas shall be scarified by disking in two directions at right angles to each other, or by other approved methods, in such a manner that the topsoil will be thoroughly incorporated into the top two inches of the subgrade. Prior to seeding, the surface of the topsoil shall be raked free of all stones and other objectionable material.

3.12.3.5.3 Grass Seed

No seeding shall be done during windy weather or when the ground is frozen, wet or otherwise non-tillable. As soon as the seed is sown, it shall be thoroughly covered with a thin layer of topsoil by raking, harrowing or dragging. The areas shall be uniformly seeded using not less than 4 pounds per 100 square yards of area. The seed shall be raked in lightly and rolled with a light roller.

3.12.3.6 <u>Maintenance</u>

Seeded areas shall be protected and maintained by watering, mowing and replanting as necessary for at least 30 days and as much longer as is necessary to establish a uniform stand of the specified grasses and until acceptance. The RA Contractor shall be responsible for the watering of all seeded areas which shall be kept moist. The Army's representative's decision will prevail in the event a dispute develops with the RA Contractor as to whether or not the seeded and grassed areas are moist. Seeded areas on which growth has started shall be watered to a minimum depth of two inches to assure continuing growth. Watering shall be done in a manner which will provide uniform coverage, prevent erosion and prevent damage to the finished surface by the watering equipment. The RA Contractor shall furnish sufficient watering equipment. Prior to acceptance of the project, the RA Contractor will be responsible for mowing the grass on all flat or rolling slopes from level, to and including 4 to 1 slopes to a height of 2" when the grass has attained a height of 3". The grass on all slopes steeper than 4 to 1 shall be cut to a height of 2" at such time as a stable turf has been established in the judgement of the Army's representative. Seeded areas shall be cut at least 3 times; none of which shall be closer than ten (10) days apart. The RA Contractor shall cut and maintain the lawn and field areas until they are judged by the Army's representative to be at least 95% satisfactory.

3.13 DOCUMENTATION/RECORDKEEPING

3.13.1 DAILY LOGS

The RA Contractor shall maintain daily logs that include the quantities of the soil excavated and treated the previous day and copies of all analytical data received the previous day. The daily logs will also include any air monitoring results obtained the previous day and the volume of water treated the previous day.

3.13.2 WEEKLY REPORTS

The RA and Asbestos Contractor shall submit weekly reports each Monday morning to the Contracting Officer or his representative. The weekly reports shall summarize the daily logs from the previous week, and address administrative issues. Topics which should be included in the weekly report are:

- A summary of the work completed.
- A discussion of the work planned for the upcoming week period.
- A review of problems that arose during the previous week and the resolution to each item.
- Documentation of health and safety meetings
- A review of health and safety issues
- Site visitor logs

The requirements for the final report are presented in Appendix D and Appendix E.

3.13.3 FINAL REPORT

The RA and Asbestos Contractor shall submit a final report to the Contracting Officer or his representatives within 30 days of demobilization. The report shall summarize all the daily logs and weekly reports, and provide tabular summaries of all data collected during the removal action. The final report shall include copies of all analytical data, visitor logs, air monitoring data, shipping forms, manifests, and description of all problems and problem resolutions. The final report shall include a project record drawing which shows the extent of the excavations and clearly indicates the locations of all samples collected to verify the extent of the excavation. The requirements for the final report are presented in Appendix D and Appendix E.

3.14 PERFORMANCE SCHEDULE

3.14.1 The RA and Asbestos Contractor shall complete each of the project tasks within the time frame presented in the Contract Data Requirements List, shown in Appendix D.

3.15 DELIVERABLE DATA

3.15.1 The RA and Asbestos Contractor shall prepare and submit a CDAP in accordance with ER 1110-1-263 and DD Forms 1423 and 1664-1.

3.15.2 The RA and Asbestos Contractor shall prepare and submit a written certification of the HSP in accordance with DD Forms 1423 and 1664-1.

3.15.3 The RA and Asbestos Contractor shall prepare and submit an SSHP in accordance with DD Forms 1423 and 1664-1.

3.15.4 The RA and Asbestos Contractor shall prepare and submit a Work Plan in accordance with DD Forms 1423 and 1664-1.

3.15.5 The RA and Asbestos Contractor shall prepare and submit weekly progress reports in accordance with DD Forms 1423 and 1664-1.

3.15.6 The RA and Asbestos Contractor shall prepare and submit a Final Report at the conclusion of the treatment period in accordance with DD Forms 1423 and 1664-1.

3.15.7 The RA and Asbestos Contractor shall submit all deliverable data to the Contracting Officer or his representatives. The Contracting Officer or his representatives will review the submissions to determine whether they meet the minimum contract requirements and will accept or reject them accordingly. The RA and Asbestos Contractor shall correct the deficiencies of the rejected deliverables and resubmit them within 30 days of rejection. The Contracting Officer's acceptance of any submittal does not constitute or imply approval or endorsement, and in no way relieves the RA and Asbestos Contractor of his responsibility to meet all the requirements of this document.

3.17 REFERENCES

U.S. Army Corps of Engineers, Huntsville Division, Manual No. HNDM 1110-1-1, Design Manual for Architect-Engineer, August 1986.

Engineering-Science, Inc., "Solid Waste Management Unit Classification Report", September 1994.

Engineering-Science, Inc., "Draft Expanded Site Inspection Seven High Priority SWMUs" June 1994.

United States Army Environmental Hygiene Agency (USAEHA), 1987, Evaluation of Solid Waste Management Units, Seneca Army Depot, Interim Final Report, Groundwater Contamination Survey, No. 38-26-0868-88.

United States Army Toxic and Hazardous Materials Agency (USATHAMA), 1989, Remedial Investigations Feasibility Studies, Seneca Army Depot Ash Landfill.

United States Army Toxic and Hazardous Materials Agency (USATHAMA), 1980, Installation Assessment of Seneca Army Depot, Report No. 157, AMXTH-IR-A-157, January 1980.

APPENDIX A

NEW YORK STATE DEPARTMENT OF HEALTH COMMUNITY AIR MONITORING PLAN

AND

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION DIVISION TECHNICAL AND ADMINISTRATIVE GUIDANCE MEMORANDUM FUGITIVE DUST SUPPRESSION AND PARTICULATE MONITORING AT INACTIVE HAZARDOUS WASTE SITES

New York State Department of Environmental Conservation

TECHNICAL AND ADMINISTRATIVE GUIDANCE MEMORANDUM #4031

FUGITIVE DUST SUPPRESSION AND PARTICULATE MONITORING PROGRAM AT INACTIVE HAZARDOUS WASTE SITES

TO: Regional Hazardous Waste Remediation Engrs., Bur. Directors & Section Chiefs

FROM: Michael J. O'Toole, Jr., Director, Division of Hazardous Waste Remediation

SUBJECT: DIVISION TECHNICAL AND ADMINISTRATIVE GUIDANCE MEMORANDUM -- FUGITIVE DUST SUPRESSION AND PARTICULATE MONITORING PROGRAM AT INACTIVE HAZARDOUS WASTE SITES

DATE: Oct 27, 1989

Michael J. O'Toole, Jr. (signed)

1. Introduction

Fugitive dust suppression, particulate monitoring, and subsequent action levels for such must be used and applied consistently during remedial activities at hazardous waste sites. This guidance provides a basis for developing and implementing a fugitive dust suppression and particulate monitoring program as an element of a hazardous waste site's health and safety program.

2. Background

Fugitive dust is particulate matter--a generic term for a broad class of chemically and physically diverse substances that exist as discrete particles, liquid droplets or solids, over a wide range of sizes--which becomes airborne and contributes to air quality as a nuisance and threat to human health and the environment.

On July 1, 1987, the United States Environmental Protection Agency (USEPA) revised the ambient air quality standard for particulates so as to reflect direct impact on human health by setting the standard for particulate matter less than ten microns in diameter (PM_{10}); this involves fugitive dust whether contaminated or not. Based upon an examination of air quality composition, respiratory tract deposition, and health effects, PM_{10} is considered conservative for the primary standard--that requisite to protect public health with an adequate margin of safety. The primary standards are 150 ug/m^3 over a 24-hour averaging time and 50 ug/m^3 over an annual averaging time. Both of these standards are to be averaged arithmetically.

There exists real-time monitoring equipment available to measure PM_{10} and capable of integrating over a period of six seconds to ten hours. Combined with an adequate fugitive dust suppression program, such equipment will aid in preventing the off-site migration of contaminated soil. It will also protect both on-site personnel from exposure to high levels of dust and the public around the site from any exposure to any dust. While specifically intended for the protection of on-site personnel as well as the public, this program is not meant to replace long-term monitoring which may be required given the contaminants inherent to the site and its air quality.

3. Guidance

A program for suppressing fugitive dust and monitoring particulate matter at hazardous waste sites can be developed without placing an undue burden on remedial activities while still being protective of health and environment. Since the responsibility for implementing this program ultimately will fall on the party performing the work, these procedures must be incorporated into appropriate work plans. The following fugitive dust suppression and particulate monitoring program will be employed at hazardous waste sites during construction and other activities which warrant its use:

1. Reasonable fugitive dust suppression techniques must be employed during all site activities which may generate fugitive dust.

2. Particulate monitoring must be employed during the handling of waste or contaminated soil or when activities on site may generate fugitive dust from exposed waste or contaminated soil. Such activities shall also include the excavation, grading, or placement of clean fill, and control measures therefore should be considered.

3. Particulate monitoring must be performed using real-time particulate monitors and shall monitor particulate matter less than ten microns (PM_{10}) with the following minimum performance standards:

   Object to be measured: Dust, Mists, Aerosols
   Size range: <0.1 to 10 microns
   Sensitivity: 0.001 mg/m^3
   Range: 0.001 to 10 mg/m^3
   Overall Accuracy: ±10% as compared to gravimetric analysis of stearic acid or reference dust

   Operating Conditions:
      Temperature: 0 to 40°C
      Humidity: 10 to 99% Relative Humidity

   Power: Battery operated with a minimum capacity of eight hours continuous operation

   Automatic alarms are suggested.

   Particulate levels will be monitored immediately downwind at the working site and integrated over a period not to exceed 15 minutes. Consequently, instrumentation shall require necessary averaging hardware to accomplish this task; the P-5 Digital Dust Indicator as manufactured by MDA Scientific, Inc. or similar is appropriate.

4. In order to ensure the validity of the fugitive dust measurements performed, there must be appropriate Quality Assurance/Quality Control (QA/QC). It is the responsibility of the entity operating the equipment to adequately supplement QA/QC Plans to include the following critical features: periodic instrument calibration, operator training, daily instrument performance (span) checks, and a record keeping plan.

5. The action level will be established at 150 ug/m^3 over the integrated period not to exceed 15 minutes. While conservative, this short-term interval will provide a real-time assessment of on-site air quality to assure both health and safety. If particulate levels are detected in excess of 150 ug/m^3, the upwind background level must be measured immediately using the same portable monitor. If the working site particulate measurement is greater than 100 ug/m^3 above the background level, additional dust suppression techniques must be implemented to reduce the generation of fugitive dust and corrective action taken to protect site personnel and reduce the potential for contaminant migration. Corrective measures may include increasing the level of personal protection for on-site personnel and implementing additional dust suppression techniques (see Paragraph 7). Should the action level of 150 ug/m^3 be exceeded, the Division of Air Resources must be notified in writing within five working days; the notification shall include a description of the control measures implemented to prevent further exceedences.

6. It must be recognized that the generation of dust from waste or contaminated soil that migrates off-site, has the potential for transporting contaminants off-site. There may be situations when dust is being generated and leaving the site and the monitoring equipment does not measure PM_{10} at or above the action level. Since this situation has the potential to migrate contaminants off-site, it is unacceptable. While it is not practical to quantify total suspended particulates on a real-time basis, it is appropriate to rely on visual observation. If dust is observed leaving the working site, additional dust suppression techniques must be employed. Activities that have a high dusting potential--such as solidification and treatment involving materials like kiln dust and lime--will require the need for special measures to be considered.

7. The following techniques have been shown to be effective for the controlling of the generation and migration of dust during construction activities:

    1. Applying water on haul roads.
    2. Wetting equipment and excavation faces.
    3. Spraying water on buckets during excavation and dumping.
    4. Hauling materials in properly tarped or watertight containers.
    5. Restricting vehicle speeds to 10 mph.
    6. Covering excavated areas and material after excavation activity ceases.
    7. Reducing the excavation size and/or number of excavations.

    Experience has shown that utilizing the above-mentioned dust suppression techniques, within reason as not to create excess water which would result in unacceptable wet conditions, the chance of exceeding the 150 ug/m^3 action level at hazardous waste site remediations is remote. Using atomizing sprays will prevent overly wet conditions, conserve water, and provide an effective means of suppressing the fugitive dust.

8. If the dust suppression techniques being utilized at the site do not lower particulates to an acceptable level (that is, below 150 ug/m^3 and no visible dust), work must be suspended until appropriate corrective measures are approved to remedy the situation. Also, the evaluation of weather conditions will be necessary for proper fugitive dust control--when extreme wind conditions make dust control ineffective, as a last resort remedial actions may need to be suspended.

There may be situations that require fugitive dust suppression and particulate monitoring requirements with action levels more stringent than those provided above. Under some circumstances, the contaminant concentration and/or toxicity may require appropriate toxics monitoring to protect site personnel and the public. Additional integrated sampling and chemical analysis of the dust may also be in order. This must be evaluated when a health and safety plan is developed and when appropriate suppression and monitoring requirements are established for protection of health and the environment.

APPENDIX B

ER 385-1-92 SAFETY AND HEALTH ELEMENTS FOR HTRW DOCUMENTS

APPENDIX B

Safety and Health Elements For HTRW Documents

1. <u>Site Description and Contamination Characterization</u>.

a. Describe the site location, topography, approximate size of the site, the onsite jobs/tasks to be performed, and the duration of planned site activities.

b. Compile a complete list of the contaminants found or known to be present in site areas to be impacted by work performed. Compilation of this listing shall be based on results of previous studies; or, if not available, select the likely contaminants based on site history and prior site uses/activities. Include chemical names, concentration ranges, media in which found, locations on-site, and estimated quantities/volumes to be impacted by site work.

2. <u>Hazard/Risk Analysis</u>.

a. Identify the chemical, physical (including radiological), biological, and safety hazards of concern for each site task and/or operation to be performed. Selection of chemicals as indicators of hazards shall be based upon media concentrations (i.e., air, water, soil), toxicity, volatility or risk potential for air entrainment at hazardous levels, and frequency of detection.

b. Describe chemical and physical properties of selected contaminants, sources and pathways of employee exposures, anticipated on- and off-site exposure level potentials, and regulatory (including Federal, State, and Local governments) or recommended protective exposure standards.

c. Specify and justify "action levels" based upon airborne exposure hazards and direct skin contact potentials for upgrades/downgrades in levels of personnel protection; for implementation of engineering and/or work practice controls; for emergency evacuation of on-site personnel; and for the prevention and/or minimization of public exposures to hazards created by site activities. Exposure monitoring/air sampling shall be performed in accordance with paragraph 8 below, resulting data compared with established "action levels," and appropriate corrective actions initiated as necessary.

3. Accident Prevention.

a. Any additional Accident Prevention Plan topics required by EM 385-1-1, but not specifically covered elsewhere in these elements, shall be addressed.

b. Daily safety and health inspections shall be conducted to determine if operations are being performed in accordance with the SSHP, USACE and OSHA regulations, and contract requirements.

c. In the event of an accident/incident, the CO (or approving authority for in-house USACE activities) shall be notified according to EM 385-1-1, Section 2. Within two (2) working days of any reportable accident, the contractor (or responsible USACE supervisor for in-house USACE activities) shall complete and submit an Accident Report on ENG Form 3394 in accordance with AR 385-40 and USACE Supplements to that regulation.

4. Staff Organization, Qualifications, and Responsibilities.

a. Discuss the organizational structure, including lines of authority (chain of command), and overall responsibilities of the contractor and all subcontractors for site activities, including supervisor/employee relationships.

b. Summarize the operational and health and safety responsibilities, and qualifications of each key person identified.

(1) Specifically, a Certified Industrial Hygienist (CIH) with experience in the hazardous waste site operations shall be responsible for the development, implementation, and oversight of the contractor's Safety and Health Program (SHP) and Site Safety and Health Plan (SSHP). The SSHP shall be signed and dated by the CIH prior to submittal. (For in-house USACE activities, this responsibility shall be undertaken by qualified USACE industrial hygiene personnel at the geographic Major Subordinate Command/District Command performing the work.)

(2) A fully trained and experienced Site Safety and Health Officer (SSHO), responsible to the contractor and the CIH (or the USACE approving authority), may be delegated to implement and continually enforce the safety and health program and site-specific plan elements on-site.

(3) At least one person currently certified in Standard First Aid/CPR by the American Red Cross or equivalent agency, according to EM 385-1-1, Section 4, shall be present on-site at all times during site operations.

per Bob Stout 10/2 --

5. Training.

a. All personnel performing on-site work activities wherein they may be exposed to safety or health hazards resulting from hazardous waste operations shall have completed applicable training in compliance with 29 CFR 1910.120(e).

b. Prior to conducting on-site HTRW activities, all USACE and contractor personnel shall successfully complete a 40 hour HTRW health and safety training course to be followed by an 8-hour annual refresher and/or an 8-hour supervisors course as mandated in OSHA (29 CFR 1910.120) and this regulation.

c. In addition, site-specific training covering site hazards, procedures, and all contents of the approved SSHP shall be conducted by the SSHO for on-site employees and visitors prior to commencement of work or entering the site.

d. The type (including initial, supervisory, refresher, and site-specific), duration, and dates of all employee training performed shall be listed by employee name and certified in the SSHP.

6. Personal Protective Equipment (PPE).

a. A written Personal Protective Equipment (PPE) program in accordance with 29 CFR 1910.120(g)(5) and the respiratory protection requirements of 29 CFR 1910.134 is required.

b. Provide a detailed description of the minimum PPE (including respirators) and specific materials from which the PPE components are constructed for each site-specific task/operation to be performed, based upon the hazard/risk analysis performed above. Component levels of protection (A,B,C,D and modifications) must be relevant to site-specific conditions, including potential heat stress and associated PPE safety hazards.

c. Provide site-specific procedures to determine PPE program effectiveness and for on-site fit-testing of respirators, proper cleaning, maintenance, inspection, and storage of all PPE.

7. Medical Surveillance.

a. All personnel performing on-site work activities wherein they may be exposed to safety or health hazards resulting from hazardous waste operations shall be participants in an ongoing medical surveillance program, meeting the requirements of 29 CFR 1910.120(f) and ANSI Z-88.2.

b. All medical surveillance protocols and examination results shall be reviewed by a licensed physician who is certified in Occupational Medicine or who, by necessary training and experience, is considered Board-eligible by the American Board of Preventive Medicine Incorporated.

c. In consultation with such an occupational physician, and based upon probable site conditions, potential occupational exposures and required protective equipment, specify minimum content and frequencies of necessary medical tests/examinations/consultations.

d. Certification of participation in the medical surveillance program, the date of last examination, and name of reviewing occupational physician shall also be included for each affected employee in the SSHP.

e. The written medical opinion from the attending physician required by 29 CFR 1910.120(f)(7) shall be made available upon request to the CO or approving authority for any site employee.

8. Exposure Monitoring/Air Sampling Program.

a. Where it has been determined that there may be potential employee exposures to and/or off-site migration of hazardous concentrations of airborne substances, appropriate direct-reading (real-time) air monitoring and time-integrated (time-weighted average (TWA)) air sampling shall be conducted in accordance with applicable regulations (OSHA, EPA, State). Air monitoring and air sampling must accurately represent concentrations of airborne contaminants encountered on, and leaving, the site.

b. Sampling and analytical methods following NIOSH criteria (for on-site personnel) and EPA criteria (for site perimeter or off-site locations) shall be appropriately utilized.

c. Personnel samples shall be analyzed only by laboratories successfully participating, in and meeting the requirements of the American Industrial Hygiene Association's (AIHA) Proficiency Analytical Testing (PAT) or Laboratory Accreditation programs.

d. Meteorological monitoring shall be performed on-site and used as an adjunct in determining perimeter and any off-site monitoring locations. Where perimeter monitoring/sampling is not deemed necessary, a suitable justification for its exclusion should be provided.

e. Noise monitoring and radiation monitoring (alpha, beta, gamma) shall be conducted as needed, depending on the site hazard assessment.

f. All monitoring/sampling results shall be compared to "action levels" established pursuant to paragraph 2. above to determine acceptability and need for corrective action.

9. Heat/Cold Stress Monitoring.

a. Heat and/or cold stress monitoring protocols shall be specified and implemented, as appropriate.

b. Work/rest schedules shall be developed by measurement of ambient temperature, humidity, wind speed (wind chill), solar radiation intensity, duration and intensity of work, and level of protective equipment.

c. Minimum required physiological monitoring protocols which will affect work schedules shall be developed.

d. In cases where impervious clothing is worn (i.e., full-body protective clothing), the NIOSH/OSHA/USCG/EPA "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities" protocol for prevention of heat stress shall be followed, and heat stress monitoring shall commence at temperatures of 70 degrees Fahrenheit and above. Where impervious clothing is not worn, the most current published ACGIH heat stress standard (TLV) shall be used. For cold stress monitoring to help prevent frostbite and hypothermia, the most current published ACGIH cold stress standard shall be referenced and followed, as a minimum.

10. Standard Operating Safety Procedures, Engineering Controls and Work Practices. Address, as appropriate:

a. Site rules/prohibitions (buddy system, eat/drink/ smoking restrictions, etc.).

b. Material handling procedures (soils, liquids, radioactive materials).

c. Drum/container handling procedures and precautions (opening, sampling, overpacking).

d. Confined space entry procedures.

e. Hot-work, sources of ignition, fire protection/prevention, and electrical safety (ground-fault protection, overhead power line avoidance, etc.).

f. Excavation safety.

g. Guarding of machinery and equipment.

h. Fall protection.

i. Hazard Communication.

j. Illumination.

k. Sanitation.

l. Engineering controls.

11. <u>Site Control Measures</u>.

a. Include a site map.

b. Delineate work zones and their access points. Work zone delineation (Exclusion Zone, Contamination Reduction Zone, Support Zone) shall be based upon the contamination characterization data and the hazard/risk analysis to be performed under paragraphs 1 and 2 above.

c. Describe on-site and off-site communications.

d. Describe site security (physical and procedural).

e. Describe general site access.

12. <u>Personal Hygiene and Decontamination</u>.

a. Specify necessary facilities and their locations.

b. Provide detailed standard operating procedures, for frequencies, supplies and materials to accomplish decontamination of site personel.

13. Equipment Decontamination.

a. Specify necessary facilities, equipment, and their locations.

b. Provide detailed procedures, frequencies, supplies and materials, and methods to determine adequacy for the decontamination of equipment used on-site.

14. Emergency Equipment and First Aid Requirements. The following items, as a minimum and as appropriate, shall be immediately available for on-site use:

a. First aid equipment and supplies approved by the consulting physician.

b. Emergency eyewashes/showers (per ANSI Z-358.1).

c. Emergency-use respirators, i.e., escape: 5 - 15 minute emergency escape mask with air bottle; rescue: positive pressure self-contained breathing apparatus (SCBA).

d. Spill control materials and equipment.

e. Fire extinguishers (specify type, size, locations).

15. Emergency Response and Contingency Procedures (On-Site and Off-Site).

a. Local fire/police/rescue authorities having jurisdiction and nearby medical facilities that would be utilized for emergency treatment of injured personnel shall be contacted in order to notify them of upcoming site activities and potential emergency situations, to ascertain their response capabilities, and to obtain a response commitment.

b. An Emergency Response Plan, which complies with 29 CFR 1910.120(l), and which, as a minimum, addresses the following elements, shall be developed and implemented:

(1) Pre-emergency planning and procedures for reporting incidents to appropriate government agencies for potential chemical exposures, personal injuries, fires/explosions, environmental spills and releases, discovery of radioactive materials.

(2) Personnel roles, lines of authority, communications.

(3) Posted instructions and list of emergency contacts: physician/nearby medical facility, fire and police departments, ambulance service, state/local/federal environmental agencies, CIH, Contracting Officer, (approving authority for in-house activities.

(4) Emergency recognition and prevention.

(5) Site topography, layout, and prevailing weather conditions.

(6) Criteria and procedures for site evacuation (emergency alerting procedures/employee alarm system, emergency PPE and equipment, safe distances, places of refuge, evacuation routes, site security and control).

(7) Specific procedures for decontamination and medical treatment of injured personnel.

(8) Route maps to nearest pre-notified medical facility.

(9) Criteria for initiating community alert program, contacts and responsibilities.

(10) Critique of emergency responses and follow-up.

16. Logs, Reports, and Recordkeeping.

a. The following logs, reports, and records shall be developed, retained, and submitted to the CO (or approving authority for in-house activities):

(1) Training logs (site-specific and visitor).

(2) Daily safety inspection logs (may be part of the Daily QC Reports).

(3) Equipment maintenance logs.

(4) Employee/visitor register.

(5) Environmental and personal exposure monitoring/sampling results.

b. All personnel exposure and medical monitoring records are to be maintained in accordance with applicable OSHA standards, 29 CFR 1910 and 1926.

APPENDIX C

ER-1110-1-263 ENGINEERING AND DESIGN CHEMICAL DATA QUALITY MANAGEMENT FOR HAZARDOUS WASTE REMEDIAL ACTION

DEPARTMENT OF THE ARMY
U. S. Army Corps of Engineers
Washington, DC 20314-1000

ER 1110-1-263

CEMP-RT

Regulation
No. 1110-1-263

1 October 1990

Engineering and Design
CHEMICAL DATA QUALITY MANAGEMENT FOR HAZARDOUS WASTE REMEDIAL ACTIVITIES

1. Purpose. This regulation prescribes Chemical Data Quality Management (CDQM) responsibilities and procedures for all chemical contamination investigative and remedial activities to assure that the analytical data obtained is of sufficient quality to meet intended usages within the project.

2. Applicability. This regulation applies to HQUSACE/OCE elements, major subordinate commands, districts, laboratories, and separate field operating activities.

3. References.

a. PL 98-212, Department of Defense (DOD) Appropriation Act, Fiscal Year 1984, Environmental Restoration, enacted 8 December 1983, and following legislation.

b. PL 96-510, Comprehensive Environmental Response, Compensation and Liability Act of 1980.

c. PL 99-499, Superfund Amendments and Reauthorization Act of 1986.

d. Interagency Agreement between the USACE and the U.S. Environmental Protection Agency (EPA) in executing PL 96-510, 10 February 1982, and following extensions or modifications.

e. EPA OSWER Directive 9355.3-01, Guidance for Conducting Remedial Investigations (RI) and Feasibility Studies (FS) Under CERCLA (Interim Final), October 1988.

f. EPA OSWER Directive 9355.0-4A, Superfund Remedial Design and Remedial Action Guidance, June 1986.

g. EPA OSWER Directive 9345.1-02, Expanded Site Inspection Transitional Guidance for FY 1988.

This regulation supersedes ER 1110-1-263 dated 30 December 1985

h. EPA 540/G-87/003, Data Quality Objectives for Remedial Response Activities, March 1987.

i. ER 1180-1-6.

j. ER 1110-1-261.

k. ER 415-1-11.

l. EP 1110-2-6.

4. Discussion.

a. The intent of this ER is to conduct CDQM activities in full compliance with all applicable federal and state regulatory requirements. Standard methods and procedures promulgated by the EPA and the American Society of Testing Materials (ASTM) will be followed when available and applicable. ASTM is developing a document entitled "Standard Practice for Generation of Environmental Data Related to Waste Management Activities". When finalized, the ASTM document is expected to be adopted by the EPA and the Industry as standard practice. Accordingly, this ER is intended to be in compliance with the ASTM standard.

b. The U.S. Army Toxic and Hazardous Material Agency (CETHA), now an FOA of USACE, has developed and is practicing a separate approach to CDQM activities. Insofar as the CETHA CDQM program meets the federal, state and ASTM requirements set forth above, the CETHA CDQM program may be utilized for activities CETHA independently executes.

5. General.

a. Hazardous waste programs under which USACE currently executes remedial activities include:

(1) EPA Superfund

(2) Defense Environmental Restoration Program (DERP)

(a) Installation Restoration Program (IRP) (Army, Air Force and Navy)

(b) Formerly Used Defense Sites (FUDS)

b. Chemical analysis of environmental samples is usually required during the following activities under the programs listed in the previous section.

(1) Preliminary Assessment (PA) and Site Inspection (SI)

(2) Remedial Investigation/Feasibility Study (RI/FS)

(3) Remedial Design (RD) and Pre-Design Activities

(4) Remedial Action (RA)

(5) Post Remedial Action Monitoring

c. Acquisition of chemical analytical data is an integral part of chemical contamination investigative and remedial activities. There are a multitude of purposes for which chemical analytical data are acquired; however, they generally can be divided into eight categories.

(1) Site investigation

(2) Health and safety; hazard assessment

(3) Determination of potential responsible parties

(4) Engineering decisions

(5) Construction contractor payment

(6) Post remedial action monitoring

(7) Legal support of government actions

(8) Determination of proper disposal

d. The purpose of CDQM is to insure that chemical analytical data, acquired during investigative, remedial and monitoring activities, are of sufficient quality to meet intended usages. Data quality depends not only on how carefully an analytical method is carried out, but also on the sample point selection, sampling procedures, sample integrity and analytical methods selected. Data quality objectives (DQO) will be defined in the scope of services or design specifications for contract services and in the Chemical Data Acquisition Plan (CDAP) for in-house work for which a scope of services is not generated.

e. CDQM during chemical contamination investigative, remedial and monitoring activities includes roles for both the government (USACE) and its contractors. Planning and reporting CDQM documents/tasks required of USACE or its contractors are listed in Tables 1, 2, and 3 shown at Appendix A. An estimate of the time required to prepare and review each submittal is also included. Table 1 contains investigation activities, Table 2 design activities, and Table 3 construction activities. In most cases, investigation activities will be conducted by Architect-Engineer (AE) firms; however, the listed documents/tasks are pertinent to all activities in which both planning and execution are carried out under a single contract or by utilizing in-house government personnel. In contrast, the documents/tasks listed under design and construction activities are pertinent to all activities in which planning and execution are carried under separate contracts. Specific guidance for carrying out the tasks in Appendix A are found in Appendices B through F, and a glossary is provided in Appendix G.

6. Responsibilities.

a. The Environmental Restoration Division, Directorate of Military Programs, Headquarters (CEMP-R), is responsible for program management, technical oversight, and USACE policy and guidance development and dissemination.

b. The Investigation District or FOA is responsible for executing investigation activities for chemical contamination cleanup projects and informing the local district of their activity.

c. The Design District or FOA is responsible for executing design activities for chemical contamination projects and coordination with the local district throughout design.

d. The Construction District or FOA is responsible for executing construction chemical contamination remedial action projects within its geographical area. It is also responsible for cooperating with activities undertaken by other Investigation and Design Districts or FOA within its geographical area.

e. Divisions are responsible for monitoring and oversight of activities of their districts to assure that program policies and procedures are implemented.

f. CEMRD has primary responsibility for implementation of CDQM requirements for all aspects of HTW activities conducted in support of the Superfund, DERP, and non-mission HTW assignments. To execute this overall responsibility CEMRD is responsible for identifying shortfalls and drafting technical guidance; training; conducting selected technical reviews of documents and chemical data; coordinating review with CDQM personnel in other districts and divisions; providing technical assistance; receiving and analyzing quality assurance samples; evaluating contract laboratories; and validating USACE division laboratories to participate in the above activities. These responsibilities are discharged through the assigned tasks of the Chemical Review Branch (CEMRD-ED-GC) and the Missouri River Division Laboratory HTW Chemistry Unit (CEMRD-ED-GL), which is designated the lead USACE QA laboratory for HTW projects.

g. CEMRD has review and approval authority for all work brokered by CEMRD to other FOA until that authority is transferred to the parent division with the approval of HQUSACE.

h. The QA Laboratory is responsible for executing CDQM activities delegated to it through the procedures specified in the Appendix E, USACE Chemical Quality Assurance.

i. Additional definition of organizational responsibilities for CDQM activities is described in Tables 4, 5, and 6 shown at Appendix A.

ALBERT J. GENETTI, JR.
Colonel, Corps of Engineers
Chief of Staff

7 Appendices
App. A - Tables
App. B - Guide to USACE Chemical Quality Assurance Procedures and Notifications
App. C - Commercial Laboratory Validation Procedures

Appendices (cont'd)

APPENDIX A

TABLES

TABLE 1

DOCUMENTS/TASKS FOR INVESTIGATIVE ACTIVITIES*

Activities	Estimated Window
Designation of a USACE Quality Assurance (QA) Laboratory	1 Week
Scope of Services	Preparation - 3 weeks Review - 3 weeks
Validation of AE's Laboratory	Begin as soon as lab is identified - allow 6-12 weeks
Chemical Data Acquisition Plan (CDAP)	Expect 1 month after scope is provided to AE - allow 3-4 weeks for review
Daily Quality Control Reports (DQCR)	Prepared daily, submitted USACE project manager daily by regular mail and to QA Lab by the USACE project manager
Submission of AE's Chemical Data to the QA Laboratory	As soon as possible
Quality Control Summary Report (QCSR)/Site Inspection Report	Expect 2-3 months after completion of field work - 3-4 weeks for review
Chemical Quality Assurance Report (CQAR)	Expect within 30 days of submission of data to the QA laboratory.

* These include SI, RI/FS, and Pre-Design investigative activities.

TABLE 4

ADDITIONAL ORGANIZATONAL RESPONSIBILITIES FOR INVESTIGATION CDQM DOCUMENTS/TASKS

Activity	Investigation*		QA		
	District	Division	Laboratory	MRD	CEMP-R
Designation of a USACE QA Laboratory	I	I		E, A	O
Scope of Services (SOS)	E	R, A	R, M	O	
Disposition of SOS Comments	E	R, A	R	M	O
Contract Laboratory Validation	I, A	I	R	E, M, A	M, O
Chemical Data Acquisition Plan (CDAP)	E	R, A	R	R, M	O**
Disposition of CDAP Comments	E	R, A	R	M	O
Notice to Proceed (field work)	E	M	M	M	O
Daily Quality Control Reports (DQCR)	E	R	R	M	O
Inspection and Analyses of QA Samples,			E	R, M	O
Quality Control Summary Report (QCSR)/Site Inspection Report	E	R, A	R	M	O
Disposition of Site Inspection Report Comments	E	R, A	R	M	O
Chemical Quality Assurance Report (CQAR)	R	R	E	R, M	O

KEY: I = initiate, E = execution, R = review, A = approve, M = monitor, and O = oversight
* = These responsibilities are for district in-house work. For AE/Contractor work, the contracting officer in the district has approval authority.
** = Documents will be provided to HQUSACE (CEMP-R) for monitoring and oversight. On an exception basis, CEMP-R will audit specific projects and will require that all project documents be submitted.

The local district/division should be kept informed of the progress of any work in their geographic area, and should be furnished copies of documents if they so desire.

TABLE 5
ADDITIONAL ORGANIZATIONAL RESPONSIBILITIES FOR DESIGN CDQM DOCUMENTS/TASKS

	Design*		Construction		QA		
Activity	District	Division	District	Division	Laboratory	MRD	CEMP-R
Designation of a USACE QA Laboratory for Design	I	I	R	R	R	M	O
Scope of Services (SOS)	E	R, A	R	R	R	R	O
Disposition of SOS Comments	E	R, A	R	R	R	R	O
AE Laboratory Validation	I, A	I			R	E, M	M, O
Chemical Data Acquisition Plan (CDAP)	E	R, A	R	R	R	R	O
Daily Quality Control Reports	E	R	R	R	R	M	O
Quality Control Summary Report/ Investigation Report	E	R, A	R	R	R	M	O**
Chemical Quality Assurance Report	R	R	R	R	E	M	O**
Design Analyses Reports and Design Plans and Specifications	E	R, A	R	R	R	R	O**
Disposition of Design Comments	E	R, A	R	R	R	R	O
Advertise and Award Construction Contract	E			O			

KEY: I = initiate, E = execution, R = review, M = monitor, and O = oversight

* = These responsibilities are for district in-house work. For AE/Contractor work, the contracting officer in the district has approval authority. For design brokered by CEMRD, review and approval authority is retained by CEMRD until transferred to the Division.

** = Documents will be provided to HQUSACE (CEMP-R) for monitoring and oversight. On an exception basis, CEMP-R will audit specific projects and will require that all project be submitted. The local district/division should be kept informed of the progress of any work in their geographical area, and should be furnished copies of documents if they so desire.

TABLE 6

ADDITIONAL ORGANIZATIONAL RESPONSIBILITIES FOR CONSTRUCTION CDQM DOCUMENTS/TASKS

Activity	Design District	Design Division	Construction District	Construction Division	QA Laboratory	MRD	CEMP-R
Designation of a USACE QA Laboratory			I	I		E	O
Contract Laboratory Validation			I	I	R	E	O
Chemical Data Acquisition Plan (CDAP)	R		E, A	R	R	R	O
Disposition of CDAP Comments	R		E	R	R	M	O
Daily Quality Control Reports			E	R	R	M	O
Inspection and Analysis of QA Samples					E	M	O
Quality Control Summary Report (QCSR)/Contractor Final Report			E, A	R	R	M	O**
Disposition of Final Report Comments			E, A	R	R	M	O
Chemical Quality Assurance Report (CQAR)			R	R	E	R, M	O**

KEY: I = initiate, E = execution, R = review, A = approve, M = monitor and O = oversight
** = Documents will be provided to HQUSACE (CEMP-R) for monitoring and oversight. On an exception basis, CEMP-R will audit specific projects and will require that all project documents be submitted.

The local district/division should be kept informed of the progress of any work in their geographical area, and should be furnished copies of documents if they so desire.

APPENDIX B

GUIDE TO USACE CHEMICAL QUALITY ASSURANCE PROCEDURES AND NOTIFICATIONS

1. Purpose. Chemical quality assurance in chemical contamination investigation, design, and remedial action activities requires the interface and coordination of several USACE units. This appendix outlines the procedures involved and provides suggested formats to aid in the coordination process. The responsibility for initiation and coordination lies with the USACE project manager for investigation and design and with the contracting officer (CO) or his representative (COR) for construction.

2. Applicability. This appendix applies to all HTW investigative, design, and remedial activities executed by USACE either in-house or utilizing the services of a contractor.

3. Procedures for Chemical Quality Management.

a. Site Investigation and Pre-Design Activities.

(1) Investigation district solicits AE services.

(2) Investigation district writes Scope of Services with data quality objectives and submits it for review to division, program management personnel and CEMRD.

(3) Project Manager obtains the services of a USACE division laboratory for quality assurance using protocols established by CEMRD (memorandum or attached Request for Government Quality Assurance Services).

(4) District negotiates and awards AE contract.

(5) AE identifies subcontract laboratory and supplies Laboratory Quality Management Manual (LQMM) or required information. See Appendix C.

(6) Project Manager verifies validation status of the laboratory with CEMRD or requests validation be initiated (memorandum or attached Request for Evaluation of Commercial Laboratory).

(7) LQMM is submitted to CEMRD, performance audit samples are sent if necessary, laboratory is inspected by CEMRD, and a recommendation for approval/disapproval is sent to the USACE project manager. Personnel from the QA laboratory or investigation district will be notified of a scheduled inspection and may assist with this process. If approval is not given, AE will select another laboratory.

(8) AE submits CDAP for investigation district's approval.

(9) CEMRD-ED-GC and QA laboratory review CDAP and make approval/disapproval recommendation to investigation district.

(10) Field work begins if CDAP is approved.

(11) AE Daily Quality Control Report is filled out daily and submitted to the investigation district. Copies are sent to the QA laboratory whenever sampling or analytical activities are included.

(12) Field work completed.

(13) AE's analytical results are submitted to the QA lab as they become available, and to the executing FOA.

(14) AE's Site Inspection or Investigation Report together with the Quality Control Summary Report is submitted to the investigation district. These are reviewed by the same offices that reviewed the CDAP.

(15) QA laboratory prepares the Chemical Quality Assurance Report and submits it to the investigation district.

b. Design Activities.

(1) Design district solicits AE services.

(2) Design district writes Scope of Services and submits it to design division, CEMRD, and program management personnel for review/approval.

(3) Design district negotiates and awards AE design contract.

(4) If investigative activities are included in the design contract, steps 5-15 of Section 3.a. should be followed.

(5) AE submits Design Analysis Reports which contain a section that specifically addresses chemical quality management concerns. AE also submits plans and specifications which include chemical quality management at the preliminary, intermediate, final and 100% phases. The chemical section of the plans and specifications should give the Construction Contractor instructions for writing the CDAP in addition to including all necessary site specific chemical detail. Relevant requirements in this ER and appendices should be addressed. These submittals are sent to the design division, CEMRD, and program management personnel for technical review, and comments are sent back to the design district.

(6) Design district assures that the comments are addressed and incorporated into the appropriate documents or provides an explanation if comments are not used. Revised documents and annotated comments are sent to the offices generating comments at the next submittal stage.

(7) 100% plans and specifications are approved by the design district and the district advertises and awards the construction contract.

c. Construction.

(1) The contractor submits a CDAP (which may be a section in his overall Quality Control Plan). The contract laboratory (if needed) along with the Contractor's proposed quality control officers are identified for the Construction District's approval.

(2) CEMRD at request of the CO designates the Construction Division Lab or CEMRD-ED-GL to be the government QA laboratory for construction (forms provided) and validate the contractor's laboratory.

(3) The designated QA laboratory together with CEMRD assists the Construction District in reviewing the CDAP. The contractor's proposed laboratory is validated by CEMRD according to protocols discussed in Appendices C and E.

(4) Construction district approves/disapproves the contractor's laboratory and/or CDAP.

(5) Construction cleanup begins after CDAP and contractor's laboratory are approved.

(6) Contractor's Daily Quality Control Report is submitted to the Contracting Officer's Representative (COR) daily. The COR submits copies to the QA laboratory when sampling or analyses are involved. Analytical results are submitted to the QA laboratory as soon as they are available.

(7) Construction work is completed.

(8) The contractor submits the Quality Control Summary Report to the construction district. This should include a complete data package.

(9) The QA laboratory prepares the Chemical Quality Assurance Report and submits it to the construction district.

4. The following pages contain suggested formats which may be used to initiate interaction among various Corps elements regarding chemical data quality management. These would initiate a request for government quality assurance services, laboratory validation or document review. If these services are initiated by memoranda, the information called for on these pages should be supplied. Examples of formats which might be used for Daily Quality Control Reports and Chemical Quality Assurance Reports are also included.

(SAMPLE FORMAT)

TO: CEMRD-ED-GC FROM: __________ DATE__/__/__

SUBJECT: **Request for Evaluation of Commercial Laboratory**

Project Name:_______________ _____________Contract No.:________________

Superfund ______ FUDS ______ IRP ______ Other ______ Phase ______

Location:____State:_____

A-E/Contractor:____State:_____

USACE Project Manager:____
Phone:_____________Address:____

Approximate Sampling Dates:_______________________________________
Laboratory Name:____
Address:____
Phone:____
POC:____

Laboratory Quality Management Manual Request ON __/__/__

Required analytical methods and approximate number of samples to be taken for above project.

METHOD	# OF WATER SAMPLES	# OF SOIL/SEDIMENT SAMPLES

State or other laboratory certification which will be required for this project:____

If the laboratory is planning to subcontract any samples to another laboratory or location, all of these are to be evaluated separately. This request should be sent for verification of laboratory status regardless of expiration date on the list of validated laboratories.

(SAMPLE FORMAT)

TO:__________________ FROM:__________________ DATE:__/__/__

SUBJECT: **Request for Government Quality Assurance Services** (To be sent to the requested USACE Laboratory with a copy to CEMRD-ED-GC)

Project Name:____________________ Contract No.:________________

Superfund ____ FUDS ____ IRP ____ Other _____ Phase ____________
Location:______________________________________ State:_________

A-E/Contractor:________________________________ State:_________
USACE Project Manager:____
Phone:________________ Address:___________________________________

Laboratory Name:____
Address:____
Phone:____
POC:____

Approximate Sampling Dates:____________________________________

The following QA Laboratory support is requested for the subject project: USACE Division Laboratory:____________________________

____ Review and comment on Draft ________________________________
____
____
____

____ Analysis and Reports of Quality Assurance Samples

METHOD	NO. OF WATER SAMPLES*	NO. OF SOIL/SEDIMENT SAMPLES‡

* Includes Blanks

‡ Includes Background Soil Sample

CF: CEMRD-ED-GC

DATE ____________

DAY	S	M	T	W	TH	F	S

A-E DAILY QUALITY CONTROL REPORT

WEATHER	Bright Sun	Clear	Overcast	Rain	Snow
TEMP	To 32	32-50	50-70	70-85	85 up
WIND	Still	Moder	High	Report No.	
HUMIDITY	Dry	Moder	Humid		

COE PROJECT MANAGER ____________

PROJECT ____________

JOB NO. ____________

CONTRACT NO. ____________

SUB-CONTRACTORS ON SITE:

EQUIPMENT ON SITE.

WORK PERFORMED (INCLUDING SAMPLING):

SHEET _____ OF _____

(Continuation Sheet)

PROJECT. ____________________ REPORT NO. __________

JOB NO. ____________________ DATE __________

QUALITY CONTROL ACTIVITIES (INCLUDING FIELD CALIBRATIONS)

HEALTH AND SAFETY LEVELS AND ACTIVITIES.

PROBLEMS ENCOUNTERED/CORRECTION ACTION TAKEN:

SPECIAL NOTES.

TOMORROW'S EXPECTATIONS:

BY ____________________ TITLE __________

(SAMPLE FORMAT)

______ LAB NO.

DEPARTMENT OF THE ARMY
________________ DIVISION, CORPS OF ENGINEERS
DIVISION LABORATORY

___________, _______, ______
(city) (state) (zip)

Subject: Chemical Quality Assurance Report

Project: ____________________
Intended Use: ____________________
Source of Material: ____________________

Submitted by: ____________________
Date Sampled: ________________, Date Received: ____________
Method of Test or Specification: See attached Tables 1 - ____

References: ____________________

-- REMARKS --

1. CONTRACTOR DATA EVALUATION: (General comments)

   a. ACCURACY:

   b. PRECISION:

   c. LABORATORY CONTMINATION:

2. QA/QC DATA COMPARISON:

3. OTHER PROBLEMS:

4. CORRECTIVE ACTION:

Submitted by:

Director, ____________ Laboratory

APPENDIX C

COMMERCIAL LABORATORY VALIDATION PROCEDURES

1. Purpose. This appendix specifies the procedure used to evaluate a commercial laboratory for hazardous and toxic chemical analysis either for AE/Contractor work or for in-house projects conducted by USACE in hazardous waste activities. The latter includes chemical analyses contracted by the quality assurance laboratory.

2. Applicability. These procedures apply to all chemical analyses conducted to support investigative and remedial actions undertaken by USACE.

3. Initiation Procedures. A project manager from a Corps District or Division contacts CEMRD-ED-GC requesting validation of a contract laboratory. A form is provided in Appendix A or a memorandum may be written. The name of the project, the contract number, analytical methods to be used, numbers of samples of each matrix, estimated dates of sampling, and any special certification requirements should be included.

4. Implementation Procedures. Ordinarily each step in this sequence is completed before the subsequent step is initiated.

a. Step 1. The laboratory must submit its qualifications. This submittal may be in the form of an off-the-shelf Quality Management Manual (LQMM) or in some other format. Blank information tables can be requested from CEMRD. The submittal includes the following information:

- General Lab Information:
  - (1) Lab name, address, POC, phone #; lab age, number of employees; square footage, etc.
  - (2) Type of analytical work routinely performed;
  - (3) Organizational chart and floor plan;
  - (4) Special capabilities.

- List of previous evaluation/validation programs and most recent results.

- List of EPA and USACE contracts held in the last two years.

- Copy of lab certificates for other environmental programs or states.

- Chart of employee training and experience or chronological resumes.

- Copy of QA manual and/or in-house SOP's for analyses to be conducted for the contract including all internal quality control practices.

- List of instruments to be used for the contract and date of purchase.

The laboratory is requested to furnish above information promptly for review. If it appears that the capabilities of the laboratory are adequate to meet project requirements, CEMRD will initiate Step 2.

b. Step 2. The Corps of Engineers will provide the laboratory with performance audit (PA) samples through CEMRD-ED-GC. Arrangements will be made with the laboratory for the analysis of these samples. The results will be submitted as directed within 20 working days after receipt of the PA samples. Failure to analyze these samples correctly and within the required time frame may result in termination of the validation process. Ordinarily the laboratory is not reimbursed for costs involved in the analysis of the PA samples. The details of payment must be clarified in advance. If any of the results are unacceptable, a second set of PA samples may be allowed.

(1) The performance audit samples are method and matrix specific. The results are considered passing if a particular method has no results outside three standard deviations as determined by USACE, and no more than two parameters outside two standard deviations. Often a laboratory will be contacted if problems such as dilution or calculation errors can be identified.

c. Step 3. On-site inspection. A representative of CEMRD will inspect the contract laboratory only after Steps 1 and 2 have been successfully completed. All in-house SOPs will be reviewed. Any problems encountered with the performance audit samples will be discussed with laboratory management at the time of the inspection. The inspecting team will prepare a detailed report using the format specified by CEMRD and submit this to CEMRD-ED-GC. An exit interview will be held with lab personnel in which any problems encountered are discussed. The project manager or contracting officer and/or the assigned QA laboratory will be invited to send a representative to the inspection.

5. Conclusion. CEMRD will evaluate lab performance on the preceding steps and make a validation decision. A letter and a copy of the inspection report will be sent to the USACE personnel who initiated the validation process and to the laboratory. Ordinarily the letter will specify the methods and matrices, the project(s) and the time period (usually 18 months) for which the validation is granted. If specific recommendations are made by the inspectors, the lab is required to respond to CEMRD within a given time frame. Centralized records of validations and lab performances are kept at CEMRD-ED-GC. If a laboratory obtains a second contract within the eighteen month period, previous performances will be checked. If different analytes/matrices are involved in the second contract, only those performance audit samples will be sent. If work done for the Corps by the lab has been satisfactory, no further action will be necessary. **A validated laboratory may not subcontract USACE samples to a second laboratory without the knowledge and approval of the contracting officer and unless the second laboratory is validated for the parameters concerned.**

6. Renewal of Validation. Towards the close of the eighteen month period CEMRD-ED-GC will notify USACE users of laboratories of the pending expiration of validation. When the next contract is awarded, the validation will be renewed. After considering use of the lab and previous performance, CEMRD-ED-GC will determine which of the steps in Part II will apply to the revalidation process.

APPENDIX D

GUIDE TO THE PREPARATION OF THE CHEMICAL DATA ACQUISITION PLAN

1. Definition and Responsibility. Chemical Data Acquisition Plan (CDAP)--a document prepared by an Architect-Engineer firm, a Contractor or USACE for all field activities, laboratory activities, and contract deliverables related to the acquisition and reporting of chemical data for HTW investigation or remedial activities. For the convenience of the sampling team, field activities may be bound separately; however for purposes of cost this should not be considered a separate document. The CDAP must be approved by the CO prior to initiation of field work. In the event corrections and comments on the draft are provided by the CO, the changes shall be incorporated by the authors in a revised plan before final approval is given. It should be noted that the purpose and content of the CDAP are essentially the same as the Quality Assurance Project Plan (QAP.P) required for Superfund investigations by the EPA. On Superfund projects QAP.P guidance may be followed as an alternative to this appendix, but ordinarily the Contract Laboratory Program (CLP) should not be used in its entirety (CLP analytical methods may be specified as well as a CLP type data validation).

2. Applicability. This guide applies to all HTW investigative, pre-design, and remedial activities undertaken by USACE. A CDAP will be prepared for each activity and submitted to the appropriate USACE personnel for review, comments, and recommendations. The identification of these reviewers for each type of project is found in Tables 4, 5, and 6 in Appendix A. Once approved, the CDAP is considered part of the contract and is enforceable as such.

3. USACE Chemical Quality Data Management. USACE requires that quality control (QC) and quality assurance (QA) samples be collected and analyzed by the contract laboratory and the USACE QA laboratory, respectively. These QC and QA samples include splits or replicates of field samples, rinsate blanks, trip blanks and background soil and groundwater samples. QC samples, which represent approximately 10% of the field samples, help the prime contractor to identify and diagnose problems related to sampling and analysis. QA samples, which represent approximately 10% of the field samples, are sent to a USACE QA laboratory by overnight delivery for government monitoring of sampling and contract laboratory performance. For additional guidance on chemical quality assurance, see Appendix E. When

the following procedures, performed by the USACE QA laboratory, demonstrate that contract requirements for chemical quality control were not met, contractor resampling and reanalysis may be required by the contracting officer.

a. Inspection of QA samples to insure that sampling procedures correspond to Chemical Data Acquisition Plan (CDAP) with regard to sample containers, preservation, labeling, and chain of custody.

b. Analyses of QA samples.

c. Evaluation of contractor deliverables specified in Chemical Data Acquisition Plan (CDAP).

d. Comparison of analytical results obtained by contract laboratory and USACE QA laboratory from split or replicate samples. The procedures for obtaining QA laboratory services are in Appendix E to ER 1110-1-263.

4. Contract Laboratory Validation. Any laboratory performing chemical analyses shall be validated by USACE Missouri River Division (MRD). Laboratories are validated for each environmental matrix and each specific analytical method to be employed. If the prime contractor selects a laboratory which has a current (within one year) validation for all analytes and matrices specific to its project, additional evaluation will not be necessary. A request for the evaluation of commercial laboratory should be sent to CEMRD to verify the status of the contract laboratory(ies). If the prime contractor selects a laboratory which does not have a current validation, the laboratory shall be validated prior to approval of the CDAP. Commercial laboratory validation procedures are in Appendix C to ER 1110-1-263. **Samples may not be subcontracted to another laboratory without knowledge and approval of the contracting officer and unless the second laboratory is validated for the parameters concerned.**

5. The CDAP shall address the following topics, not necessarily in the presented order within subsections.

SECTION 1.0 TABLE OF CONTENTS
SECTION 2.0 PROJECT DESCRIPTION
SECTION 3.0 CHEMICAL DATA QUALITY OBJECTIVES - GENERAL DISCUSSION
SECTION 4.0 AE CONTRACTOR PROJECT ORGANIZATION AND FUNCTIONAL AREA RESPONSIBILITIES.
SECTION 5.0 FIELD ACTIVITIES

5.1 List of Field Equipment, Containers, and Supplies
5.2 Sampling Locations
5.3 General Information and Definitions
5.4 Sampling and Preservation Procedures
5.4.1 Matrix 1
5.4.1.1 Locations
5.4.1.1.1 Sampling Procedure
5.4.1.1.2 Analytical Parameters
5.4.1.1.3 Sample Containers, Preservation Procedure and Holding Time
5.4.2 Matrix 2
5.4.2.1 Locations(s)
5.4.2.1.1 Sampling Procedure
5.4.2.1.2 Analytical Parameters
5.4.2.1.3 Sample Containers, Preservation Procedure and Holding Time
5.4.3 Matrix 3, etc.
5.5 Field Documentation

SECTION 6.0 SAMPLE CHAIN OF CUSTODY, PACKING AND TRANSPORTATION
SECTION 7.0 LABORATORY ANALYTICAL PROCEDURES
7.1 Analytical Method 1
7.1.1 Matrix 1
7.1.1.1 Sample Preparation
7.1.2 Matrix 2
7.1.2.1 Sample Preparation
7.1.3 Matrix 3, etc.
7.1.4 Analytical Method (if not standard)
7.1.5 Method Specific Data Quality Objectives
7.1.6 Preventive Maintenance
7.1.7 Instrument Calibration and Frequency
7.1.8 Internal Quality Control Checks
7.1.9 Corrective Action
7.1.10 Data Reduction, Validation, and Documentation
7.2 Analytical Method 2
7.2.1 Matrix 1
7.2.1.1 Sample Preparation
7.2.2 Matrix 2, etc.
7.2.3 Matrix 3, etc.
7.2.4 Analytical Method
7.2.5 Method Specific Data Quality Objectives
7.2.6 Preventive Maintenance
7.2.7 Instrument Calibration and Frequency

6. Project Description (SECTION 2.0 in Table of Contents). This section of the CDAP shall include a description of the work site and any unusual conditions. Anticipated project start and completion dates shall be estimated. This section shall also provide a summary of past and future work at the site including past chemical data of significance as well as a presentation of the multi-media sampling to be carried out in the present work effort.

7. Chemical Data Quality Objectives (SECTION 3.0 in Table of Contents). This section of the CDAP shall include a description of the general scope of work and relevant background information as it relates to the acquisition of chemical analytical data. State the objectives of the project: what questions must be answered and what decisions must be made; one specific objective may be completion of the USACE Hazardous Ranking System. Describe the level and extent of chemical data required to answer questions and support decisions during the project: the approach for sample collection, sample analysis, and QA/QC which will result in the required chemical data. The extent of analytical effort and data validation procedures to be required must be specified. Guidance for this requirement can be found in "Data Quality Objectives for Remedial Response Activities", EPA 540/G-87/003.

8. Contractor Project Organization and Functional Area Responsibilities (SECTION 4.0 in Table of Contents). The project organization for the prime contractor and any subcontractors shall be clearly defined with a discussion of quality control responsibilities. The prime contractor's Quality Assurance (QA) Officer shall report to a responsible senior officer of the company (i.e., QA management shall be separate from project management). A list of all individuals shall be provided and will include QC officers for the various components (those responsible for initiating and carrying out corrective actions and those involved in the data reporting sequence) and all analytical laboratory personnel (supervisors, chemists, and technicians). Resumes of all non-laboratory AE/Contractor personnel listing education and experience are

required, including personnel collecting samples. List the names of field personnel that will wear monitoring equipment. The name of the contract laboratory with a brief description of location, facilities and capabilities should be included.

9. Field Activities. Briefly summarize types of field activities required by the project.

10. List of Equipment, Containers, and Supplies to be taken to the Field (SECTION 5.1 in the Table of Contents). This section of the CDAP shall include all sample screening equipment to be used (brand, model, serial number) and a description of its calibration as well as sampling equipment, decontamination supplies and sample containers (specific numbers and types).

11. Sampling Locations (SECTION 5.2 in Table of Contents). This section of the CDAP shall provide the location of each sampling point on a site map. These locations shall be identified by the AE/Contractor after a visual inspection if they are not already specified in their Scope of Services or in the Specifications. In addition, at least one soil sample and one groundwater sample shall be collected in areas presenting the least potential for contamination and shall be used as background samples if this data has not been obtained in a previous phase. This section shall describe the rationale that governed the selection of sampling locations.

12. General Information and Definitions (SECTION 5.3 in Table of Contents). Some commonly used definitions are given below.

a. Contractor Laboratory. The laboratory performing analysis of the field samples. This may be an AE laboratory, a Remedial Action contractor laboratory or a laboratory subcontracted by either.

b. QA and QC Samples. Samples analyzed for the purpose of assessing the quality of the sampling effort and of the analytical data. QA and QC samples include splits or replicates of field samples, rinsate blanks, trip blanks, and background (up gradient) samples.

c. QC Samples. Quality Control samples are collected by the sampling team for use by the contractor's laboratory. The identity of these samples is held blind to the analysts and laboratory personnel until data are in deliverable form. The purpose of the sample is to provide site specific field originated checks that the data generated by the contractor's analytical lab are of suitable quality. QC samples represent approximately 10% of the field samples.

d. QA Samples. Samples sent to a USACE QA laboratory by overnight delivery and analyzed to evaluate AE and contractor laboratory performance. QA samples represent approximately 10% of the field samples. The contractor shall coordinate with the designated QA laboratory not less than 48 hours before sampling to assure that the QA laboratory is alerted to receive the QA samples and process them within the time limits specified by applicable EPA regulations and guidelines.

e. Split Samples. Samples that are collected as a single sample, homogenized, divided into two or more equal parts, and placed into separate containers. The sample shall be split in the field prior to delivery to a laboratory. Ordinarily split samples are analyzed by two different laboratories.

f. Replicate (duplicate, triplicate, etc.) Samples. Multiple grab samples, collected separately, that equally represent a medium at a given time and location. This is the required type of collocated sample for volatile organic analyses and most groundwater and surface water samples.

g. Rinsate Blank. Samples consisting of reagent water collected from a final rinse of sampling equipment after the decontamination procedure has been performed. The purpose of rinsate blanks is to determine whether the sampling equipment is causing cross contamination of samples.

h. Trip Blank. Containers of organic-free reagent water that are kept with the field sample containers from the time they leave the laboratory until the time they are returned to the laboratory. The purpose of trip blanks is to determine whether samples are being contaminated during transit or sample collection. Trip blanks pertain only to volatile organic analyses; therefore, the containers must contain no headspace. Only one trip blank is needed for one day's sampling and shall satisfy trip blank requirements for all matrices for that day if the volatile samples are shipped in the same cooler.

13. Sampling and Preservation Procedures (SECTION 5.4 in Table of Contents). The CDAP shall include a table, which lists sampling locations, matrix (waste, soil, water, etc.), number of field samples, number of split or replicate samples, and number of rinsate or trip blank samples. Specific sampling, preservation, etc. details shall be included. All details

shall meet the requirements of one of the following: (a) EPA SW-846 method; (b) another EPA method; (c) ASTM method; (d) NIOSH method (for air sampling); or (e) another accepted published method. Container and preservation requirements shall meet the USACE Sample Handling Protocol (Appendix F to ER 1110-1-263). Each table entry shall include the reference, if any, from which the specifications were taken. Any modifications to the standard methods must be approved by the CO with the concurrence of the QA laboratory prior to their use. All methods should be referenced to the most recent edition of their source. If a standard method is not available, the AE/Contractor or subcontractors shall propose a nonstandard method with validation data for approval by the CO.

14. Details of Sampling and Preservation Procedures. The composition and volume of sample containers shall be specified along with a description of their preparation and cleaning. Sampling equipment directly contacting the sample shall be stainless steel or Teflon. The CDAP shall describe the cleaning of equipment and precautions for prevention of sample cross contamination during collection. Any field screening methods employed to select samples for analysis shall be discussed in detail. Compositing and homogenizing procedures shall be included. Sample containers, volumes, preservatives and holding times for the common analyses in low concentration are presented in Table D-1. A more detailed table is presented in the Sample Handling Protocol (Appendix F).

a. Soil Sampling Procedure. Using stainless steel or Teflon sampling equipment enough solid is removed from a specified depth to fill the required containers. The volatile organic samples should be removed first with as little mixing as possible. The remaining soil shall be placed in a clean stainless steel bowl and mixed thoroughly with stainless steel implements (spoons, spades, etc.), then divided among the sample containers to be filled and properly preserved. QC and/or QA sample containers shall be filled from the same mixture as one of the samples.

b. Groundwater Sampling Procedure. Valid, representative samples must be obtained. Before a sample is collected from a well, the water level shall be measured and recorded. Then the well shall be pumped or bailed with clean equipment to remove a quantity of water equal to at least three times the submerged volume of the casing and filter pack. If the well does not recharge fast enough to permit removing three casing volumes, the well shall be pumped or bailed dry, and sampled as soon as sufficient recharge has occurred. The field parameters of pH, conductivity and temperature must be stable before sampling. Containers to be analyzed for volatiles should be filled first allowing no headspace and with as little disturbance of the water as possible. If preservative is added to the bottles prior to shipment to the field, care must be taken not to overfill the containers and pH must be measured on samples where a value is specified.

c. Other Matrices. Sampling methods and equipment used shall meet the requirements of EPA or NIOSH methods.

15. Field Documentation (SECTION 5.5 in Table of Contents). The system for identifying and tracking the samples shall be described, and shall include the recording of field data in permanently bound notebooks along with the method of relating the field data to the proper samples. All field documentation shall be done in indelible ink. Daily Quality Control Reports shall be prepared daily, dated, signed by the site manager, and sent to the CO. These reports shall include (with respect to chemistry) weather information at the time of sampling, samples taken with reference given to appropriate sections of the CDAP, field instrument measurements and calibrations. Any deviations from the CDAP shall be stated. All field documentation will become part of the project files.

16. Sample Chain of Custody and Transportation (SECTION 6.0 in Table of Contents). All sample labeling, packing, transportation and chain of custody procedures shall follow the USACE Sample Handling Protocol (Appendix F to ER 1110-1-263).

17. Laboratory Analytical Procedures (SECTION 7.0 in Table of Contents). Specific laboratory procedural details shall be included. Each method shall be specified exactly and in detail by one of the following: (a) reference to an EPA SW-846 method; (b) reference to another EPA method; (c) reference to an ASTM method; (d) reference to a NIOSH method (for air analysis); (e) reference to another accepted published method; (f) reference to an accepted published method with a description of any deviations from the published procedure; or (g) complete description of the procedure, e.g., copies of laboratory instructions. EPA SW-846 methods shall be used where possible. Generally, nonstandard methods are not allowed. In special cases that require the consideration of nonstandard methods, the contract laboratory shall be prepared to provide validation data. The use of proposed nonstandard methods requires prior approval of the CO. A list of sample preparation and analytical methods most frequently used is presented in Table D-2. A table shall be included which lists for each matrix

sample preparation method number, analytical method number, analytes and laboratory quantitation limits.

18. Preventive Maintenance. The instrument, including manufacturer, model, accessories, etc., shall be specified and preventive maintenance shall be described. Preventive maintenance shall be performed by qualified personnel. Records of repairs, adjustments and calibrations shall be maintained and available for inspection by the CO on request.

19. Instrument Calibration and Frequency. Description of the procedure used for calibration and frequency of checks is required for each instrument or method. These shall be consistent with the requirements of the contract and the analytical method.

20. Analytical Methods. Include the required concentration range and data on the sensitivity (detection limits), precision, and accuracy when this information is not included in the method. Indicate how preexisting data on sensitivity, precision, and accuracy were determined, and procedures to be used to validate the method. State source and purity of analytical reference materials and laboratory chemicals necessary to perform the analyses. Nominal detection limits for common analytes are given in Tables D-3 and D-5. DQO's for specific projects will affect the value of required detection limits and goals for precision, accuracy and completeness.

21. Method Specific Data Quality Objectives. Provide objectives for precision, accuracy, detection limits, and completeness. DQO's for accuracy and precision established for each measurement parameter will be based on prior knowledge of the specific measurement system used and method validation studies employing replicate analyses, spikes, standards, calibrations, recoveries, control charts and project specific requirements. Completeness refers to the amount of valid data obtainable (by the specific method in the laboratory used with the instrument to be employed) from a measurement system compared to the expected amount of data, and is usually expressed as a percentage.

22. Quality Control Checks. Quality control checks are necessary to evaluate performance reliability for each measurement parameter. Describe procedures to assess the precision, accuracy and completeness of the measurement. The numbers and types of internal laboratory QC checks and samples proposed (e.g., blanks, duplicates, splits, spikes, surrogates, and reference standards, as applicable) shall be defined

clearly. At a minimum these must be run at the rates prescribed in the individual methods. The laboratory's established practice for including control samples among the samples analyzed and any additional controls required by the present project shall be described. Describe the feedback systems used to identify problems by means of the results obtained from control samples. Limits of data acceptability shall be included. Results from laboratory internal quality control checks shall be reported with the analytical data. Standard forms should be used, preferably CLP or SW-846 recommended format.

23. Corrective Action. Plans for corrective actions to be taken when results appear unusual, questionable, or limits of acceptability are exceeded shall be included. When limits of acceptability are exceeded, information justifying the poor recovery or precision shall be documented. Describe how reestablishment of control is demonstrated.

24. Data Reduction, Validation, and Documentation. Equations, including units, required to calculate the concentration or value of the measured parameter, shall be included. Describe the data management systems which collect raw data, store data, and document quality control data. If statistical procedures are used for data review before reporting, include descriptions. Data validation procedures and organization shall be specified. Data validation shall be conducted as determined by the Data Quality Objectives.

25. CDQM Deliverables (SECTION 8.0 in Table of Contents). The contractor shall address the frequency and content of chemical data quality control reports that shall be submitted during the project.

a. Daily Quality Control Report (DQCR) during field activities.

b. Daily Quality Control Report from the contract laboratory if this is required in the specifications or Scope of Work.

c. Departure From Approved Plans. Include problems identified, corrective actions, and verbal/written instructions from USACE personnel for sampling or re-analysis. These reports of significant problems should be sent to the CO within 48 hours of the occurrence.

d. Data Report to the QA Laboratory. The contractor's data must be submitted to the designated quality assurance laboratory (for data validation and comparison purposes) as soon as it is available. This submittal should include all sample, blank and internal quality control results such as spike and surrogate recoveries and agreement between replicate analyses. Interim data reports may be requested if the project warrants. A complete data set should also be submitted to the executing FOA for evaluation. If the submission of raw data such as chromatograms is required, it should be specified in the approved CDAP.

e. Quality Control Summary Report (QCSR)/Final Investigation Report. Ordinarily these reports are completed within thirty days of the availability of results. The QCSR addresses quality control practices employed and summarizes the DQCR. For investigative activities the QCSR may be included in the Final Investigation Report.

f. Final Investigation Report. (For investigation projects).

TABLE D-1

SAMPLE CONTAINERS, PRESERVATION AND HOLDING TIMES

Matrix	Parameter[1]	Container[2]	Preservation[3]	Maximum Holding Times[4]	
				Extraction)	Analysis
Water	Volatiles	2 x 40 mL G, Septa vial	Ice to 4°C 4 drops con HCl or $NaHSO_4$ to pH < 2	-	14 d
Water	B/N/A	2 x 1 L amber G	Ice to 4°C	7 d	40 d
Water	PCBs, Pesticides	2 x 1 L amber G	Ice to 4°C	7 d	40 d
Water mo[5]	Metals[5]	1 x 1 L P	HNO_3 to pH<2	-	6
Water	TRPH	2 x 1 L amber G	Ice to 4°C HCl to pH<2	-	28 d
Water	Common anions[6]	1 x 1 L G	Ice to 4°C	-	28 d[6]
Water	Explosives	2 x 1 L amber G	Ice to 4°C	7 d	40 d
Water	Cyanide	1 x 1 L P	Ice to 4°C NaOH to pH > 12	-	14 d
Soils/ Sed.	Volatiles	2 x 40 mL or 2 x 125 mL G, Septa vial	Ice to 4°C	-	14 d
Soils/ Sed.	B/N/A, PCBs Pesticides	1 x 8 oz G	Ice to 4°C	14 d	40 d
Soils/ Sed.	Metals, Cyanid TRPH	1 x 8 oz G	Ice to 4°C	-	6mo[5] (TRPH: 28d)
Soils/ Sed.	Explosives	1 x 4 oz G	Ice to 4°C	14 d	40 d

TABLE D-1 (cont'd)

1. B/N/A = Base/Neutral/Acid extractable organics; TRPH = Total Recoverable Petroleum Hydrocarbons.

2. All containers must have Teflon-lined seals (Teflon-lined septa for VOA vials). G = Glass; P = High density polyethylene.

3. Sample preservation will be done in the field immediately upon sample collection. If preservative is added to the bottles prior to shipment, care must be taken not to overfill them and pH should be checked. If samples are filtered in the field, differential pressure methods and 45 micron filters will be used. (Preservative is added after filtration.) VOA samples must never be filtered.

4. When only one holding time is given, it implies total holding time from sampling until analysis.

5. Total Recoverable Metals for water samples. Holding time for Hg is 28 days; for Cr(VI) is 24 hours.

6. Cl^-, Br^-, F^-, NO_3^-, NO_2^-, PO_4^{3-}, SO_4^{2-}; 1 L for each method; orthophosphate requires filtration. Holding time for analysis is 48 hours for NO_2^-, NO_3^-, and PO_4^{3-} if not preserved with H_2SO_4 to pH < 2.

TABLE D-2
EPA METHODS FOR SAMPLE ANALYSIS

Part 1. General Information. All sample analyses of water or soils will be performed using standard EPA methods as listed below. All procedures specified must be followed exactly with no deviations unless modifications are specifically authorized by the government's QA laboratory. All method QC requirements will be followed explicitly. The running of QC duplicates and spike samples shall be in accordance with the laboratory QA/QC Plan as set forth in the LQMP, or at a minimum rate of 1 in 20 but at least 1 per batch. The detection limits stated in each method must be met by the AE laboratory. All samples must be extracted and analyzed within the specific holding times specified by each method. All analyses must be performed by the validated laboratory (in-house) and may not be subcontracted out to another laboratory. EPA-CLP methods may be substituted for analytical parameters included in the CLP Statements of Work.

Part 2. Methods for the Determination of Metals (RCRA and Priority Pollutants) by Atomic Absorption and Inductively Coupled Plasma

		Extraction and Analysis Method		
Metal	Technique[1]	Soil/Sed.	Groundwater[2]	Surface Water[2]
Antimony (Sb)	DA	CLP[4]/7040	3005/7040	204.1
	GF	CLP[4]/7041	3020/7041	204.2
	ICP	CLP[4]/6010	3005/6010	200.7
Arsenic (As)	GF	3050/7060	Inc[3]/7060	206.2
	H	Inc[3]/7061	Inc[3]/7061	206.3
Barium (Ba)	DA	3050/7080	3005/7080	208.1
	GF	3050/7081	3020/7081	208.2
	ICP	3050/6010	3005/6010	200.7
Beryllium (Be)	DA	3050/7090	3005/7090	210.1
	GF	3050/7091	3020/7091	210.2
	ICP	3050/6010	3005/6010	200.7
Cadmium (Cd)	DA	3050/7130	3005/7130	213.1
	GF	3050/7131	3020/7131	213.2
	ICP	3050/6010	3005/6010	200.7
Calcium (Ca)	DA	3050/7140	3005/7140	215.1
	GF	-	-	-
	ICP	3050/6010	3005/6010	200.7

Table D-2 (Cont'd)

Metal	Technique[1]	Extraction and Analysis Method		
		Soil/Sed.	Groundwater[2]	Surface Water[2]
Chromium (Cr)	DA	3050/7190	3005/7190	218.1
	GF	3050/7191	3020/7191	218.2
	ICP	3050/6010	3005/6010	200.7
Copper (Cu)	DA	3050/7210	3005/7210	220.1
	GF	3050/7211	3020/7211	220.2
	ICP	3050/6010	3005/6010	200.7
Iron (Fe)	DA	3050/7380	3005/7380	236.1
	GF	3050/7381	3020/7381	236.2
	ICP	3050/6010	3005/6010	200.7
Lead (Pb)	DA	3050/7420	3005/7420	239.1
	GF	3050/7421	3020/7421	239.2
	ICP	3050/6010	3005/6010	200.7
Manganese (Mn)	DA	3050/7460	3005/7460	243.1
	GF	3050/7461	3020/7461	243.2
	ICP	3050/6010	3005/6010	200.7
Mercury (Hg)	CV	Inc[3]/7471	Inc[3]/7470	245.1
Nickel (Ni)	DA	3050/7520	3005/7520	249.1
	GF	-	-	249.2
	ICP	3050/6010	3005/6010	200.7
Selenium (Se)	GF	3050/7740	Inc[3]/7740	270.2
	H	Inc[3]/7741	Inc[3]/7741	270.3
Silver (Ag)	DA	3050/7760	Inc[3]/7760	272.1
	GF	3050/7761	Inc[3]/7761	272.2
	ICP	3050/6010	3005/6010	200.7
Sodium (Na)	DA	3050/7770	3005/7770	273.1
	GF	-	-	273.2
	ICP	3050/6010	3005/6010	200.7
Thallium (Tl)	DA	3050/7840	3005/7840	279.1
	GF	3050/7841	3020/7841	279.2
	ICP	3050/6010	3005/6010	200.7
Zinc (Zn)	DA	3050/7950	3005/7950	289.1
	GF	3050/7951	3020/7951	289.2
	ICP	3050/6010	3005/6010	200.7

Table D-2 (Cont'd)

Part 2. Methods for the Determination of Metals (RCRA and Priority Pollutants) by Atomic Absorption and Inductively Coupled Plasma (continued)

NOTES:
1. Abbreviations: DA = Direct Aspiration; GF = Graphite Furnace; H = Hydride; CV = Cold Vapor; ICP = Inductively Coupled Plasma.

2. (a) Any water samples may be analyzed by the groundwater techniques. Groundwater samples must be analyzed by these techniques. Surface water and other water samples (drinking, silo, leachate, etc.) may be analyzed by the 200-series or the SW-846 series methods.

(b) Other extraction procedures may be appropriate instead of those listed. Methods 3010 (for flame and ICP) and 3020 (for graphite furnace) are used as extraction procedures for Total Metals and are used in TCLP methodology. Method 3040 is used to extract metals from oily wastes (greases, waxes, etc.).

(c) All 200 series methods are from EPA 600/4-79-020 (1983) "Methods for Chemical Analysis of Water and Wastes"; all other methods are from SW-846 (1986), "Test Methods for Evaluation of Solid Waste".

3. Method-specific extraction procedure is incorporated into method.

4. Follow CLP sample preparation procedures. Existing guidance in SW-846 is inadequate in this regard.

Table D-2 (Cont'd)

Part 3. Methods for the Determination of Non-Metallic Analytes

Organic Analytes	Technique[1]	Analytical Methods Soil/Sed	Groundwater[2]	Surface Water[2]
Halogenated Volatile Organics	GC	5030/8010	5030/8010[3]	601[3]
Non-Halogenated Volatile Organics	GC	5030/8015	5030/8015[3]	602[3]
Aromatic Volatile Organics	GC	5030/8020	5030/8020[3]	602[3]
Organochlorine Pesticides and PCBs	GC	3540/8080 3550/8080	3510/8080 3520/8080	608
Organophosphorus Pesticides	GC	3540/8140 3550/8140	3510/8140 3520/8140	
Chlorinated Herbicides	GC	Inc[4]/8150	Inc[4]/8150	509B[10]
Volatile Organics	GC/MS	Inc[4]/8240	Inc[4]/8240	624
Base/Neutral Semi-volatile Organics	GC/MS[5]	3540/8250 3550/8250 3540/8270 3550/8270	3510/8250 3520/8250 3510/8270 3520/8270	625
Acid Semivolatile Organics	GC/MS	3540/8250 3550/8250 3540/8270 3550/8270	3510/8250 3520/8250 3510/8270 3520/8270	625
Dioxins, etc.	GC/MS	Inc[4]/8280	Inc[4]/8280	613
Polynuclear Aromatic Hydrocarbons	HPLC	3540/8310 3550/8310	3510/8310 3520/8310	

Table D-2 (Cont'd)

		Analytical Methods		
Inorganic Analytes	Technique[1]	Soil/ Sediment	Ground-water[2]	Surface Water[2]
Total and Amenable Cyanide		9010 or 9012		335
Sulfide		9030	9030	376
Sulfate		9035, 9036, or 9038		375
Nitrate		9200	9200	353
Chloride		9250, 9251, or 9252		325
Common Anions[6]	IC			300.0 429[10]
Total Organic Carbon			9060	415
Oil and Grease	IR	9071/413.2	413.2	413.2
TRPH[7]	IR	9071/418.1[7]	418.1	418.1
Ignitability		1010 or 1020		
Corrosivity		9045	9040/1110	9040/1110
Reactivity	(Section 7.3.3 and 7.3.4 of SW-846)			
EP Toxicity		1310[8]	1310[8]	
TCLP		1311[8,9]	1311[8,9]	
pH		9045	9040	
Gross alpha and beta		9310	9310	
Explosives		____[11]	____[11]	____[11]

Table D-2 (Cont'd)

Part 3 continued:
NOTES:
1. Abbreviations: GC = Gas Chromatograph; GC/MS = Gas Chromatograph/Mass Spectroscopy; IC = Ion Chromatograph; IR = Infrared Spectroscopy; HPLC = High Pressure Liquid Chromatograph.

2. (a) All water samples may be analyzed by these techniques. Groundwater samples must be analyzed by these techniques. Surface water and other water samples (drinking, silo, leachate, etc.) may be analyzed by the 200-series or the SW-846 series methods. Soil or sediment preparation unless otherwise specified involves extration of a predetermined weight of the dried samples with a fixed anount (500 mL) of water.

(b) All 300-600 series methods are from EPA 600/4-79-020 (1983) "Methods for Chemical Analysis of Water and Wastes"; all other methods are from SW-846 (1986), "Test Methods for Evaluation of Solid Waste".

3. Direct injection may be used for high concentrations of contaminates in water. It is preferable to use Method 8240. If Method 8010, 8015, 8020, 601, or 602 is used, it is necessary to confirm results with a second GC column or a validation by GC/MS.

4. Method-specific extraction procedure is incorporated into method.

5. Either method may be used. Extract cleanup by Methods 3600 is usually also required.

6. Common anions are fluoride (F^-), chloride (Cl^-), bromide (Br^-), nitrite (NO_2^-), nitrate (NO_3), Orthophosphate (PO_4^{3-}), and sulfate (SO_4^{2-}).

7. Total Recoverable Petroleum Hydrocarbons. Follow extraction procedures 9071 through Step 7.11 and then dilute with Freon-113 to 100 mL.

8. Extraction procedure only. Analysis must follow.

9. Federal Register March 29, 1990. TCLP leachates are analyzed by one or more of the following methods. Scope must specify which analyses are to be performed on TCLP leachate extracts.

Table D-2 (Cont'd)

Metals: Methods 6010, 7060, 7470, and 7740
Pesticides: Method 8080
Herbicides: Method 8150
Volatile organics: Method 8240 (Zero headspace TCLP extraction required)
Semi-volatile organics: Method 8270

10. Standard Methods for the Examination of Water and Wastewater, 16th Edition, 1985.

11. USACE method developed by Cold Regions Research and Engineering Laboratory to be obtained from CEMRD.

Table D-3. Inorganic Analysis Nominal Values for Instrument Detection Limits[a].

Analyte:	User's Guide to CLP ug/L	SW-846		
		ICP ug/L	AA-DA ug/L	AA-GF ug/L
Aluminum, Al	200	45	100	-
Antimony, Sb	60	32	200	3
Arsenic, As	10	53	2[b]	1
Barium, Ba	200	2	100	-
Beryllium, Be	5	0.3	5	0.2
Cadmium, Cd	5	4	5	0.1
Calcium, Ca	5000	10	10	-
Chromium, Cr	10	7	50	1
Cobalt, Co	50	7	50	1
Copper, Cu	25	6	20	-
Iron, Fe	100	7	30	-
Lead, Pb	5	42	100	1
Magnesium, Mg	5000	30	1	-
Manganese, Mn	15	2	10	-
Mercury, Hg	0.2	-	0.2[c]	-
Nickel, Ni	40	15	40	-
Potassium, K	5000	-	10	-
Selenium, Se	5	75	2[b]	2
Silver, Ag	10	7	10	-
Sodium, Na	5000	29	2	-
Thallium, Tl	10	10	100	1
Vanadium, V	50	8	200	4
Zinc, Zn	20	2	5	-
Cyanide, CN^-	10	-	-	-

<u>Important Note:</u> These estimated instrument detection limits are to be used as a guide. The actual detection limits are matrix dependent and sample dependent. For ICP, each instrument must have an established analyte interference table as per Method 6010. See Method 6000 or 7000 for further guidance.

a. AA-DA = Atomic Absorption - Direct Aspiration
AA-GF = Atomic Absorption - Graphite Furnace

b. Gas hydride technique

c. Cold vapor technique

Table D-4. Volatile Organic Analysis Nominal Values for Practical Quantitation Limits

Analyte:	Ground Water ug/L	Low Soil Sediment ug/kg
Chloromethane	10	10
Bromomethane	10	10
Vinyl Chloride	10	10
Chloroethane	10	10
Methylene Chloride	5	5
Acetone	100	100
Carbon Disulfide	5	5
1, 1-Dichloroethene	5	5
1, 1-Dichloroethane	5	5
1, 2-Dichloroethene	5	5
Chloroform	5	5
1, 2-Dichloroethane	5	5
2-Butanone	100	100
1,1,1-Trichloroethane	5	5
Carbon Tetrachloride	5	5
Vinyl Acetate	50	50
Bromodichloromethane	5	5
1,2-Dichloropropane	5	5
cis-1,3-Dichloropropene	5	5
Trichloroethene	5	5
Dibromochloromethane	5	5
1,1,2-Trichloroethane	5	5
Benzene	5	5
trans-1,3-dichloropropene	5	5
Bromoform	5	5
2-Chloroethyl Vinyl Ether	10	10
4-Methyl-2-pentanone	50	50
2-Hexanone	50	50
Tetrachloroethene	5	5
Toluene	5	5
1,1,2,2-Tetrachloroethane	5	5
Chlorobenzene	5	5
Ethyl Benzene	5	5
Styrene	5	5
Xylenes (Total)	5	5

Table D-5. Semivolatile Organic Analysis Nominal Values for Practical Quantitation Limits

Analyte:	Ground Water ug/L	Low Soil Sediment ug/kg
Phenol	10	660
Bis (2-chloroethyl) ether	10	660
2-Chlorophenol	10	660
1,3-Dichlorobenzene	10	660
1,4-Dichlorobenzene	10	660
Benzyl alcohol	20	1300
1,2-Dichlorobenzene	10	660
2-Methylphenol	10	660
Bis (2-chloroisopropyl)ether	10	660
4-Methylphenol	10	660
N-Nitroso-di-n-dipropylamine	10	660
Hexachloroethane	10	660
Nitrobenzene	10	660
Isophorone	10	660
2-Nitrophenol	10	660
2,4-Dimethylphenol	10	660
Benzoic Acid	50	3300
Bis(2-chloroethoxy)methane	10	660
2,4-Dichlorophenol	10	660
1,2,4-Trichlorobenzene	10	660
Naphthalene	10	660
4-Chloroaniline	20	1300
Hexachlorobutadiene	10	660
4-Chloro-3-methylphenol	20	1300
2-Methylnaphthalene	10	660
Hexachlorocyclopentadiene	10	660
2,4,6-Trichlorophenol	10	660
2,4,5-Trichlorophenol	50	3300
2-Chloronaphthalene	10	660
2-Nitroaniline	50	3300
Dimethylphthalate	10	660
Acenaphthylene	10	660
2,6-Dinitrotoluene	10	660
3-Nitroaniline	50	3300
Acenaphthene	10	660
2,4-Dinitrophenol	50	3300
4-Nitrophenol	50	3300
Dibenzofuran	10	660
2,4-Dinitrotoluene	10	660
Diethylphthalate	10	660
4-Chlorophenyl phenyl ether	10	660
Fluorene	10	660
4-Nitroaniline	50	3300
4,6-Dinitro-2-methylphenol	50	3300

Table D-5. (Cont'd)

Analyte:	Ground Water ug/L	Low Soil Sediment ug/kg
N-Nitrosodiphenylamine	10	660
4-Bromophenyl phenyl ether	10	660
Hexachlorobenzene	10	600
Pentachlorophenol	50	3600
Phenanthrene	10	660
Anthracene	10	660
Di-n-butylphthalate	10	660
Fluoranthene	10	660
Pyrene	10	660
Butylbenzylphthalate	10	660
3,3'-Dichlorobenzidine	20	1300
Benzo(a)anthracene	10	660
Chrysene	10	660
Bis(2-ethylhexyl)phthalate	10	660
Di-n-octylphthalate	10	660
Benzo(b)fluoranthene	10	660
Benzo(k)fluoranthene	10	660
Benzo(a)pyrene	10	660
Indeno(1,2,3-cd)pyrene	10	660
Dibenzo(a,h)anthracene	10	660
Benzo(g,h,i)perylene	10	660

Table D-6. Pesticide/PCB Analysis Nominal Values for Practical Quantitation Limits

Analyte:	Ground Water ug/L	Low Soil Sediment ug/kg
Aldrin	0.04	2.7
alpha-BHC	0.03	2.0
beta-BHC	0.06	4.0
delta-BHC	0.09	6.0
gamma-BHC (Lindane)	0.04	2.7
Chlordane (technical)	0.14	9.4
4,4'-DDD	0.11	7.5
4,4'-DDE	0.04	2.7
4,4'-DDT	0.12	8.0
Dieldrin	0.02	1.3
Endosulfan I	0.14	9.4
Endosulfan II	0.04	2.7
Endosulfan sulfate	0.66	44.2
Endrin	0.06	4.0
Endrin aldehyde	0.23	15.4
Heptachlor	0.03	2.0
Heptachlor epoxide	0.83	55.6
Methoxychlor	1.76	117.9
Toxaphene	2.4	160.8
Aroclor-1016	0.5	80.0
Aroclor-1221	0.5	80.0
Aroclor-1232	0.5	80.0
Aroclor-1242	0.65	43.6
Aroclor-1248	0.5	80.0
Aroclor-1254	1.0	160.0
Aroclor-1260	1.0	160.0

APPENDIX E

USACE CHEMICAL QUALITY ASSURANCE

1. Purpose. This appendix defines the components of USACE HTW chemical quality assurance and delineates the responsibilities of those USACE elements which provide these services.

2. Applicability. The policies in this appendix apply to all HTW projects executed by USACE districts, divisions and other FOA and their contractors. Every project must be assigned a QA Laboratory. QA functions may not be contracted out directly by the FOA to commercial enterprises. Sample analysis may be performed by a commercial lab under direct contract to the USACE QA Laboratory.

3. Elements and Responsibilities of USACE Chemical Quality Assurance. CEMRD is appointed by HQUSACE to exercise the lead in Corps-wide chemical data quality management and maintain consistency in this effort for all HTW activities. The elements of chemical data quality management involved in quality assurance are document review, analysis of field quality assurance samples, generation of the Chemical Quality Assurance Report (CQAR), validation of commercial laboratories, and assignment of quality assurance responsibilities. The first three are responsibilities transferred to the assigned quality assurance laboratory for a given project. The latter two activities remain the responsibility of CEMRD.

4. Procedures. The following procedures are followed for each investigation and remedial activity involving chemical analysis.

a. The project manager/COR notifies CEMRD and the preferred QA Laboratory (CEMRD-ED-GL or the geographic USACE Division Laboratory) of the need for chemical quality assurance services. A suggested format is provided for this purpose. If a memorandum is preferred the same information should be included.

b. The proposed QA laboratory requests project specific assignment providing CEMRD with information on procedures which will be employed to discharge their responsibilities. The suggested format provided in this appendix or a memorandum which addresses the same information should be sent.

c. CEMRD confirms the assignment in writing to the project manager/COR and the Division Laboratory and monitors the chemical data quality management through oversight review of

documents and review of the Chemical Quality Assurance Report. To facilitate this the quality assurance laboratory should send copies of their comments and of the CQAR to CEMRD as soon as these are available.

d. The quality assurance laboratory will either analyze the QA samples in-house or send them to a USACE validated commercial laboratory for analysis. Analysis in-house requires method and matrix-specific validation by CEMRD. Ongoing retention of validation requires periodic analysis of performance audit samples and laboratory site audits. Internal quality control specified in the methods--blanks, replicate analyses, spikes, surrogates, etc. must be included and reported in the analyses of the QA samples and results must be reported.

e. USACE quality assurance laboratories are required to maintain a Laboratory Quality Management Manual which is updated regularly. The manual should contain chronological resumes of all HTW chemistry personnel, a list of instruments and accessories with dates of purchase, and SOP's for the following activities:

(1) sample check-in, logging, and cooler packing procedure,

(2) in-house chain of custody,

(3) glassware cleaning,

(4) analytical procedures used in-house,

(5) data analysis and reporting,

(6) quality control procedures employed for each analytical method.

A copy of updated pages or the revised LQMM should be sent to CEMRD when these are generated.

f. The validation of commercial laboratories for nationwide USACE work is centralized at CEMRD. If a Division Quality Assurance Laboratory assists in this effort by sending an inspector to a commercial laboratory, CEMRD will be notified immediately by phone of general inspection results. A written report will be prepared by the inspector and sent to CEMRD within two weeks of the inspection date, and should not specify approval but rather make recommendations based on the inspection. The formats of the inspection checklist to be used and of the report will be provided to the inspector by CEMRD.

CEMRD will take into account all aspects of laboratory performance during evaluation and determine extent and length of validation, and make an approval recommendation to the requesting FOA.

5. Guidance on Field Quality Assurance Sample Rates. Quality Assurance Samples are duplicates and/or splits and field blanks which are sent to one of the USACE Division Laboratories to be analyzed and later compared in the CQAR with the contractor's results. Some attempt should be made to select contaminated samples for QA, as based on physical evidence such as appearance, odor, or field screening tests. Prior to determining the QA rates on a site, the following should be ascertained:

a. Number of Matrices - groundwater, surface water, soil, sediment, and waste are those most commonly encountered.

b. Whether dedicated sampling equipment will be used for each sampling event or decontamination in the field will be an issue.

c. Whether the QA splits or duplicates will be taken on the same sample as the contractor's QC or whether these will be staggered.

d. Whether the rinsates will be associated with samples which will be split for QA purposes (in most cases this would be advisable).

(1) In general samples which are taken for volatiles analyses are discrete collocated samples. Most groundwater and surface water samples also fall under this category. Soil and sediment samples which are taken for analytical methods other than volatiles should be thoroughly mixed in the field and then split for QC and/or QA purposes, with a portion going to the contractor as a regular sample.

(2) Trip blanks are relevant only when water samples are taken for volatile organics analysis. Ordinarily one trip blank is shipped in each cooler containing aqueous volatile samples. To reduce the number of trip blanks needed, it is recommended that all VOA samples be shipped in the same cooler. The trip blank is not to be opened at any time between its preparation and its analysis.

(3) The rinsates should be associated by sample number with the sample for which the equipment was decontaminated.

Rinsates taken for government quality assurance samples should be taken just prior to the QA sample. If the sample is analyzed first, and is clean, the rinsate and trip blanks need not be analyzed. If dedicated sampling equipment is used for each sampling event, rinsate blanks are not required.

(4) The Scope of Services or the CDAP for the site should contain a Data Quality Objectives section which discusses in some detail the rationale for the rates of QA which are selected for the site. The following are proposed minimum rates for the USACE QA samples.

a. DERP Site Inspection Confirmation Studies (usually a sample set of 1 to 20 samples per matrix).

(1) Soil or sediment -- 1 duplicate/split to be analyzed for all site specific analytes. Under some circumstances such as suspected heavy contamination, a rinsate may be advisable. See Section 5.d.(3) above.

(2) Groundwater -- 1 duplicate, 1 rinsate analyzed for all groundwater parameters, 1 trip blank analyzed only for volatiles.

(3) Surface water -- 1 duplicate, 1 rinsate analyzed for all surface water parameters. If volatiles are included among the parameters, ship VOA vials with groundwater VOA's to avoid the necessity of an additional trip blank.

(4) A background soil sample with no attendant blanks to be analyzed for metals, total recoverable petroleum hydrocarbons, volatiles, BNAs and PCBs/Pesticides if these are site-specific analytes for soils.

b. RI/FS or Pre-Design CDQM.

(1) Include 5-10% duplicates/splits or at least one per matrix for both QC and QA. If there is a possibility of litigation, the higher rate should probably be selected.

(2) A background soil sample should be included and analyzed for metals, volatiles, BNA's, PCB's/Pesticides, and total recoverable petroleum hydrocarbons if these are site-specific soil analytes. Additional background samples may be specified depending upon the degree of confidence needed in establishing background levels.

(3) Rinsates at the rate of one per day for water samples.

(4) Include 1 trip blank per shipping cooler containing water samples to be analyzed for volatiles.

c. Construction and other activities. Special projects such as pilot plant treatability studies, kinetic studies, leachate tests, etc. undertaken in Design/Construction stages require separate consideration. The rates of quality assurance should be decided on a case-by-case basis by the project manager or COR in concurrence with CEMRD. Ordinarily they will be somewhat less than 10%.

6. The Chemical Quality Assurance Report. The CQAR is written by the USACE Quality Assurance Laboratory and sent to the project manager within 30 days of receipt of the contractor's data and completion of the quality assurance data. This report should address the following concerns:

a. Overall performance of the laboratory--commercial or USACE--that analyzed the site primary samples,

b. Detailed evaluation of the contractor's data--laboratory blanks, replicate analyses, agreement between duplicates/splits, acceptability of spike and surrogate recoveries,

c. Comparison of the quality assurance analytical results with those of the project laboratory,

d. Any other problems or issues encountered such as packing and shipment errors, chain of custody failures, etc.

Tables should be prepared which compare the results for duplicates, splits and blanks sent to both laboratories. The quality assurance data with internal quality control results should be appended.

7. In-House Work. When a USACE Division Laboratory is functioning as the primary laboratory on a project, special arrangements for quality assurance should be made. If the samples are contracted out by the division laboratory, and only the QA samples are analyzed in-house, the final report written by the division laboratory would have to be modified to accommodate this arrangement. If the division laboratory is analyzing all of the project samples or a method subset of the samples in-house, ordinarily a second USACE Division Laboratory should be selected as the quality assurance laboratory for the project.

8. When the following procedures, performed by the designated USACE QA laboratory, demonstrate that contract requirements are not being met, resampling and/or reanalysis may be required by the COR at the expense of the contractor.

a. Inspection of QA samples to insure that sampling procedures correspond to the CDAP with regard to containers, preservation, labeling, packing, chain of custody, etc.

b. Analyses of QA samples,

c. Evaluation of contractor analytical deliverables specified in the CDAP,

d. Comparison of analytical results obtained by contract laboratory and USACE QA laboratory from split or duplicate samples.

(SAMPLE FORMAT)

TO: CEMRD-ED-GC FROM:____________________ DATE:__/__/__

SUBJECT: **Request for USACE Project Specific Chemical Quality Assurance Assignment** (To be filled out by the Quality Assurance Laboratory)

Project Name:______________________ Contract No.:________________

Superfund ___ FUDS ___ IRP ___ Other ___ Phase ________________

Location:____ State:__________

A-E/Contractor:__________________________________ State:__________

USACE Project Manager:____

Phone:________________ Address:___________________________________

Approximate Sampling Dates:_______________________________________

Document to be reviewed: ____

____

____

____

Reviewer: ____

QUALITY ASSURANCE SAMPLES:

MATRIX	METHOD	NO. OF SAMPLES	ANALYTICAL LABORATORY*	ESTIMATED COST†

* Name of USACE validated laboratory to be used or designated "in-house" analyses.

† Include cost of review, sample checks, etc.

(SAMPLE FORMAT)

TO:__________________ FROM:____________________ DATE: / /

SUBJECT: **Request for Government Quality Assurance Services** (To be sent to the requested USACE Laboratory with a copy to CEMRD-ED-GC)

Project Name:_____________________ Contract No.:________________

Superfund ___ FUDS ___ IRP ___ Other ___ Phase ________________
Location:_______________________________________ State:_________

A-E/Contractor:________________________________ State:_________
USACE Project Manager:____
Phone:___________ Address:_____________________________________

Laboratory Name:____
Address:____
Phone:____
POC:____

Approximate Sampling
Dates:____

The following QA Laboratory support is requested for the subject project: USACE Division Laboratory:__________________

____ Review and comment on Draft ______________________________
____
____
____

____ Analysis and Reports of Quality Assurance Samples

METHOD	NO. OF WATER SAMPLES*	NO. OF SOIL/SEDIMENT SAMPLES‡

* Includes Blanks

‡ Includes Background Soil Sample

CF: CEMRD-ED-GC

APPENDIX F

SAMPLE HANDLING PROTOCOL FOR LOW, MEDIUM AND HIGH CONCENTRATION SAMPLES OF HAZARDOUS WASTE

1. Purpose. This protocol provides guidance on sample volumes, containers, packing, and shipping for low, medium, and high concentration environmental samples taken for chemical analysis.

2. Applicability. The guidance in this appendix applies to all samples taken by USACE for HTW chemical analysis. The requirements are consistent with those of the Environmental Protection Agency and all standard chemical methods generally used are included.

3. Low Concentration Samples. Low level samples are considered to be those collected off-site, around the perimeter of a waste site, or in areas where hazards are thought to be significantly reduced by normal environmental processes.

a. Waters.

(1) Organics.

(a) Bottle and Preservative Requirements.

- o Four 1-liter amber glass bottles (Teflon-lined caps), iced to 4°C (may not be held at site over 24 hours). Remember: Leave some headspace!
- o Two 40 mL glass VOA vials (with Teflon septa), iced to 4°C (may not be held at site over 24 hours). Fill completely! All air bubbles must be excluded. Add HCl (4 drops of concentrated HCl) or $NaHSO_4$ to pH < 2.
- o The samples above are needed when Method 8240 is used to analyze for volatile (or purgeable) organics, when Methods 8250 or 8270 are used to analyze for Base/Neutral/Acid (B/N/A) extractable organics, and when Method 8080 is used to analyze for pesticides and PCB's. Two of the 1-L bottles are needed for 8250 or 8270 and two for 8080.

- Oil and Grease, Total Organic Carbon (TOC) or TRPH. For each analyte, two 1-liter glass bottle (Teflon-lined cap), 5 mL 1:1 HCl (to pH < 2), and 4°C. Leave headspace.

(b) Paperwork/Labels.

- (ENG Form 5021-R) Chain of Custody Record. See attached example. It is important to note that only one site may be listed per form even if the sites have the same project number. Top original goes with the samples; a copy should be saved for the sampler's files.

- Receipt for Samples. See attached example. This form complies with the requirements that the owner, operator, or agent-in-charge is legally entitled to: (1) a receipt describing the samples obtained from the site and; (2) a portion of each sample equal in weight or volume to the portion retained, if requested. The original form is retained for the Project Coordinator and a copy is given to the owner, operator, or agent-in-charge.

- Sample Labels/Tags. See attached example. You must label the sample with a date, time of collection, site name, and brief description on a label that will not float/soak off - no masking tape, please. Use only indelible ink on all labels. Numbered sample labels should be used on all samples. Some projects may also require the use of sample tags in addition to labels.

(c) Packaging and Shipping.

- Waterproof metal (or equivalent strength plastic) ice chests or coolers only.

- After filling out the pertinent information on the sample label and tag, put the sample in the bottle or vial and screw on the lid. For bottles other than VOA vials, secure the lid with strapping tape. (Tape on VOA vials may cause contamination.) Then, secure the string from the numbered approved tag around the lid.

- Mark volume level on bottle with grease pencil.

- o Place about 3 inches of inert cushioning material such as vermiculite in the bottom of the cooler.
- o Enclose the bottles in clear plastic bags through which sample tags and labels are visible, and seal the bag. Place bottles upright in the cooler in such a way that they <u>do not touch</u> and will not touch during shipment.
- o Put in additional inert packing material to partially cover sample bottles (more than halfway). Place bags of ice around, among, and on top of the sample bottles. If chemical ice is used, it should be placed in a plastic bag.
- o Fill cooler with cushioning material.
- o Put paperwork (chain of custody record) in a waterproof plastic bag and tape it with masking tape to the inside lid of the cooler.
- o Tape the drain shut.
- o Secure lid by taping. Wrap the cooler completely with strapping tape at a minimum of two locations. Do not cover any labels.
- o Attach completed shipping label to top of the cooler.
- o Put "This Side Up" labels on all four sides and "Fragile" labels on at least two sides.
- o Affix numbered and signed custody seals on front right and back left of cooler. Cover seals with wide, clear tape.

Remember that each cooler cannot exceed the weight limit set by the shipper.

(2) <u>Inorganics</u>.

(a) <u>Bottle and Preservative Requirements</u>.

- o <u>Metals</u>. One 1-liter high density polyethylene bottle (Teflon-lined cap), adjust to pH < 2 with 1:1 HNO_3 (usually 3 mL).

- **Cyanides**. One 1-liter high density polyethylene bottle (Telfon-lined cap), adjust to pH > 12 with NaOH (usually 2 mL of 10N NaOH or 4 pellets), and 4°C.

- **Sulfide**. One 1-liter high density polyethylene bottle (Teflon-lined cap), 4 mL 2.0 N zinc acetate and adjust pH > 9 with NaOH, and 4°C.

- **Fluoride**. One 1-liter high density polyethylene bottle (Teflon-lined cap), no preservative, and 4°C.

- **pH**. No preservative. Must be measured twice immediately in field. Do not ship.

- **Ammonia, Total Kjeldahl Nitrogen, Nitrate/Nitrite**. For each analyte, one 1-liter high density polyethylene bottle (Telfon-lined cap), adjust to pH < 2 with H_2SO_4 (usually 4 mL 1:1 H_2SO_4), and 4°C.

(b) Paperwork/Labels.

- **Inorganic Paperwork** is the same as described for organics (see Section 3.a.(1).(b). above) and includes the Chain of Custody Record, Receipt for Samples, and Labels/Sample Tags. See previous examples and explanations.

(c) Packaging and Shipment.

- Follow packaging and shipping requirements listed for organics (see Section 3.a.(1).(c). above). "Fragile" labels are optional for coolers not containing glass bottles. In cases where ice is not required (metals), fill cooler with only packing material. Once again, remember that the cooler must not exceed the shipper's weight limit.

b. Soils/Sediments (Organics and Inorganics).

(1) Bottle and Preservative Requirements.

- Two 8-ounce glass wide mouth jars at least 3/4 full (Teflon-lined caps), iced to 4°C - one jar for organics (non-VOA) and one jar for inorganics. For analysis of volatiles in soil, two 40 mL VOA vials or two 125 mL jars with Teflon septa are used. These shoudl be completely filled and iced to 4°C.

(2) Paperwork/Labels.

- o Follow paperwork requirements listed for water samples in Section 3.a.(1).(b). above. See attached examples of forms.

(3) Packaging and Shipping.

- o Follow packaging and shipping requirements in Section 3.a.(1).(c). above. Be sure that the shipping cooler does not exceed the shipper's weight limits.

4. Medium Concentration Samples. Medium level samples are most often those collected on-site, in areas of moderate dilution by normal environmental processes.

a. Water/Liquids (Organics and Inorganics).

Note: Samples are not known to contain highly toxic compounds.

(1) Bottle and Preservative Requirements.

- o Four 32-ounce wide mouth glass jars (Teflon-lined caps), no preservatives, and iced to 4°C for B/N/A extractable organics and PCB/Pesticides (two jars for each method). Remember: Leave some headspace.
- o Two 40 mL glass VOA vials (Teflon septa), Iced to 4°C. Fill completely. No headspace.
- o Two 16-ounce wide mouth glass jars nearly full (Teflon-lined caps) one for metals and one for cyanides. (Preserved as for low level. See Section 3.a.(2).(a).)

(2) Paperwork/Labels.

- o See previous examples. Follow paperwork requirements in Section 3.a.(1).(b). for low concentration samples.

(3) Packaging and Shipping

- o Secure sample jar lids with strapping tape or evidence tape. At the same time secure string from USEPA numbered tag around lid.

- Mark volume level of bottle with grease pencil.
- Position jar in Ziploc bag so that tags may be read.
- Place about 1/2 inch of cushioning material in the bottom of metal can.
- Place jar in can and fill remaining volume of can with cushioning material.
- Close the can using three clips to secure lid.
- Write sample number on can lid. Indicate "This Side Up" by drawing an arrow and place "Flammable Liquid N.O.S." label on can. Personnel who ship samples must be sure to comply with DOT shipping regulations and not knowingly <u>over-classify</u> a sample prior to shipment. If the person shipping a sample <u>knows</u> that the sample is not a "Flammable Liquid" (i.e., a water phase sample or a soil sample), he should not classify it as "Flammable Liquid."
- Place about 1 inch of packing material in bottom of cooler.
- Place cans in cooler and fill remaining volume of of cooler with packing material. Add ice bags if required.
- Put paperwork in plastic bags and tape with masking tape to inside lid of cooler.
- Tape drain shut.
- After acceptance by shipper, tape cooler completely around with strapping tape at two locations. Secure lid by taping. Do not cover any labels.
- Place lab address on top of cooler.

<u>Note</u>: Write "Flammable Liquid N.O.S." on side of cooler if this is not marked on the margin of your DOT label.

- For all medium and high concentration shipments, complete shipper's hazardous material certification form.

- o Put "This Side Up" labels on all four sides sides, "Flammable Liquid N.O.S." and "Danger-Peligro" on all sides.

Note: "Danger-Peligro" labels should be used only when net quantity of samples in cooler exceeds 1 quart (32 ounces) for liquids or 25 pounds for solids. In other words, for our purposes "Danger-Peligro" labels will never be used for Flammable Solids N.O.S.

- o Affix number custody seals on front right and back left of cooler. Cover seals with wide, clear tape.

b. Soils/Sediments/Solids (Organics and Inorganics).

(1) Bottles and Preservatives Requirements.

- o For analysis of volatiles, two 40 mL VOA vials or two 125 mL jars with Teflon septa are used. These should be completely filled and iced to 4°C.
- o Two 8-ounce wide mouth glass jars, 3/4 full (Teflon-lined caps), no preservatives, one jar for organics (non-VOA) and one jar for inorganics (metals and cyanide) or
- o Four 4-ounce wide mouth glass jars each 3/4 full (Teflon-lined caps), no preservative; two jars for organics (non-VOA) and two jars for inorganics.

(2) Paperwork/Labels.

- o See previous examples. Follow paperwork requirements listed in Section 3.a.(1).(b). for low concentration samples.

(3) Packaging and Shipping.

- o Follow packaging and shipping requirements listed in Section 3.a.(1).(c). for medium concentration water/liquids above substituting "Flammable Liquid N.O.S." with "Flammable Solid N.O.S."

5. High Concentration Samples (Hazardous: Determined Not to be D.O.T.-Defined Poison A). High concentration samples include those from drums, surface impoundments, direct discharges, and chemical spills, where there is little or no evidence of environmental dilution. High concentration (or high

hazard) samples are suspected to contain greater than 15% concentration of any individual chemical substituent.

a. <u>Liquids (Organics and Inorganics)</u>.

(1) <u>Bottle and Preservative Requirements</u>.

- o One 8-ounce wide mouth glass jar filled 1/2 to 3/4 full (Teflon-lined cap). No preservative.

(2) <u>Paperwork/Labels</u>.

(a) See previous examples. Follow paperwork requirements listed in Section 3.a.(1).(b). above.

(b) Shipper may require special forms to be completed before shipment of high hazard concentration samples.

(3) <u>Packaging and Shipping</u>.

- o Follow packaging and shipping requirements listed in Section 3.a.(1).(c). above for medium concentration water/liquids.

b. <u>Soils/Sediments/Solids (Organics and Inorganics)</u>.

(1) <u>Bottle and Preservative Requirements</u>.

- o One 8-ounce wide-mouth glass jar filled 1/2 to 3/4 full (Teflon-lined cap). No preservative.

(2) <u>Paperwork/Labels</u>.

- o See attached examples. Follow paperwork requirements in Section 3.a.(1).(b). above.

(3) <u>Packaging and Shipping</u>.

- o Follow packaging and shipping requirements listed in Section 3.a.(1).(c). for medium concentration water/liquids, substituting "Flammable Liquid N.O.S." with "Flammable Solid N.O.S."

TABLE F-1

SAMPLE CONTAINERS, PRESERVATIVES, AND HOLDING TIMES

Low Concentration Samples

				Maximum Holding Times:	
Matrix	Parameter[1]	Container[2]	Preservation[3]	Extraction)[4]	Analysis
Water	Volatiles	2 x 40 mL[8] G, Septa vial	Ice to 4°C 4 drops con HCl or $NaHSO_4$ to pH<2	-	14 d
Water	B/N/A	2 x 1 L[5,8] amber G	Ice to 4°C	7 d	40 d
Water	PCBs, Pesticides	2 x 1 L[5,8] amber G	Ice to 4°C	7 d	40 d
Water	Metals[6]	1 x 1 L P	HNO_3 to pH<2	-	6 mo[6]
Water	TRPH	2 x 1 L G	Ice to 4°C HCl to pH<2	-	28 d
Water	Common anions[7]	1 x 1 L[7] G	Ice to 4°C	-	28 d[7]
Water	Explosives	2 x 1 L G (amber)	Ice to 4°C	7 d	40 d
Water	Cyanide	1 x 1 L P	NaOH to pH>12 Ice to 4°C	-	14 d
Soils/ Sed.	Volatiles	2 x 40 ml G or 2 x 125 mL G, Septa vial	Ice to 4°C	-	14 d
Soils/ Sed.	B/N/A, PCBs, Pesticides	1 x 8 oz G	Ice to 4°C	14 d	40 d
Soils/ Sed.	Metals, Cyanide, TRPH	1 x 8 oz G	Ice to 4°C (Cyanide & TRPH)	-	6 mo[6] (TRPH: 28d)
Soils/ Sed.	Explosives	1 x 4 oz G	Ice to 4°C	14 d	40 d

TABLE F-2

SAMPLE CONTAINERS AND PRESERVATIVES[9]

Medium Concentration Samples

Matrix	Parameter[1]	Container[2]	Preservation[3]
Water/Liquid	Volatiles	2 x 40 mL G, Septa vial	Ice to 4°C[8]
Water/Liquid	B/N/A[5]	2 x 32 oz wide mouth jars, G	Ice to 4°C[8]
Water/Liquid	PCBs[5], Pesticides	2 x 32 oz wide mouth jars, G	Ice to 4°C[8]
Water/Liquid	Metals	1 x 16 oz wide mouth jar, G	HNO_3 to pH<2
Water/Liquid	Cyanide	1 x 16 oz wide mouth jar, G	Ice to 4°C
Water/Liquid	Explosives	2 x 1 L G (Amber)	Ice to 4°C
Soils/ Sediments	Volatiles	2 x 40 ml G or 2 x 125 mL G	Ice to 4°C
Soils/ Sediments	B/N/A, PCBs, Pesticides	1 x 8 oz wide mouth jar, G	---
Soils/ Sediments	Metals, Cyanide, TRPH	1 x 8 oz wide mouth jar, G	Ice to 4°C (Cyanide & TRPH)
Soils/ Sediments	Explosives	1 x 4 oz wide mouth jar, G	Ice to 4°C

High Concentration Samples

Matrix	Parameter[1]	Container[2]	Preservation
Liquid	All organic and inorganic analyses	1 x 8 oz wide mouth jar, G	---
Solid	All organic and inorganic analyses	1 x 8 oz wide mouth jar, G	---

1. B/N/A = Base/Neutral/Acid extractables; TRPH = Total Recoverable Petroleum Hydrocarbons

2. All containers must have Teflon-lined seals (Teflon-lined septa for VOA vials). G = Glass; P = High density polyethylene.

3. Sample preservation will be done in the field immediately upon sample collection. If water samples are filtered in the field, differential pressure methods using 45 micron filters will be used, and preservative added after filtration. VOA samples should never be filtered.

4. When only one holding time is given, it implies total holding time from sampling until analysis.

5. Three bottles are required on at least 5-10% (but at least one) sample so that laboratory can perform all method QC checks for SW-846 method.

6. Total Recoverable Metals for water samples. Holding time for Hg is 28 days in glass; for Cr(VI) is 24 hours.

7. Cl^-, Br^-, F^-, NO_3^-, NO_2^-, PO_4^{3-}, SO_4^{2-}; 1 L for each method; orthophosphate requires filtration. Holding time for extraction is 48 hours for NO_2^-, NO_3^-, and PO_4^{3-} if not preserved with H_2SO_4 to $pH < 2$.

8. Samples with residual chlorine present will be dechlorinated with sodium thiosulfate as specified in SW-846 (Third edition).

9. Holding times for medium concentration samples are the same as those specified for low concentration samples.

U.S. Army Corps of Engineers

Chain of Custody Record
(ER 1110-1-263)

Proj. No.	Project Name					Number of Containers								
Sampler : (Signature)														
Date	Time	Pres.	Grab	Comp	Site Code/Sample Number									Remarks:

FOR ILLUSTRATION PURPOSES ONLY
(Local reproduction authorized - blank masters available from local FMO)

Sampler Relinquished by:	Date/Time	Received by: (Sig.)	Date/Time	Hazards Associated with Samples
Relinquished by: (Sig.)	Date/Time	Received by: (Sig.)	Date/Time	
Relinquished by: (Sig)	Date/Time	Received for Laboratory by: (Sig.)	Date/Time	Remarks at time of receipt:
Custody Seal No.		Lab case No.:		

ENG Form 5021-R, Oct 90

Proponent: CEMP-RT

SAMPLE

U.S. Army Corps of Engineers

Chain of Custody Record
(ER 1110-1-263)

Proj. No. 017	Project Name ANY ARMY AMMUNITION PLANT
Sampler: (Signature) Marcia C Davis	

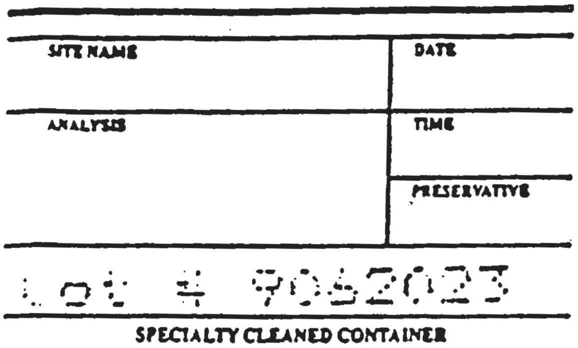
Date 90	Time	Pres.	Grab	Comp	Site Code/Sample Number	Number of Containers	Volatile Organics	B/N/A	Total Metals	TRPH	Explosives			Remarks:
9/4	0930	4°C	X		AAAP-SB01-0001	2	X							Strong hydrocarbon odor
9/4	0935	4°C	X		AAAP-SB01-0001	1		X	X		X			" " "
9/4	0937	4°C	X		AAAP-SB01-0001	1				X				" " "
9/4	1035	pH<2 HCL 4°C	X		AAAP-MW02-0001	2	X							No visual turbidity
9/4	1036	4°C	X		AAAP-MW02-0001	2		X						" " "
9/4	1040	pH<2 HNO3 4°C	X		AAAP-MW02-0001	1			X					" " "
9/4	1050	pH<2 HCL 4°C	X		AAAP-MW02-0001	2				X				" " "
9/4	1055	4°C	X		AAAP-MW02-0001	1					X			" " "

Sample Relinquished by: Marcia C Davis	Date/Time 9/4 1400	Received by: (Sig.)	Date/Time	Hazards Associated with Samples NONE
Relinquished by: (Sig.)	Date/Time	Received by: (Sig.)	Date/Time	
Relinquished by: (Sig)	Date/Time	Received for Laboratory by: (Sig.)	Date/Time	Remarks at time of receipt:
Custody Seal No. 1535		Lab case No.:		

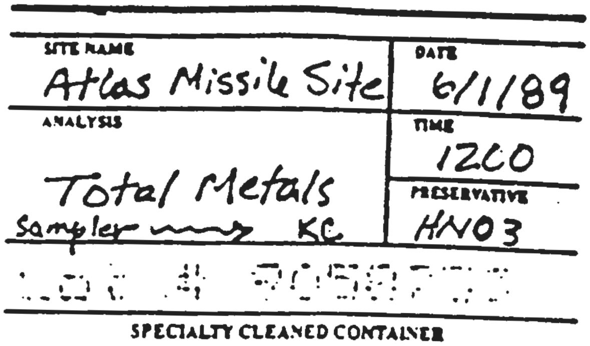
ENG Form 5021-R, Oct 90

Proponent: CEMP-RT

SAMPLE LABELS

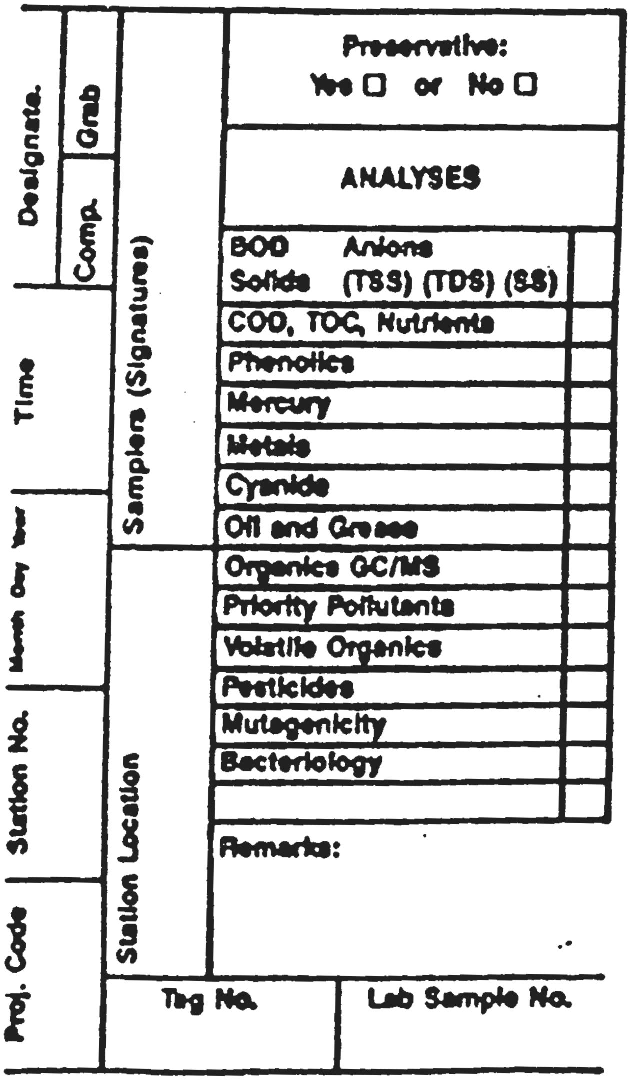


SITE NAME
DATE
ANALYSIS
TIME
PRESERVATIVE
Lot # 9062023
SPECIALTY CLEANED CONTAINER



SITE NAME: Atlas Missile Site
DATE: 6/1/89
ANALYSIS: Total Metals
Sampler KC
TIME: 1200
PRESERVATIVE: HNO3
Lot # 9058[illegible]
SPECIALTY CLEANED CONTAINER

SAMPLE TAGS



Proj. Code
Station No.
Month Day Year
Time
Designate: Comp. / Grab
Samplers (Signatures)
Station Location

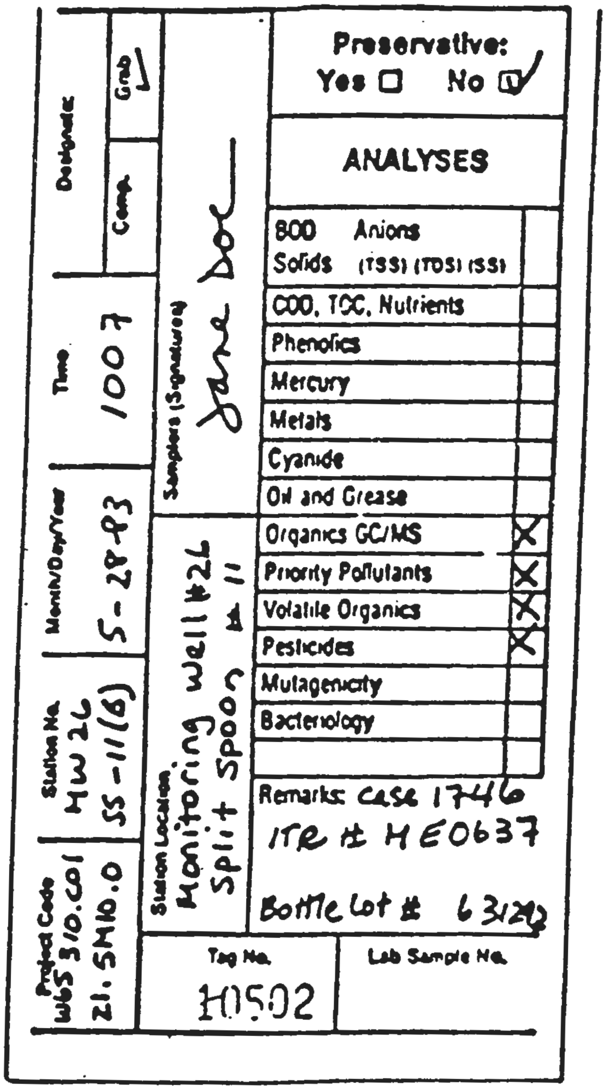
Preservative:
Yes ☐ or No ☐

ANALYSES

BOD Anions Solids (TSS) (TDS) (SS)	☐
COD, TOC, Nutrients	☐
Phenolics	☐
Mercury	☐
Metals	☐
Cyanide	☐
Oil and Grease	☐
Organics GC/MS	☐
Priority Pollutants	☐
Volatile Organics	☐
Pesticides	☐
Mutagenicity	☐
Bacteriology	☐
	☐

Remarks:

Tag No.
Lab Sample No.



Project Code: WBS 310.C01 Z1.SM10.0
Station No.: MW 26 SS-11(6)
Month/Day/Year: 5-28-93
Time: 1007
Designate: Comp. / Grab ✓
Samplers (Signatures): Jane Doe
Station Location: Monitoring well #26 Split Spoon # 11

Preservative:
Yes ☐ No ☑

ANALYSES

BOD Anions Solids (TSS) (TDS) (SS)	☐
COD, TOC, Nutrients	☐
Phenolics	☐
Mercury	☐
Metals	☐
Cyanide	☐
Oil and Grease	☐
Organics GC/MS	☒
Priority Pollutants	☒
Volatile Organics	☒
Pesticides	☒
Mutagenicity	☐
Bacteriology	☐
	☐

Remarks: Case 1746
ITR # HE0637
Bottle Lot # 631292

Tag No. H0502
Lab Sample No.

APPENDIX G

GLOSSARY

1. **Chemical Contamination Activities** - All activities related to the cleanup of chemical contamination at a site including investigation and remedial activities. This definition includes activities defined by EPA as "removal activities" and "remedial activities".

2. **Chemical Data Acquisition Plan (CDAP)** - A submittal document which describes the site specific implementation of CDQM requirements. For investigation and design contracts, CDQM guidance and requirements for CDAP preparation and implementation are found in the Scope of Services. For construction contracts, these requirements are found in the contract technical specifications in language which is clearly biddable and enforceable. The CDAP shall include detailed plans for sampling, analysis, and chemical QC activities. A guide for preparation of the CDAP is found in Appendix D. A CDAP is required for both in-house and contracted work. The EPA equivalent is called a Quality Assurance Project Plan (QAP$_j$P) and may be substituted for the CDAP.

3. **Chemical Data Quality Management (CDQM)** - The combination of activities establishing a government quality assurance (QA) program and specifying quality control (QC) operations for the AE, construction contractor, or USACE District. CDQM includes the maintenance of field and laboratory practices/checks which insure that Data Quality Objectives (DQO) are met.

4. **Chemical Data Management Specifications** - Construction Contract technical specifications prepared during design which describe all construction contractor sampling, sample handling and custody, documentation, analytical procedures, and data reporting. The specifications outline contractor QC responsibilities and the requirements of the Chemical Data Acquisition Plan for construction. Appropriate chemical concerns should be addressed at each design submittal phase.

5. **Chemical Quality Assurance (QA)** - The government activities required to assure desired and verifiable levels of quality in chemical data for a specific project. Chemical Quality Assurance activities are defined in Appendix E.

6. **Chemical Quality Assurance Report (CQAR)** - Prepared by the designated QA laboratory; approved by the investigation/design/construction division; and normally ready for distribution within 30 days of receipt of the AE/contractor analytical data. The report will include an overall evaluation of the contractor's/AE's data and quality assurance data, a comparison of the contractor's and government results, problems in accomplishing the CDAP, and lessons learned. The CQAR shall be prepared in accordance with the guidance found in Appendix E.

7. **Chemical Quality Control (QC)** - Specific activities for insuring that data of the required quality will be obtained for a specific project by the AE, construction contractor, or government (for in-house chemical analyses). Normally this consists of the analysis of field blanks, duplicate samples and the inclusion of laboratory internal quality control procedures as required by the methods or otherwise specified.

8. **Construction District** - The district assigned the responsibility to administer the construction contract.

9. **Construction Division** - The geographic USACE division in which the Construction District is located.

10. **Contract Laboratory** - The laboratory retained by a USACE AE/contractor or QA laboratory to perform chemical analyses of field samples. These laboratories are evaluated in accordance with the procedures in Appendix C, and must be validated by CEMRD prior to performing chemical analyses for HTW projects.

11. **Daily Quality Control Report (DQCR)** - A daily report prepared by an AE in accordance with the Scope of Services or by a construction contractor per contract specifications and submitted to the Contracting Officer (CO) during chemical contamination investigation and remedial activities. Copies are sent by the COR to the QA laboratory whenever sampling and analytical activities are involved. The DQCR shall contain at a minimum the following with respect to chemistry:

(a) Work performed. Sections in the CDAP that specify the sampling procedure and the analytical procedure shall be referenced. Weather information at the time of sampling shall be included. Information concerning all field samples, sample shipping, and field instrument measurements and calibration shall be included.

(b) Departures from the approved sampling plan. Include problems identified, corrective actions, and verbal/written instructions from USACE personnel. These shall be reported to the contracting officer (CO) in writing within two working days.

12. **Data Quality Objectives (DQO)** - DQOs are qualitative and quantitative statements specifying the level and extent of chemical data required to support decisions during remedial activities. They are determined based on the end uses of the data to be collected. DQOs are established prior to data collection and are not considered a separate deliverable. Rather, the DQO development process is integrated with the project planning process and the results are incorporated into Scopes of Work and Work Plans for the site. The levels and responsibility for data validations should be determined with the DQOs.

13. **Design Analysis Reports** - Documents prepared during design to support the Plans and Specifications. Technical Design Analysis Reports should have a section or chapter dedicated to design chemical evaluations and to the level of sampling, analysis, and CDQM required to support and document construction.

14. **Design District** - The USACE district assigned the responsibility for coordinating, reviewing, and completing design documents, including plans and specifications for HTW site design activities either in-house or through contracted services. Other Design District responsibilities include procuring AE services and construction contracts when work is not done in-house.

15. **Design Division** - The USACE Division overseeing the Design District.

16. **HQUSACE (CEMP-R)** - Headquarters office responsible for CDQM requirements and other supporting issues related to the proper implementation and execution of all phases of HTW program activities under USACE management.

17. **Internal Quality Control** - Measures which a laboratory implements to ensure data reliability. These include the analysis of blanks of various types, replicate sample or extract analysis, lab duplicates, blind standards, matrix spikes, matrix spike duplicates, surrogate compound analysis, calibrations, generation of control charts, etc. Minimal requirements are

usually specified in the analytical methods. Internal quality control needs and requirements should be determined as a part of the Data Quality Objectives. All internal quality control results should be reported with the sample results.

18. **Investigation District** - The USACE district assigned the responsibility for coordinating, reviewing, and completing an HTW site investigation activity either in-house or through contracted services.

19. **Investigation Division** - The USACE Division overseeing the Investigation District.

20. **Laboratory Validation** - An ongoing assessment of laboratory capabilities, including evaluation of personnel, equipment, QA/QC procedures, results from performance evaluation samples and an on-site laboratory inspection.

21. **Matrix** is the environmental medium which is sampled; e.g. groundwater, surface water, soil, sediment, waste, etc.

22. **Quality Assurance** - Measures taken by USACE to oversee the work of contractors.

23. **QA Laboratory** - The validated USACE Division Laboratory performing or coordinating CDQM activities for a project. These activities ordinarily include: document review, inspection and analysis of quality assurance samples, technical assistance to project managers and preparation of the Chemical Quality Assurance Reports. A given Division Laboratory may not have capability for in house performance of all these activities. The QA laboratory is assigned on a project specific basis by CEMRD. QA functions may not be contracted out directly by the FOA to commercial enterprises. QA sample analysis may be performed under contract to the USACE QA laboratory.

24. **Quality Assurance and Quality Control Samples**. Samples analyzed for the purpose of assessing the quality of the sampling effort and of the analytical data. QA and QC samples include splits or replicates of field samples, rinsate blanks, trip blanks, and background (up gradient) samples. The purpose of the sample is to provide site specific field originated checks that the data generated by the contractor's analytical lab are of suitable quality.

25. **Quality Control** - Measures taken by contractors and to verify the reliability of their own work and to oversee subcontractors.

26. **Quality Control Summary Report (QCSR)** - A report submitted by the AE/construction contractor at the conclusion of a chemical contamination remedial activity. For an investigation activity, the QCSR may be included in the Investigation Report. The QCSR should include the following.

(a) An outline of QC practices employed by the AE/construction contractor, including any problems and corrective actions taken;

(b) A consolidation and summary of the DQCR, as prescribed in the contract.

27. **Replicate (duplicate, triplicate, etc.) Samples**. Multiple grab samples, collected separately, that equally represent a medium at a given time and location. This is the required type of collocated sample for volatile organic analyses and most groundwater and surface water samples.

28. **Rinsate blanks** (equipment blanks) are field blanks generated by passing analyte-free reagent water through sampling equipment after it has been decontaminated between uses. Rinsates are analyzed by the same methods as the samples for which they are blanks and are a check on sampling and decontamination procedures.

29. **Split** is a field sample taken, homogenized, divided in the field, contained and sent to one or more laboratories for analysis.

30. **Trip Blank**. 40 mL vials of organic-free reagent water that are kept with the field sample containers from the time they leave the laboratory until the time they are returned to the laboratory. The purpose of trip blanks is to determine whether samples are being contaminated during transit or sample collection. Trip blanks pertain only to volatile organic analyses; therefore, the containers must contain no headspace. Only one trip blank is needed for one day's sampling and shall satisfy trip blank requirements for all matrices for that day if the volatile samples are shipped in the same cooler.

31. **Scope of Services** - Prepared by a District or Field Operation Activity (FOA) and provided to a contractor for the purposes of work definition and fee negotiation. The Scope of Services for an investigation activity shall have attached guidance to the AE including Guide for Preparing a Chemical Data Acquisition Plan (CDAP) (Appendix D), and the Sample Handling Protocol (Appendix F). The Scope of Services for design shall provide the AE with guidance including any appropriate Guide Specifications for Chemical Data Quality Management and the Sample Handling Protocol (Appendix F).

32. **Site Inspection Report or Investigation Report** - Prepared by the AE firm or the investigating district (in-house work) and includes a summary of work done, departures from the CDAP, analytical results, results from all testing, field observations, and regulatory or action level factors which impact on decisions to be made as a result of the investigation.

APPENDIX D

CONTRACT DATA REQUIREMENTS LIST

DD FORM 1423

CONTRACT DATA REQUIREMENTS LIST

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 440 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

A. CONTRACT LINE ITEM NO.
B. EXH/ATCH NO.
C. CATEGORY: TDP ____ TM ____ OTHER ____
D. SYSTEM/ITEM
E. CONTRACT/PR NO.
F. CONTRACTOR

1. DATA ITEM NO. A001
2. TITLE OF DATA ITEM Sampling and Analysis Plan (SAP)
3. SUBTITLE
17. PRICE GROU
4. AUTHORITY (Data Acquisition Document No.)
5. CONTRACT REFERENCE
6. REQUIRING OFFICE
18. ESTIMATED TOTAL PRICE
7. DD 250 REQ
9. DIST STATEMENT REQUIRED
10. FREQUENCY
12. DATE OF FIRST SUBMISSION 10 days after award
14. DISTRIBUTION
8. APP CODE
11. AS OF DATE
13. DATE OF SUBSEQUENT SUBMISSION 30 days after award
16. REMARKS

SAP prepared in accordance with EM-200-1-3

a. ADDRESSEE	b. COPIES Draft	Final Reg	Final Repro
15. TOTAL →			

1. DATA ITEM NO. A002
2. TITLE OF DATA ITEM Certification of Health & Safety Program (HSP)
3. SUBTITLE
17. PRICE GROU
4. AUTHORITY (Data Acquisition Document No.)
5. CONTRACT REFERENCE
6. REQUIRING OFFICE
18. ESTIMATED TOTAL PRICE
7. DD 250 REQ
9. DIST STATEMENT REQUIRED
10. FREQUENCY
12. DATE OF FIRST SUBMISSION 10 days after award
14. DISTRIBUTION
8. APP CODE
11. AS OF DATE
13. DATE OF SUBSEQUENT SUBMISSION
16. REMARKS

A written certification of the development and implementation of the HSP in accordance with 29 CFR 1910.120 shall be submitted.

a. ADDRESSEE	b. COPIES Draft	Final Reg	Final Repro
15. TOTAL →			

1. DATA ITEM NO. A003
2. TITLE OF DATA ITEM Site Health & Safety Plan (SSHP)
3. SUBTITLE
17. PRICE GROU
4. AUTHORITY (Data Acquisition Document No.)
5. CONTRACT REFERENCE SOW - Section C, 3.2.2
6. REQUIRING OFFICE
18. ESTIMATED TOTAL PRIC
7. DD 250 REQ
9. DIST STATEMENT REQUIRED
10. FREQUENCY
12. DATE OF FIRST SUBMISSION 10days after award
14. DISTRIBUTION
8. APP CODE
11. AS OF DATE
13. DATE OF SUBSEQUENT SUBMISSION 30 days after award
16. REMARKS

SSHP prepared in accordance with requirements of EM 385-1-1 and 29 CFR 1910.120. Plus a UXO Avoidance Work Plan.

a. ADDRESSEE	b. COPIES Draft	Final Reg	Final Repro
15. TOTAL →			

1. DATA ITEM NO. A004
2. TITLE OF DATA ITEM Work Plan
3. SUBTITLE
17. PRICE GRO
4. AUTHORITY (Data Acquisition Document No.)
5. CONTRACT REFERENCE SOW - Section C, 3.2.1
6. REQUIRING OFFICE
18. ESTIMATE TOTAL PR
7. DD 250 REQ
9. DIST STATEMENT REQUIRED
10. FREQUENCY
12. DATE OF FIRST SUBMISSION 20 days after award
14. DISTRIBUTION
8. APP CODE
11. AS OF DATE
13. DATE OF SUBSEQUENT SUBMISSION 40 days after award
16. REMARKS

A detailed work plan documenting the proposed equipment, procedures and subcontractors to be used.

a. ADDRESSEE	b. COPIES Draft	Final Reg	Final Repro
15. TOTAL →			

G. PREPARED BY
H. DATE
I. APPROVED BY
J. DATE

DD Form 1423, APR 89
Previous editions are obsolete
Page ____ of ____ Pages
131/122

APPENDIX E

DATA ITEM DESCRIPTIONS

DD FORM 1664

DATA ITEM DESCRIPTION	**Form Approved OMB No. 0704-0188**
2. Title Sampling and Analysis Plan (SAP)	**1. Identification Number** 1

3. Description/Purpose
The SAP shall provide detailed information on chemical QA/QC during execution of this contract.

4. Approval Data	**5. Office of Primary Responsibility (OPR)**	**6a. DTIC Applicable**	**6b. GIDEP Applicable**

7. Application/Interrelationship

8. Approval Limitation	**9a. Applicable Forms**	**9b. AMSC Number**

10. Preparation Instructions

The Contractor shall comply with the EM-200-1-3 to prepare and submit the SAP.

11. Distribution Statement

DATA ITEM DESCRIPTION		**Form Approved OMB No. 0704-0188**	
2. Title Written Certification of Health and Safety Program (HSP)		**1. Identification Number** 2	
3. Description/Purpose Certification of the development and implementation of HSP.			
4. Approval Data	**5. Office of Primary Responsibility (OPR)**	**6a. DTIC Applicable**	**6b. GIDEP Applicable**
7. Application/Interrelationship			
8. Approval Limitation		**9a. Applicable Forms**	**9b. AMSC Number**
10. Preparation Instructions The Contractor shall prepare and submit a written certification that a Health and Safety Program (HSP) has been developed, implemented and maintained.			
11. Distribution Statement			

DATA ITEM DESCRIPTION

Form Approved OMB No. 0704-0188

2. Title

Site specific Health and Safety Plan (SSHP)

1. Identification Number

3

3. Description/Purpose

The SSHP shall provide detailed information on safety at SEDA during the execution of the contract.

4. Approval Data

5. Office of Primary Responsibility (OPR)

6a. DTIC Applicable

6b. GIDEP Applicable

7. Application/Interrelationship

8. Approval Limitation

9a. Applicable Forms

9b. AMSC Number

10. Preparation Instructions

The Contractor shall prepare the SSHP in accordance with EM385-1-1, 29 CFR 1910 and 1926, Appendix B. The SSHP shall address the elements described in Appendix B. The services of a Certified Industrial Hygienist experienced in hazardous waste site operation shall be utilized to oversee the development and implementation of the SSHP. In addition the Contractor (or his subcontractor) shall prepare a UXO Avoidance work plan.

11. Distribution Statement

DATA ITEM DESCRIPTION

Form Approved OMB No. 0704-0188

2. Title

Work Plan

1. Identification Number

4

3. Description/Purpose

Documentation on the proposed equipment, procedures and subcontractors to be used during the project.

4. Approval Data

5. Office of Primary Responsibility (OPR)

6a. DTIC Applicable

6b. GIDEP Applicable

7. Application/Interrelationship

8. Approval Limitation

9a. Applicable Forms

9b. AMSC Number

10. Preparation Instructions

The Contractor shall provide a detailed workplan for the owner's review prior to mobilization. The work plan shall provide the information specified in Section 3.1.

11. Distribution Statement

DATA ITEM DESCRIPTION		**Form Approved OMB No. 0704-0188**	
2. Title Weekly Progress Reports		**1. Identification Number** 5	

3. Description/Purpose
Weekly progress reports will be used to monitor the actual progress of the contractor. These reports will be the basis for progress payments.

4. Approval Data	**5. Office of Primary Responsibility (OPR)**	**6a. DTIC Applicable**	**6b. GIDEP Applicable**

7. Application/Interrelationship

8. Approval Limitation	**9a. Applicable Forms**	**9b. AMSC Number**

10. Preparation Instructions

The Contractor shall issue a weekly progress report which shall include the following information:

1. Weight of treated soil processed for the week and cumulative.
2. Weight of treated soil passing the treatment standard for the week and cumulative.
3. Weight of the debris shipped off site for disposal for the week and cumulative.
4. Volume of wastewater collected, treated and discharged for the week and cumulative.
5. Site plan updated monthly with treated areas highlighted.
6. Weight tickets.
7. Laboratory Reports.
8. Air monitoring results.
9. Manifests for material shipped offsite.

11. Distribution Statement

DATA ITEM DESCRIPTION		**Form Approved OMB No. 0704-0188**	
2. Title Final Reports		**1. Identification Number** 6	
3. Description/Purpose The final report shall document that the contractor has successfully completed the SEDA open burning grounds remedial action.			
4. Approval Data	**5. Office of Primary Responsibility (OPR)**	**6a. DTIC Applicable**	**6b. GIDEP Applicable**
7. Application/Interrelationship			
8. Approval Limitation		**9a. Applicable Forms**	**9b. AMSC Number**

10. Preparation Instructions

The final report shall contain the following information:

1. Description of work completed with weight of soil processed, weight of debris disposed shipped off site, volume of water treated and discharged.
2. As built site plan with limits of excavation, sample locations and limits of the soil cover.
3. Laboratory reports and summary tables.
4. Air monitoring results.
5. Daily logs with weight tickets.
6. Manifests for material disposed offsite.
7. Surveyor report defining the limits of the treated area.
8. Monitoring well installation documentation.

11. Distribution Statement

APPENDIX F

SITE SPECIFIC HEALTH AND SAFETY PLAN

METAL CONTAMINATED SITES

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ATTACHMENTS

1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

The purpose of this Health and Safety Plan (HASP) is to establish personnel protection standards and mandatory safety practices and procedures for field investigation efforts. This plan assigns responsibilities, establishes standard operating procedures, and provides for contingencies that may arise during the Removal Actions at SEADs – 24, 50, 54, and 67 at Seneca Army Depot, Romulus, New York.

This plan may be modified by Addenda to accommodate changes in specific work plans and task specific and location specific hazards encountered during various solid waste management unit (SWMU) investigation activities. Addenda to this plan will incorporate data obtained during subsequent sampling.

The provisions of the plan are mandatory for all of the architect-engineer's (AE's) personnel engaged in on-site hazardous waste operations. Subcontractors working for the AE must conform to this Health and Safety Plan unless they prepare and administer a documented plan with equivalent requirements. All AE and AE contract personnel who engage in project activities must be familiar with this plan and comply with its requirements; these personnel must sign-off on the Plan Acceptance Form (see **Attachment 3**), which will be submitted to the AE Project Manager for retention in the project file. All personnel performing work under this plan must be trained and have a current medical examination in accordance with Title 29 Code of Federal Regulations (CFR) §1910.120. This HASP follows the requirements of ER385-1-92, Safety and Health Elements for HTRW Documents.

1.2 PERSONNEL

All AE site personnel and AE subcontractors performing duties or working in areas where there is the potential for exposure to hazardous material will meet the training requirements specified by the Occupational Safety and Health Administration (OSHA) 29 CFR §1910.120 before working on-site. Site personnel and their duties are outlined below:

1. The AE's Site Manager is responsible for all AE and AE subcontractor personnel on-site and designates duties to the on-site personnel. The name of the Site Manager or, if the Site Manager is absent, the name of the acting Site Manager, shall be posted in the command post.

2. The Site Safety Officer is responsible for carrying out and enforcing provisions of this HASP with regard to site work. The Site Safety Officer will also ensure that all personnel entering the site understand and adhere to the provisions of this plan and that personnel meet the training and medical monitoring requirements of 29 CFR §1910.120. Any changes in the provisions of this HASP shall be made in writing by the Site Safety Officer and shall be approved by the Project Safety Officer or Corporate Health and Safety Officer. Any personal protective equipment upgrades or downgrades shall be documented in writing by the Site Safety Officer. The Site Safety Officer shall have the authority to stop an operation or site work if, in the opinion of the Site Safety Officer, the site conditions or the manner in which the work is being conducted presents a hazard to site personnel, surrounding populations, or the environment. The name of the Site Safety Officer or, if the Site Safety Officer is absent, the name of the Acting Site Safety Officer, shall be posted in the Command Post.

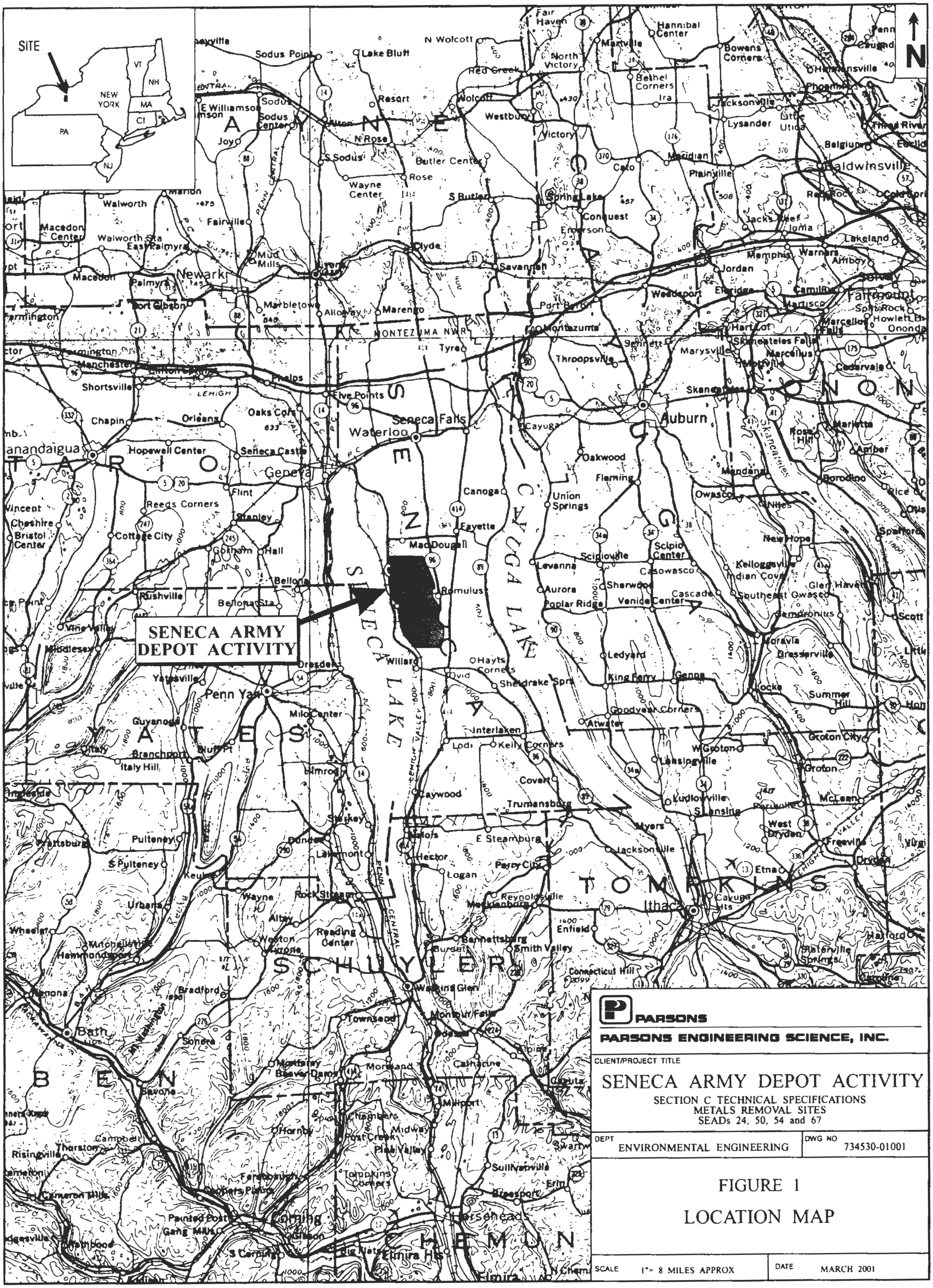
3. The Site Safety Monitors are responsible for all air monitoring. Air monitoring requirements for the Seneca Site are set forth in Section 6.0 of the HASP.

4. Field personnel will be involved in sampling, inspections, field monitoring, and decontamination, as specified in this HASP, the Work Plan, and the Field Sampling and Analysis Plan. These activities will be carried out in accordance with the QA/QC protocols in the Chemical Data Acquisition Plan (CDAP). Site personnel will only perform tasks for which they have received appropriate training.

Site visitors who are not affiliated with the AE, the AE's subcontractors, USEPA, NYSDEC, or Seneca Army Depot will not be allowed into active work areas without making arrangements with Seneca and the AE in advance of the planned visit. Site visitors must present evidence of appropriate training and participation in a medical surveillance program in accordance with 29 CFR §1910.120, and evidence of ability to use a respirator in accordance with 29 CFR §1910.134.

Seneca Army Depot, USEPA and NYSDEC personnel will be permitted into active work areas after presenting a letter addressed to the AE's Site Safety Officer certifying they have passed a physical examination and are certified to wear the appropriate respiratory protective equipment.

All visitors will follow the advice and instructions of the AE's Site Manager and Site Safety Officer. Failure to follow these instructions may endanger the health and safety of visitors and other on-site personnel.



PARSONS

PARSONS ENGINEERING SCIENCE, INC.

CLIENT/PROJECT TITLE

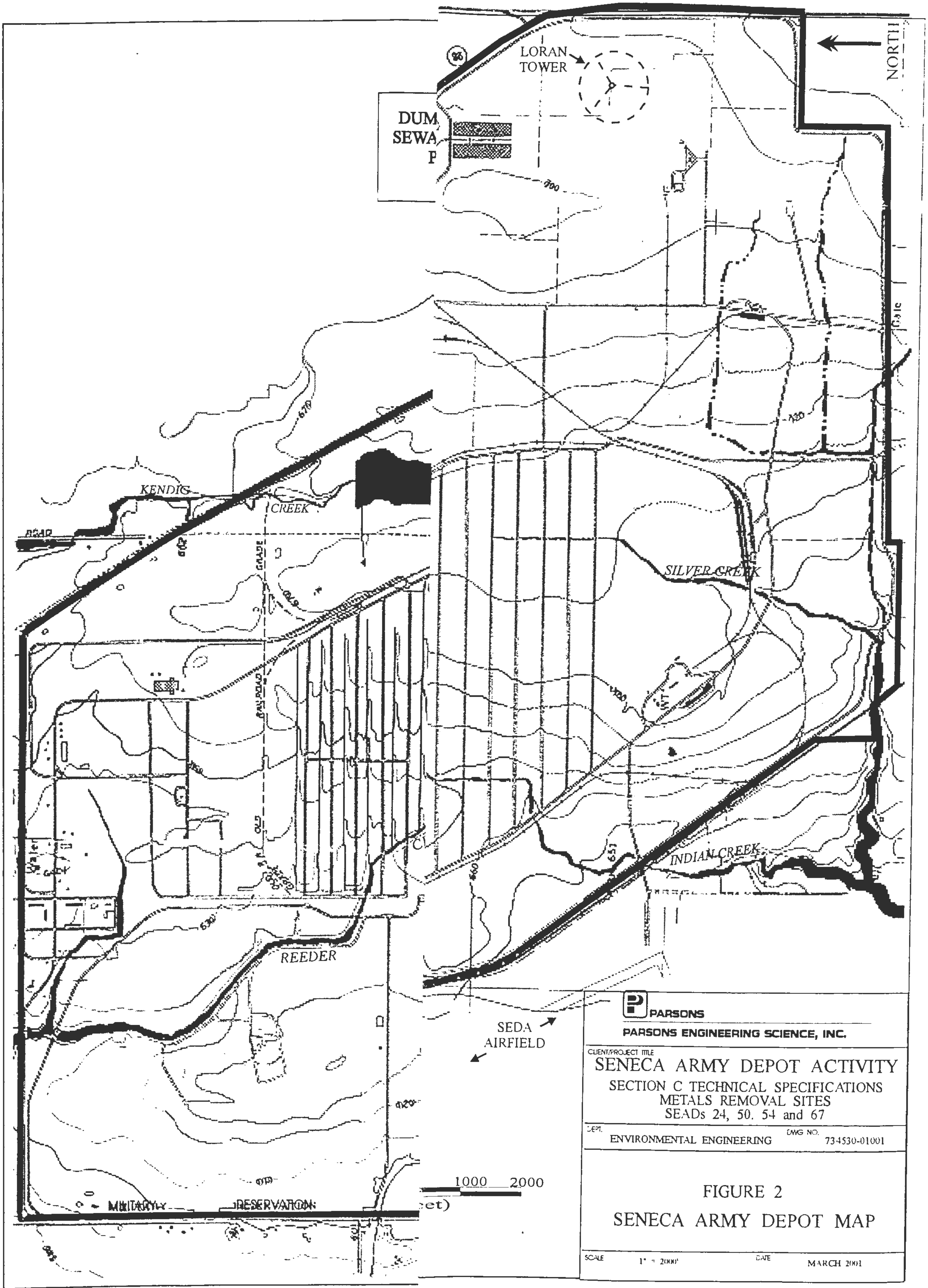
SENECA ARMY DEPOT ACTIVITY
SECTION C TECHNICAL SPECIFICATIONS
METALS REMOVAL SITES
SEADs 24, 50, 54 and 67

DEPT	DWG NO
ENVIRONMENTAL ENGINEERING	734530-01001

FIGURE 1
LOCATION MAP

SCALE	DATE
1"= 8 MILES APPROX	MARCH 2001

R:\PROJECTS-GRAPHICS\SENECA\S46_57RI\LOCMAP.CDR(CVM)



PARSONS

PARSONS ENGINEERING SCIENCE, INC.

CLIENT/PROJECT TITLE

SENECA ARMY DEPOT ACTIVITY

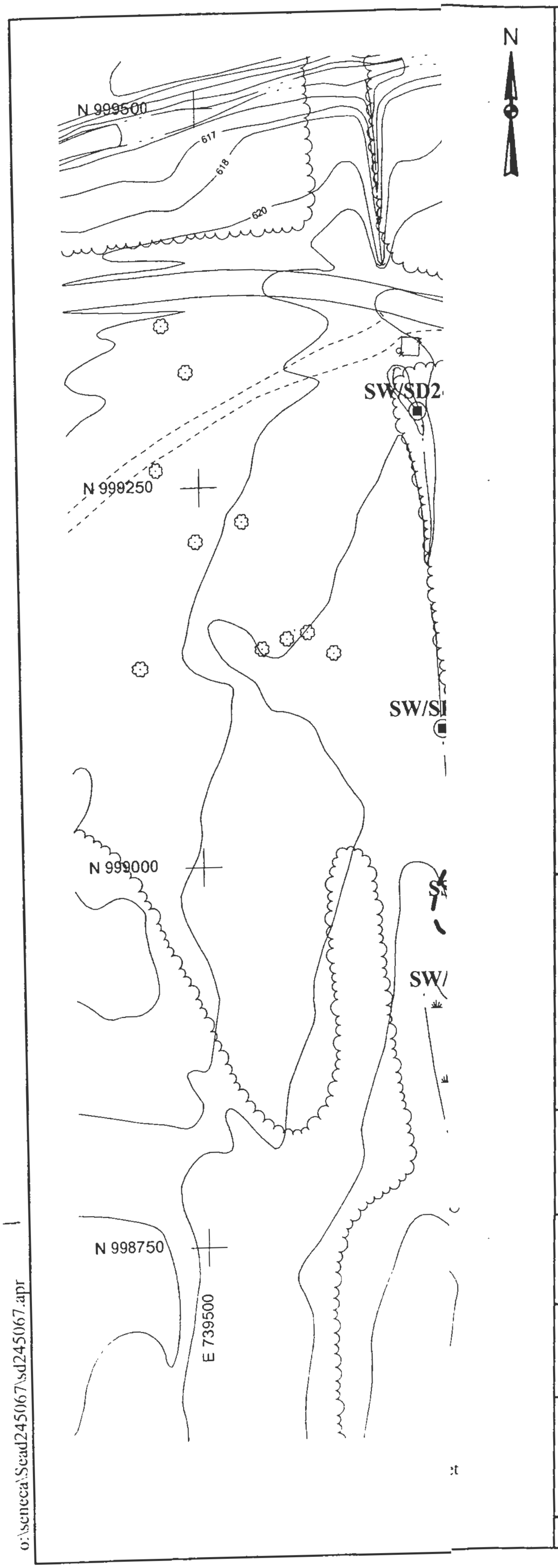
SECTION C TECHNICAL SPECIFICATIONS
METALS REMOVAL SITES
SEADs 24, 50, 54 and 67

DEPT. ENVIRONMENTAL ENGINEERING DWG NO. 734530-01001

FIGURE 2
SENECA ARMY DEPOT MAP

SCALE 1" = 2000' DATE MARCH 2001

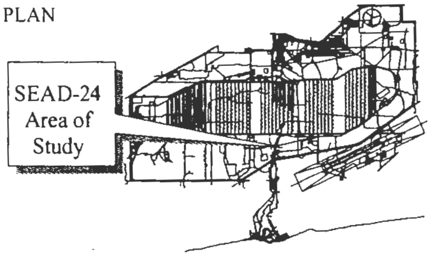
P \PIT\PROJECTS\SENEC \\S245054\SPECS MET\LOC_MAP CDR(CVM)



LEGEND

≡	PAVED ROAD
680	GROUND CONTOUR AND ELEVATION
	WETLAND
○	BRUSH
—	CHAIN LINK FENCE
•	UTILITY POLE
✦	APPROXIMATE LOCATION OF FIRE HYDRANT
┼┼┼	RAILROAD
⊕	Monitoring Well
☒	Survey Monument
SS24-13 ◈	Post-Removal Verification Surface Soil Sample
SW/SD24-1 ▣	Post-Removal Verification Surface Water and Sediment Sample
◌	Area To Be Remediated

KEY PLAN



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SENECA ARMY DEPOT ACTIVITY
ABANDONED POWDER BURNING PIT
SEAD-24

FIGURE 3

PROPOSED EXTENT OF
REMOVAL ACTION

JOB NUMBER: 734530-01001

DATE: MARCH 2001

petroleum hydrocarbon fuel was used to initiate the burn. There is a shale-covered area adjacent to the bermed area; however, the use of this area is not known.

Previous investigations have detected three semivolatile organic compounds and 14 metals present at concentrations of concern in the surface and subsurface soils of SEAD-24. The SVOCs that were detected were all PAHs (i.e., benzo(a)anthracene, benzo(a)pyrene, and dibenz(a,h)anthracene). The compound, 2,4-dinitrotoluene, a component of explosive materials was also detected. Arsenic and zinc were the metals detected most frequently at concentrations of concern.

Previous groundwater investigations suggest that the groundwater near the abandoned powder burning pit has not been adversely impacted by any of the constituents found in the soil or by those presumed to have been burned in the area.

2.1.2 SEADs-50 and 54

SEADs-50 and 54 are located at the depot's historic tank farm that was located in the southeastern portion of SEDA. The tank farm was sited in a triangular-shaped tract of land immediately west of East Patrol Road between Building 350 and Buildings 356 and 357 (see **Figure 4**). Four tanks remain at the tank farm site, three of which are currently empty. The three empty tanks comprise SEAD-50; two of these tanks were previously used for the storage of antimony ore. The remaining empty tank was used to store rutile (i.e., titanium dioxide) ore. SEAD-54 encompasses the remaining tank, Tank #88, which currently contains asbestos material. SEAD-54 was listed as a separate SWMU because it contained asbestos material and will require special handling.

The topography of the area is relatively flat, with a total relief of 2 to 3 feet. There is an east-west running access road that bisects the site and connects Avenue H with East Patrol Road. The asbestos storage tank is located immediately north of the access road on the east side of SEAD-50. North of the access road, SEAD-50 is generally overgrown with vegetation, exclusive of the spots where historic tanks were located. The circular footprints of the former tanks are generally clear of vegetation and covered with gravel. The area south of the access road is flat and grassy. A ferro-chromate ore pile is located in the southern area of the historic tank farm at the border of the grassy area. There are no mapped wetlands in the area.

The history of the tank farm area is not well documented. At one time, there were approximately 160 aboveground storage tanks in this area. According to interviews with SEDA personnel, the

LEGEND

PAVED ROAD

680

GROUND CONTOUR AND ELEVATION

WETLAND

BRUSH

CHAIN LINK FENCE

UTILITY POLE

APPROXIMATE LOCATION OF FIRE HYDRANT

RAILROAD

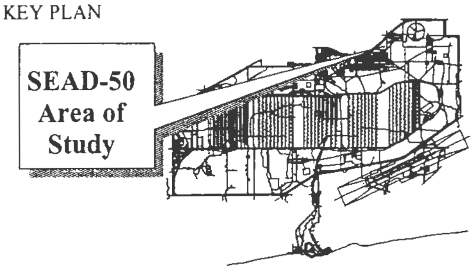
⊕ Monitoring Well

SS50-16 Post-Removal Verification Surface Soil Sample

SW/SD50-4 Post-Removal Verification Surface Water and Sediment Sample

Area to be Remediated

KEY PLAN



PARSONS

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SENECA ARMY DEPOT ACTIVITY
TANK FARM
SEAD-50 AND SEAD-54

FIGURE 4

REMOVAL PLANS

JOB NUMBER: 734530-01001

DATE: MARCH 2001

o:\seneca\Sead245067\sd245067.apr

tanks were always used to store dry materials such as ores and minerals, including asbestos. Through the years, all but the remaining four tanks were removed.

Previous investigations indicate that shallow soil at SEADs-50/54 has been impacted by semivolatile organic compounds, predominantly polynuclear aromatic hydrocarbons (PAHs), heavy metals (including antimony, arsenic, chromium, copper, lead, magnesium, mercury, and zinc), and asbestos. Sediment has been impacted by PAHs (benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, and indeno(1,2,3-cd)pyrene), PCBs (endosulfan I, 4,4'-DDE, alpha-Chlordane, aroclor-1242 and aroclor-1260) and metals (antimony, arsenic, cadmium, copper, iron, lead, manganese, nickel and zinc).

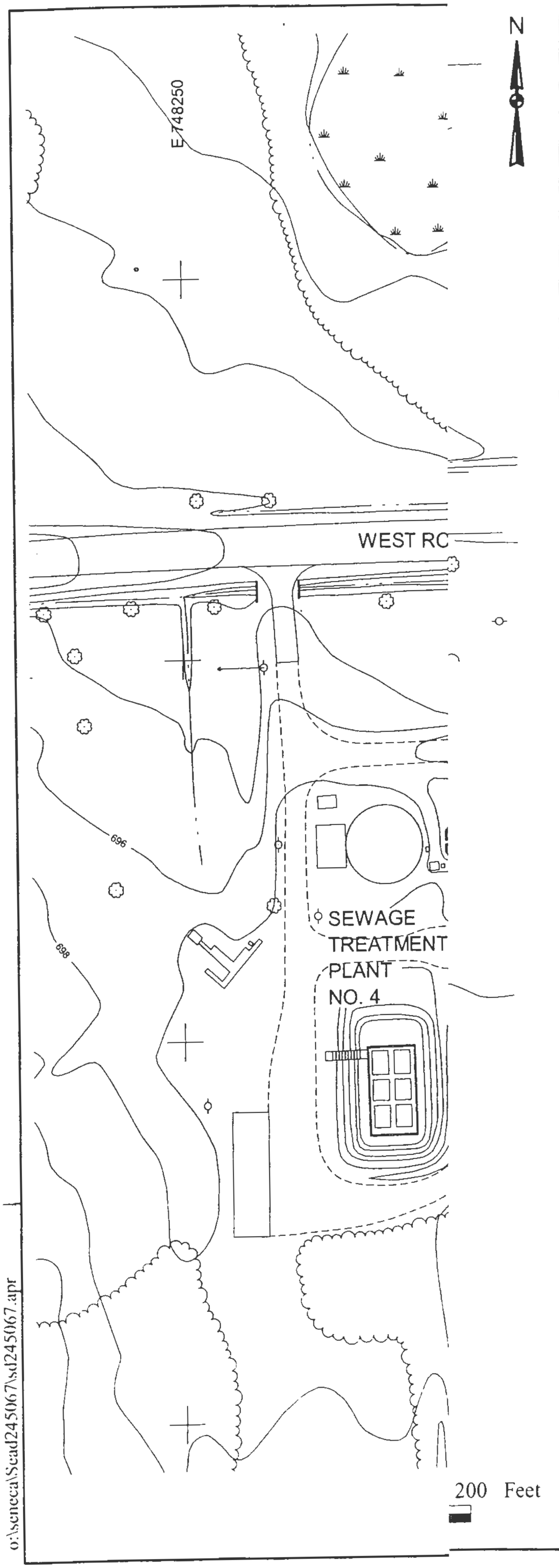
Previous investigations indicate that groundwater and surface water at SEADs 50/54 have not been significantly impacted by the historic storage activities that were performed in this area.

2.1.3 SEAD-67

SEAD-67 is comprised of five waste piles and two berm structures that are located east of sewage treatment plant No. 4 and south of West Romulus Road in the east-central portion of SEDA (see **Figure 5**). The site is entirely undeveloped and is heavily vegetated with low brush and deciduous trees. One, 10-foot diameter waste pile and a second, 5-foot diameter waste pile are located approximately 50 feet and 70 feet, respectively, south of West Romulus Road. Both of these piles are grass covered. A brush-covered berm, measuring approximately 60 feet long and 10 to 15 feet in width, and a second, 10-foot diameter waste pile are located approximately 175 feet south of the West Romulus Road. Continuing further south, a second, larger and irregularly-shaped berm is found. The second berm structure is located approximately 50 feet south of the first, smaller berm structure. The second berm measures approximately 110 feet in length, and is shaped roughly like a "y" that is lying on its side. The waste pile and berm locations are shown as dotted lines in Figure 3. All of the piles and berms are approximately 3 to 4 feet high, with the exception of the 10-foot diameter pile that is approximately 5 feet high.

The topography in SEAD-67 slopes gently to the west towards a small stream. The stream flows north where it passes beneath West Romulus Road and passes into a large wetland area that is located to the north of SEAD-67. This wetland provides tertiary treatment for wastewater discharges from the treatment plant.

Little is known about the history of SEAD-67 or the origin of the bermed structures and the waste piles. The contents of the piles and the berms are unknown, as are the dates when they were first



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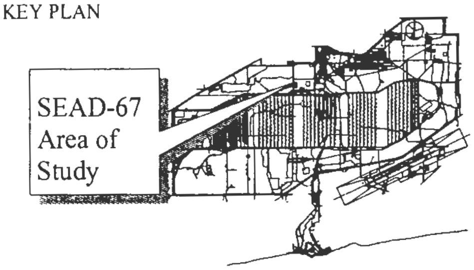
LEGEND

- PAVED ROAD
- GROUND CONTOUR AND ELEVATION (680)
- WETLAND
- BRUSH
- CHAIN LINK FENCE
- UTILITY POLE
- APPROXIMATE LOCATION OF FIRE HYDRANT
- RAILROAD
- ⊕ Monitoring Well
- SS67-1 — Post-Removal Verification Surface Soil Sample
- SW/SD67-3 — Post-Removal Verification Surface Water and Sediment Sample
- Area to be Remediated

KEY PLAN



PARSONS

PARSONS ENGINEERING SCIENCE, INC.

SENECA ARMY DEPOT ACTIVITY

DEBRIS PILES EAST OF SEWAGE TREATMENT PLANT NO. 4
SEAD-67

FIGURE 5

REMOVAL PLANS

JOB NUMBER: 734530-01001	DATE: MARCH 2001

placed in this area. As the site is overgrown with thick vegetation, it is suspected that this site appeared many years ago and has been inactive since that time.

Previous investigations indicate that that soil at SEAD-67 has been impacted by SVOCs, predominantly polynuclear aromatic hydrocarbons (benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(a)pyrene, and dibenz(a,h)anthracene), and metals (calcium, manganese, mercury and potassium). Sediment at SEAD-67 has been impacted by SVOCs (mostly the PAHs benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, and indeno(1,2,3-cd)pyrene), pesticides (alpha-chlordane, endosulfan I, 4,4`-DDT) and some metals (copper, manganese, and nickel).

Previous investigations indicate that groundwater and surface water have not been significantly impacted by historic operations at SEAD-67.

2.2 PLANNED SITE ACTIVITIES

The activities associated with this Removal Action include the excavation, management, and disposal of semi-volatile organic compounds, pesticides, metals and/or asbestos contaminated soils and sediments that have been identified at SEADs-24, 50, 54, and 67.

Cleanup goals established for the excavated soils and sediments are based on and derived from the following documents:

- US EPA, Office of Solid Waste and Emergency Response, "Clarification to the 1994 Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities," OSWER Directive # 9200.4-27, EPA/540/F-98/030, PB98-963244, (August 1998)
- NYSDEC, Technical and Administrative Guidance Memorandum #4046 "Determination of Soil Clean-up Objectives and Cleanup Levels" (January 1994)
- NYSDEC, Technical Guidance for Screening Contaminated Sediments (January 1999)

This program focuses on the removal of large, contiguous areas of contamination, or upon areas where particular analytes have been found in soil or sediment at sufficient concentrations to warrant immediate action. Residual soil and sediment contamination remaining at a site (if such does exist) will be handled under separate actions that may be required by subsequent determinations. Site-specific factors used as the basis of the proposed actions are identified below:

SEAD-24 Removal of soil that has been contaminated by arsenic and zinc at concentrations above NYSDEC TAGMs.

SEAD-50/54 Removal of soil that has been contaminated with arsenic, mercury, and zinc at concentrations above NYSDEC TAGMs. Also, removal of sediments that have been contaminated with pesticides and polynuclear aromatic hydrocarbons at concentrations above NYSDEC criteria limits.

SEAD-67 Removal of soil that has been contaminated with mercury and polynuclear aromatic hydrocarbons at concentrations above NYSDEC TAGMs. Also, removal of sediments that have been contaminated with pesticides, polynuclear aromatic hydrocarbons, and metals at concentrations above NYSDEC criteria limits.

The field activities will include the following:

- the establishment and maintenance of necessary site security in the area of the planned excavation;
- the definition and implementation of dust suppression procedures to minimize air borne releases during the excavation operations;
- the excavation and removal of the contaminated soil and sediment from the site;
- the collection and analysis of any required air samples to document that the removal action has been completed in accordance with prevailing environmental requirements;
- the collection and analysis of samples needed for waste disposal purposes;
- the collection and analysis of samples to confirm that the extent of the excavation and removal action is adequate to eliminate the potential threat;
- the handling and on-site management of excavated soil and sediment prior to transport off-site;
- the transportation of the excavated soil and sediment to the selected off-site disposal site;
- the off-site disposal of the contaminated soil and sediment;
- backfilling of soils and sediment at four solid waste management units (SWMUs), designated as SEADs 24, 50, 54 and 67; and
- regrading, compacting, and as necessary, reseeding excavated areas to return them to their pre-excavation condition.

2.3 HAZARD EVALUATION

The chemical and physical hazards that may be encountered at the areas of concern are described below.

2.3.1 Exposure Potential

The primary sources of exposure at the subject sites will be the surface and subsurface soils. These soils may be contaminated with PAHs, pesticides, metals and/or asbestos. The exposure potential for each of the planned site activities is described below.

Establishment of Site Security – There is a low potential of exposure during the establishment of site security. These activities will not involve any direct contact with contaminated media and the site excavation activities will not yet have taken place.

Dust Suppression - The primary route of exposure during dust suppression will be through inhalation of dust generated by the excavation activities. There is a low potential for inhalation of contaminated dust.

Excavation of Contaminated Soil and Sediment – The primary route of exposure during the soil excavation will be through contact with metal/semivolatile organic compound/pesticide contaminated soil or sediment. There is a high potential for direct contact with contaminated soils and sediment. There is also a potential for exposure through the inhalation of dust generated by the excavation. The excavations are planned to extend 1-2 feet in depth; therefore, contact with groundwater is unlikely.

Air Sampling – The primary route of exposure during air sampling will be through inhalation of dust generated by the excavation activities, as discussed above. There is a low potential for inhalation of contaminated dust.

Soil Sampling – The primary route of exposure during the confirmatory soil sampling and sampling for waste disposal will be through direct contact with TPH/PAH contaminated soil. There is a high potential for direct contact with contaminated soils.

Transportation and Disposal of Excavated Soil - The primary route of exposure during the transportation and disposal will be through contact with metal/semivolatile organic compound/pesticide contaminated soil or sediment. There is a high potential for direct contact with contaminated soils. There is also a potential for exposure through the inhalation of dust generated by the loading and unloading of material from the trucks.

Backfilling – There is a low potential for exposure during backfilling activities because uncontaminated fill material will be used.

2.3.2 Chemical Hazards

PAHs, pesticides, metals and to some extent, asbestos are the primary compounds that have been detected in previous investigations at the SEADs-24, 50, 54, and 67. The following is a summary of the toxic effects of these compounds. Exposure limits and physical properties are given in **Table 1** and in the Material Safety Data Sheets contained in **Attachment 1**.

2,4-DNT - The chemical name of 2,4-DNT is 2,4-dinitrotoluene. It is not expected to hydrolyze under normal environmental conditions. 2,4-DNT is poisonous if swallowed or injected subcutaneously. It has been shown to be carcinogenic, teratogenic, and mutagenic in experimental tests. 2,4-DNT can cause anemia, methemoglobinemia, cyanosis, and liver damage. The chemical will combust when exposed to heat or flame; can react with oxidizing materials. There have been cases of explosion during manufacture and storage and mixture with nitric acid is a high explosive. Other mixtures such as alkalies can cause a significant increase in pressure. When heated to decomposition it emits toxic fumes of NOx.

Polycyclic Aromatic Hydrocarbons - Polycyclic aromatic hydrocarbons (PAHs) are a large group of chemicals formed during the incomplete combustion of organic materials. There are over one hundred PAHs, and they are found throughout the environment in air, water, and soil. Seven of the 15 PAHs listed below are classified as probable human carcinogens.

Acenaphthene
Acenaphthylene
Anthracene
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(g,h,i)perylene
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Chrysene
Dibenzo(a,h)anthracene
Fluoranthene
Fluorene
Indeno(1,2,3-cd)pyrene
Phenanthrene
Pyrene

Because the physical and chemical properties of PAHs vary substantially depending on the specific compounds in question, the fate and transport characteristics vary. Ingestion of, inhalation of, or dermal contact with PAHs by laboratory animals has been shown to produce tumors. Reports show that humans exposed by inhalation or dermal contact for long periods of time to mixtures of PAHs

TABLE 1
PERMISSIBLE EXPOSURE LIMITS FOR SELECTED COMPOUNDS AT SEDA

		Permissible Exposure Limits(1) (mg/m3)	Short-Term Exposure Limits (mg/m3)(2)	Ceiling Limits (mg/m3)(3)	Other Exposure Limits (mg/m3)(4)	Carcinogenic Rating(5)
Semi-volatiles	PAHs					
	Coal Tar Pitch Volatiles	0.2	--	80(6)	0.1	
	(includes the following compounds)					
	Benzo(a)anthracene					B2
	Benzo(a)pyrene					B2
	Benzo(b)fluoranthene					B2
	Benzo(k)fluoranthene					B2
	Chrysene					B2
	Dibenzo(a.h)anthracene					B2
	Indeno(1.2.3-cd)pyrene					B2
Pesticides						
	alpha-Chlordane	0.5(skin)	--	100(6)	0.5(7)	B2
	Endosulfan I	--	--	--	0.1(7)	--
	4.4'-DDT	1.0(skin)	--	--	0.5(7)	B2
PCBs		0.5 (skin)	--	--	0.001(7)	B2
Explosives						
	2.4-DNT	1.5 (skin)	--	--	--	B2
Metals	Aluminum	15	--	--	10(7)	D
	Antimony	0.5	--	50(6)	0.5(7)	D
	Arsenic	0.010	--	--	0.002(6)	A
	Beryllium	0.002	--	0.005	0.0005(7)	B2
	Cadmium dust	0.005	--	0.6	--	A (VI)
	Calcium Oxide	5	--	25(6)	2(7)	--
	Chromium	1.0	--	250(6)	0.5	A
	Copper. Dust and Mist	1.0	--	--	--	D
	Iron Oxide	10	--	2500	5(7)	D
	Lead	0.05	--	100(6)	0.1(7)	B2
	Magnesium Oxide	15	--	750(6)	--	D
	Manganese	--	3.0	5.0	1.0(7)	D
	Mercury	0.1	0.03	0.1	.05	D
	Nickel	1.0	--	--	0.015(7)	A
	Potassium	--	--	--	2(7)	--
	Zinc Oxide (total dust)	15	10.0	15.0	5.0	--
Asbestos		0.1fiber/cm3	--	--	--	

Notes:

(1) OSHA 8-hour time-weighted average Permissible Exposure Limits (PEL). For metals. PEL shown is lowest of compounds likely to be encountered on-site.

(2) OSHA Short-Term Exposure Limit. 15 minute time-weighted average concentration

(3) OSHA Ceiling Limit. Concentration not to be exceeded during any part of the work day.

(4) Occupational Exposure Limits from other sources.

(5) EPA weight of evidence ratings for each compounds.

A	Confirmed human carcinogen
B1	Probable confirmed human carcinogen. Limited human evidence.
B2	Probable confirmed human carcinogen. Sufficient animal evidence.
C	Possible Human Carcinogen. Limited Animal Evidence
D	Not classifiable
--	No data or carcinogenic rating not determined.

(6) NIOSH REL Ceiling

(7) NIOSH REL TWA

and other compounds can also develop cancer. However, the relationship of exposure to any individual PAH with the onset of cancer in humans is not clear.

Polychlorinated Biphenyls (PCBs) - Polychlorinated biphenyls primarily effect the skin and the liver. Skin areas exposed to PCBs develop chloracne, which consists of small pimples and dark pigmentation. Later, comedones and pustules develop. Some PCBs are suspected carcinogens, producing liver tumors. Acute and chronic exposures can result in edema, jaundice, vomiting, anorexia, nausea, abdominal pains, and fatigue.

alpha-Chlordane - The major target of chlordane toxicity is the central nervous system. Chlordane is generally considered nonmutagenic however it is a probable human carcinogen. Acute symptoms from ingestion of chlordane include vomiting, diarrhea, seizures, coma and respiratory failure. Symptoms associated with accidental inhalation exposure to chlordane include headache, dizziness, vision problems, loss of coordination, excitability, weakness, muscle twitching, convulsions, gastrointestinal effects, and jaundice. Similar effects have been reported following dermal exposure.

Endosulfan I - Endosulfan has caused nervous system damage and death in humans and animals. Adverse effects to the liver, kidney, blood, immune system, and reproductive organs have also been observed in laboratory animals. It has not been evaluated for evidence of human carcinogenicity. Symptoms of oral exposure include gagging, vomiting, diarrhea, agitation, writhing, unconsciousness, cyanosis, dyspnea, foaming of the mouth, and noisy breathing. The most prominent signs of acute overexposure to endosulfan following dermal contact are neurological; that is, muscle tremors, hyperactivity, and convulsions.

4,4'-DDE - The major targets of this compound is the central nervous system (CNS) and the liver. Chromosomal damage has been observed in exposed individuals. It is a probable human carcinogen.

4,4'-DDT - The major targets of this compound is the CNS and the liver. Chromosomal damage has been observed in exposed individuals. It is a probable human carcinogen. The initial symptoms of oral poisoning include a burning or prickling sensation of the mouth and face, tremor of the extremities, confusion, malaise, headache, fatigue and delayed vomiting. Inhalation is considered to be a minor route of entry and dermal contact with 4,4'-DDT does has not been shown to cause irritation or systemic effects.

Aluminum - Excess exposure to aluminum is not beneficial and may be harmful to some people. Excess aluminum has been associated with neurodegenerative diseases, although the link between the two is tenuous. The primary targets of aluminum toxicity are the central nervous system, skeletal system, respiratory system and the developing fetus. Inhalation of aluminum results in irritive effects on the respiratory system, including asthma, cough, lung fibrosis and decreased pulmonary function. Dermal exposure to aluminum may cause a skin rash.

Antimony – The major targets of antimony toxicity are the respiratory system, the heart, the gastrointestinal system and the skin. Metallic antimony has not been placed in a weight-of-evidence cancer group. The effects of antimony in occupationally exposed workers include pneumoconiosis, altered EKG readings, increased blood pressure, abdominal distress, ulcers, dermatosis, and eye irritation. Antimony is not a skin sensitizer in humans, but animal studies have shown that antimony is a skin and eye irritant.

Arsenic - Arsenic becomes a skin irritant with prolonged exposure: moist areas of the skin; respiratory mucosa; angles of eyes, ears, nose, and mouth; and the wrists being common sites of irritation. Acute exposure symptoms include abdominal pain, vomiting, and watery diarrhea followed by shock due to fluid loss. Acute inhalation exposure can cause chest pain, coughing, giddiness, and general weakness which precede gastrointestinal symptoms. Symptoms of chronic inhalation exposure proceed in three phases. Initial symptoms are weakness, loss of appetite, occasional nausea and vomiting, and some diarrhea. The second phase consists primarily of irritant effects of the eyes, nose, and respiratory passages, with perforation of the nasal septum common, and allergic reactions of the skin. The third phase consists of peripheral neural effects, usually numbness. Arsenic has been causally associated with skin cancer and implicated in increases in the incidence of lung cancer.

Beryllium - The major target of beryllium toxicity is the respiratory system. Beryllium is considered a probable human carcinogen. The respiratory system is the target of beryllium toxicity following both acute and chronic exposure. Short-term exposure results a condition called chemical pneumonitis, which is characterized by cough, a burning in the chest, shortness of breath, anorexia and increasing fatigue. Chronic exposure to beryllium results in a condition known as berylliosis, or chronic beryllium disease, which is characterized by the presence of granulomas, fibrosis and emphysema in the lungs. Dermal exposure to beryllium may result in allergic reactions in both humans and animals. Skin granulomas (non-cancerous growths) may form on the skin of sensitized individuals.

Cadmium - Cadmium compounds induce vomiting at low oral doses and systemic oral poisoning is rare. Acute exposure can occur by inhalation, producing irritation in the respiratory tract followed hours later by coughing, chest pain, sweating and chills and, later, general weakness, severe respiratory irritation, and fluid build up in the lungs. These symptoms can lead to emphysema or death. Chronic exposure can lead to emphysema, kidney damage, and possible heart and blood pressure effects. Animal studies have shown cadmium to produce cancer, birth defects, testicular atrophy, and liver and nerve damage. Some studies in man have shown an association of cadmium exposure with cancers of the prostate and kidney.

Chromium - Chromium compounds can act as allergens, resulting in local irritation of the skin and respiratory tract. Systemic effects are generally a result of the irritating properties of chromium compounds on the eyes, nose, and respiratory tracts. Chromium compounds has been shown to be carcinogenic in rats and has been associated with increases in lung cancer in humans. The irritant and carcinogenic effects differ widely for various compounds of chromium.

Copper - Copper is a soft, heavy metal which occurs naturally as a variety of salts, as well as in the pure metallic form. Copper is an essential trace element in humans and animals. Copper salts are irritating to the skin and cause itching, erythema, and dermatitis. They may cause conjunctivitis, ulceration and clouding of the cornea. Metallic copper can cause keratinization of the hands and soles of the feet. Inhalation of copper fumes can cause congestion of the nasal mucous membranes and perforation of the septum. Ingestion causes irritation of the gastrointestinal tract, producing nausea, vomiting, gastritis, and diarrhea. If vomiting fails to occur, gradual absorption from the bowel may cause systemic poisoning. The systemic effects of copper include capillary damage, kidney and liver damage, and excitation followed by depression. Jaundice and hemolytic anemia can also occur following acute poisoning.

Lead - The effects of lead are the same regardless of whether it enters the body through breathing or ingestion. The major health threat from lead arises from the damage it causes to the brain, especially in fetuses, infants, and young children. Lead exposure may increase blood pressure in middle-aged men. High-level exposure can severely damage the brain and kidneys in adults or children. In addition, high doses of lead will cause abortion and damage the male reproductive system. It is considered to be a probable human carcinogen.

Manganese - The only adverse health effect identified following exposure to high levels of manganese is a condition known as "manganism," which results in psychomotor disturbances. Manganese in small amounts is believed to be an essential nutrient for humans. It is not classifiable as to human carcinogenicity.

Mercury - Mercury is a local irritant of skin and mucous membranes any may be a skin sensitizer in some people. Acute poisoning symptoms are generally irritant: acute inhalation exposure results in inflammation of the lung and bronchioles. Chronic exposure symptoms are non-specific: weight loss, appetite loss, memory loss, insomnia, indigestion, weakness, metallic taste in mouth, tremors in eyelids, fingers, lips, or tongue, and loosening of teeth. Symptoms may vary among individuals. Long-term or high dose exposures can produce irritability, delirium, anxiety, or manic depressive psychosis.

Nickel - Dermal exposure to nickel and nickel compounds results in contact dermatitis and chronic eczema. Nickel and its compounds are also irritants to the conjunctiva of the eye and mucous membranes of the upper respiratory tract. Chronic exposure to elemental nickel and its salts may result in lung and nasal passage cancer. Effects are also seen on the heart, muscles, brain, and kidney.

Zinc - The major targets of zinc toxicity are the gastrointestinal tract following oral exposure and the lungs following inhalation exposure. Zinc is not mutagenic and is not classifiable as to human carcinogenicity. In humans, gastrointestinal effects (vomiting, abdominal cramps, diarrhea) and hematological effects (anemia) have resulted from oral exposure. Short-term exposure to zinc dust and zinc fumes results in "metal fume fever". This condition is characterized by an acute impairment of pulmonary function. Acute inhalation zinc oxide has resulted in nasal passage irritation, cough, chest pain, lung rales, and decreased vital capacity.

Asbestos – Prolonged or repeated exposure to airborn dust containing asbestos may lead to asbestosis and mesothelioma. Smoking combined with asbestos fiber inhalation greatly increases lung cancer risk. Dust may also cause eye irritation.

2.3.3 Physical Hazards

The principle physical hazards associated with the Removal Action at SEADs- 24, 50, 54, and 67, involve working around heavy equipment, site terrain, and site debris.

Terrain hazards include marshy areas, drainage ditches, areas of rough terrain, and areas of protruding debris. In areas where access is difficult or hazardous, access paths shall be cleared and maintained, and movement through these areas shall be along the access paths.

Activities on-site will include:

1. Site visits
2. Soil and sediment excavation
3. Dust suppression
4. Air sampling
5. Confirmatory soil sampling
6. Transportation/disposal of excavated material
7. Backfilling, Compacting, Regrading and Revegetation

Hazards associated with these activities are varied and include vehicle/pedestrian collisions; fire; contact or crushing injuries resulting from materials handling and equipment operations; abrasions, contusions, lacerations, etc. resulting from use of power tools; and elevated noise levels. The potential for such hazards necessitates that all on-site personnel wear appropriate protective clothing, including coveralls, gloves, eye and face protection, safety boots, ear plugs and hard hats.

2.3.4 Motor Vehicles and Motorized Equipment

All motor vehicles will be maintained in a safe operating condition and in accordance with local and state safety requirements. All vehicles and moving equipment will be operated on-site and en route to and from sites in accordance with state and local motor vehicle regulations for speed, lights and warnings, passenger carrying, and operation. If any equipment is left unattended at night adjacent to a highway in use, it will be provided with suitable barricading, lighting, reflectors, or other suitable visual warnings to identify its location.

Any mobile equipment, including drilling rigs, earth-moving machinery, or other similar types of equipment, will be operated in strict compliance with the manufacturer's instructions, specifications, and limitations, as well as any applicable regulations. The operator is responsible for inspecting the equipment daily to assure that it is functioning properly and safely. This inspection will include all parts subject to faster than normal wear and all lubrication points.

Hand and audible (horn) signals to equipment operators will be the commonly accepted industry standard signals for the type of equipment being used. All signals will be reviewed by the operator and signaller before work begins. Only one person will signal the equipment operator at any give time.

When equipment with moving booms, arms, or masts is operated near overhead hazards, the operator, with assistance from the designated signaling person, will assure that the moving parts of the equipment maintain safe vertical and horizontal clearances to the hazards. Moving booms, arms, or masts will be lowered and secured prior to being moved from one location to another, even on the same site. Equipment will be kept at least 10 feet (ft) away from energized electrical lines rated up to 50 kilo volts (kV) and 16 ft away from lines rated over 50 and up to 750 kV.

Drill rigs and other equipment not specifically designed to move with the boom, mast or arm in an elevated position will be returned to traveling position and condition before being moved. Movement through the depot facility will be along established roads. All site equipment will be inspected before each use to ensure that it is in proper working order. Any equipment found to be unsafe shall be repaired or taken out of service.

2.3.5 Heat Stress

Site work at the SWMUs may be conducted during the summer and early fall months and heat stress is a serious concern. Heat stress monitoring for employees wearing protective clothing will be conducted whenever the temperature is above 60 degrees Fahrenheit (^{O}F). For employees not wearing protective clothing, heat stress monitoring will be conducted when the temperature is above 80^{O}F. Pulse rate and oral temperature measured at the end of each work period will be used to monitor heat stress in on-site employees. Heat stress monitoring procedures are described in **Attachment 2** of this HASP, Standard Operating Procedures for Emergencies Due to Heat and Heat Stress Monitoring.

2.3.6 Cold Stress

Site work at the SWMUs may be conducted during cold weather. Cold stress monitoring for employees working outdoors will be conducted. Two factors influence the development of a cold injury: ambient temperature and wind velocity. Cold stress monitoring will be conducted when temperatures are below 4 degrees Celsius (^{O}C i.e., 40^{O}F). Cold stress monitoring procedures are described in Attachment B-2 of this HASP, Standard Operating Procedures for Emergencies Due to Cold and Cold Stress Monitoring.

2.3.7 Biological Hazards

Biological hazards can result from encounters with mammals, insects, snakes, spiders, ticks, plants, parasites, and pathogens. Mammals can bite or scratch when cornered or surprised. The bite or scratch can result in local infection or infection with systemic pathogens or parasites. Insect and spider bites can result in severe allergic reactions in sensitive individuals. Exposure to poison ivy, poison oak or poison sumac results in skin rash. Ticks are a vector for a number of serious diseases. Dead animals, organic wastes, and contaminated soil and water can harbor parasites and pathogens.

2.3.7.1 Poison Ivy

Poison ivy is common throughout SEDA. Site workers should how to recognize the poison ivy plant and avoid walking through areas of heavy growth. If walking through areas of poison ivy is unavoidable, workers should keep extremities covered and avoid contact of bare skin with poison ivy leaves and stems. When digging in areas of poison ivy growth, contact with the roots should be avoided; these can also produce a reaction.

Skin areas exposed to the poison ivy should be washed as soon as possible. Oils from the poison ivy plant can adhere to clothes. Clothes exposed to poison ivy should be washed before wearing again.

2.3.7.2 Ticks and Lyme Disease

Ticks may be common during the spring and summer at SEDA. Two types of ticks may be encountered.

The dog tick is the larger, more common tick. After biting, the dog tick will remain attached to the victim until engorged with blood. Usually, dog ticks can be found by careful inspection of the body at the end of the workday. If the tick is already imbedded in the skin, remove it with tweezers or fingers by grasping the tick as close to the skin as possible and pulling downward. Check to make sure all tick parts have been removed from the skin. Wash the area of the bite with soap and water. Seek medical attention if any tick parts remain in the skin. Dog ticks may transmit Rocky Mountain spotted fever and other diseases.

The deer tick is much smaller, ranging from poppy seed to grape seed size, and does not remain attached to the skin for very long after biting. You may be bitten by a deer tick and never see the tick. Deer ticks can transmit Lyme disease, which can have serious, long-term health effects if left untreated. If you discover a small tick imbedded in the skin, remove it as above. Check the area of the bite periodically. If you develop a rash or develop flu-like symptoms, seek medical attention. Lyme disease is characterized by a bull's-eye type rash: light in the center with an outer red area. Flu-like symptoms may also occur. These signs may occur at different times and the rash may not appear.

If workers discover any bites on the skin, they should wash the affected area and seek medical attention if a rash or flu-like symptoms appear.

Workers should the following steps to limit the likelihood of getting tick bites:

- Tuck pants legs into socks;
- Wear long sleeves, hat and closed shoes;
- Use tick repellant, such as DEET, on clothes;
- Check body for ticks daily; and
- Shower immediately after work and wash work clothes daily.

2.3.7.3 Snakes

Poison snakes are not common to the area of SEDA, though central New York is within the range of rattlesnakes and copperhead snakes. To minimize the chance of snake bites workers should:

- Not put hands and feet where they have not looked;
- Avoid stepping into clumps of weeds and brush;
- Step heavily. Snakes can feel footfalls through the ground and will avoid you if they can; and
- Wear heavy leather boots and loose fitting pants.

Caution should be used if any snake is encountered.

3.0 HEALTH AND SAFETY TRAINING

All site workers involved in hazardous work must meet the training requirements set forth in 29 CFR §1910.120(e). All employees engaged in hazardous waste site work must receive an initial 40 hours of training in hazardous waste site operations and safety procedures. Written certification of this training will be provided as an attachment to the HASP. This training must be followed by 3 days of supervised on-site experience. Employees performing hazardous waste work prior to March 1987, who received initial training that was standard at that time, are assumed to satisfy 29 CFR §1910.120 as a result of training and experience. In addition, at least two workers per shift shall be certified in First Aid and CPR.

Supervisors and site managers must receive an additional 8 hours of specialized training on the safe management of site operations. All employees must receive an additional 8 hours of refresher training, annually. Additional training must also be provided to those employees who have been designated to respond to site emergencies. Additional training will be provided to those employees who may be exposed to unique or special hazards at the site.

On-site safety training will consist of a detailed safety meeting and training session prior to the beginning of any fieldwork. This meeting will cover all site activities and will also review the site emergency response plan. All site workers and managers are required to attend this meeting. Other topics to be discussed will include donning and doffing of personal protective equipment as well as a brief toxicological review of site-specific known and suspected contaminants.

Daily safety meetings will also be conducted prior to each day's activities. These meetings will cover the safety measures to be employed during that day's activities and the emergency response and evacuation procedures for each work site and work crew.

On-site training will be documented using the form contained in **Attachment 3**, On-Site Documentation Forms.

3.1 INITIAL SITE TRAINING

Initial site training shall consist of a review of this site specific HASP and shall cover the following topics:

- Site Personnel and Duties;
- Site Description;

- Site Characterization;
- Chemical and Physical Hazard Evaluation;
- Toxicological Information;
- Heat Stress and Cold Stress;
- Site Layout, Site Control Measures, and Work Zones;
- Personal Protective Equipment;
- Safe Work Practices and Engineering Controls;
- Emergency Response Plan;
- On-site Emergency Plan;
- Off-site Emergency Plan;
- Evacuation Procedures;
- Emergency and Personal protective equipment;
- Emergency Telephone Numbers;
- Directions to Hospital;
- Medical Surveillance Requirements; and
- Health and Safety Training.

3.2 SAFETY BRIEFINGS

Safety briefings shall be conducted at least weekly and at the beginning of new operations, changes in site conditions, and changes in operating procedures due to weather, new equipment, or additional site information.

The topics covered in the safety briefings will include, as appropriate:

- Evacuation routes and emergency procedures;
- Use of additional protective equipment;
- Terrain hazards;
- Weather hazards;
- New chemical or toxicological information;
- Periodic review of portions of the site specific HASP; and
- Review of site incidents, follow-up, and corrective measures.

4.0 MEDICAL SURVEILLANCE

All personnel conducting work in the exclusion and contamination reduction zones will be participating in a medical surveillance program that meets the criteria set forth in OSHA 29 CFR §1910.120. This rule requires that employees engaged in hazardous waste site work receive a medical examination at least annually and that they become certified by the examining physician to wear a respirator without restrictions. All subcontractors involved in hazardous work must certify to the AE that all site workers meet the above criteria. Written certification of completion of medical exams for designated project employees will be provided as a separate attachment of this HASP.

Employees of Seneca Army Depot (SEDA) who will be performing activities in active work areas at the SWMUs will be required to participate in SEDA's medical surveillance program for respirator use.

4.1 PHYSICAL EXAMINATIONS

Employees receive physical exams annually and at the time of termination from the AE's or reassignment from the hazardous work assignments.

Personnel who are significantly exposed to hazardous materials may require special exams. The need for these tests will be determined by the attending physician after consulting with supervisors and health and safety personnel. Provisions will be made to repeat tests when necessary.

Physical exams will be conducted by or under the direct supervision of a licensed physician or a medical consultant who is Board Certified or Board Eligible in Occupation or Aerospace Medicine by the American Board of Preventive Medicine, Inc. with at least three years of experience in occupational medicine.

The examining physician will furnish the AE's Health and Safety Officer with an oral report and indicate any adverse effects. A written report will follow. The physician is instructed, however, to reveal any specific findings or diagnoses unrelated to occupational exposure to the employee or the employee's designee only.

Medical records for the AE's personnel are kept on file by the AE for at least 30 years plus the length of employment. Medical monitoring for the AE's employees is the responsibility of the AE, and the AE will bear the entire cost.

5.0 SITE LAYOUT AND CONTROL MEASURES

5.1 WORK ZONES

The support zone and command post for the fieldwork at the SWMU areas will consist of an office trailer and storage areas at one central location for all SWMUs. The location of the support zone will be determined prior to the commencement of the fieldwork. Exclusion zones will be established onsite.

If surface contamination is created or suspected as a result of the operations, an exclusion zone will be defined around the suspected surface contamination until the problem has been mitigated. Mobile operations, such as sediment sampling, will not have defined exclusion zones.

5.2 UTILITIES CLEARANCE

Facility maps will be obtained and consulted prior to commencing any intrusive work. Borehole sites will be positioned accordingly, marked with wooden stakes, and then cleared with SEDA. Drilling is to be done at the marked, cleared locations only.

5.3 SITE CONTROL

SEDA is responsible for overall site security. All AE personnel and subcontractors and all equipment to be used in the field investigation shall be logged each day at the command post prior to proceeding to other areas of the site. All persons other than work crews wishing to enter the active work areas shall first sign in at the command post.

5.4 SITE COMMUNICATIONS

Routine site communications will be maintained between all work crews and the support zone with two-way radios. On-site emergency communications will be maintained by the use of air horns. Details of the emergency communications are contained in the Emergency Response Plan in Section 10 of this HASP.

6.0 MONITORING

6.1 GENERAL

Standard Operating Procedures for the calibration and operation of all monitoring instruments and copies of the operating manuals for these instruments will be kept in the command post. Instruments will be field calibrated daily (each day the instrument is used). Calibration log sheets (**Attachment 3**) will be kept for each instrument and will become part of the permanent file.

Instruments will be kept on charge whenever not in use. All monitoring and instrument calibration will be done by persons who have been trained in the use of the equipment.

6.2 ON-SITE MONITORING

6.2.1 Monitoring Overview

All site work which breaks the ground surface will be monitored, at a minimum, using an organic vapor meter with a photoionization detector [e.g., Thermoenvironmental Organic Vapor Meter (OVM-580B/580S) equipped with a 10.6e V lamp] and a particulate meter (e.g., MIE Miniram PDM-3). Field monitoring log sheets will be kept (**Attachment 3**).

Instrument settings on all direct reading air monitoring instruments will be set on the most sensitive scale unless a reading is detected. The action levels for changes in personal protective equipment and personnel actions are given in **Table 2**, Action Levels for Changes in Respiratory Protection. The action levels specified for the organic vapors may be increased or decreased if air sample analysis, using species appropriate draeger tubes (e.g., benzene, toluene, ethylbenzene, etc), results indicate a greater or lesser degree of hazard for the given organic vapors readings. Any changes in the action levels will be documented in writing by the Site Safety Officer and approved by the Project Safety Officer or the Corporate Health and Safety Officer.

6.2.2 Volatile Organics Monitoring

Monitoring of volatile organics will be conducted with an organic vapor meter (OVM 580B or 580S) during excavation activities. Two OVMs will be used, one at the work site and one downwind of the work site.

TABLE 2

ACTION LEVELS FOR CHANGES IN RESPIRATORY PROTECTION AND SITE EVACUATION

	LEVEL OF PROTECTION/ACTION TAKEN*				
INSTRUMENT	LEVEL D	LEVEL C	LEVEL B	PROCEED WITH CAUTION	EVACUATE SITE
OVM (ppm as isobutylene)	BKGD	<5**	5-500		>500
OXYGEN (%)	19.5-23	19.5-23	19.5-23		>23
LOWER EXPLOSIVE LIMIT (%)	<10	<10	<10	10<LEL<25	>25
AEROSOL MONITOR (mg/m3)	<1.0	1.0-10	10-50		<50

Notes:

* All monitoring performed in the breathing zone for a period of at least 30 seconds.

** If OVM reading equals or exceeds 5 ppm take a benzene Draeger tube. If no benzene is present, action level for Level D protection may be increased to between 5 and 50 ppm.

6.2.3 Dust/Particulates Monitoring

Monitoring of airborne particulates will be conducted with the MIE Miniram (PDM-3) during excavation activities and in areas where surface contamination and fugitive dust is expected to be high. Measurements will be data logged and a time-weighted average (TWA) for the work period will be calculated. Two Minirams will be used, one at the worksite, and one downwind of the work area.

If working conditions cannot be controlled to minimize the exposure and the production of visible dust in the breathing zone, such as staging equipment and personnel upwind or dampening the soil with water, particulate monitoring will be required. If levels continuously exceed 5.0 mg/m3 (OSHA respirable nuisance dust permissible exposure limit (PEL)) work will stop immediately and the Safety Officer will be notified. Work may resume upon the return of acceptable readings in the work zone and the approval of the Safety Officer.

Surface and subsurface soils at SEADs-24, 50, 54, and 67 have PAHs and various metal concentrations that exceed regulatory limits. The metals include aluminum, antimony, arsenic, beryllium, cadmium, calcium, chromium, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, and zinc. There also may be asbestos in the airborne particulate.

Calculations were performed to justify the elimination of the need for real time aerosol monitoring or ambient monitoring of the metal compounds during work at the site. As shown in **Table 3** the air concentration of total dust at which the contaminant of concern would be at its PEL (EL_{mix}) is well above the nuisance dust PEL. Therefore, additional monitoring will not be necessary.

6.2.4 O_2/LEL/H_2S Monitoring

The use of a 3-range monitor (O_2/LEL/H_2S) will allow the site worker to evaluate the oxygen level, explosivity, as well as detect the presence of hydrogen sulfide (H_2S) gas in any SWMU where these levels are of concern (such as in a confined space).

6.3 ACTION LEVELS AND RESPIRATORY PROTECTION

Action levels for all instruments are given in **Table 2**, Action Levels for Changes in Respiratory Protection. When an action level is equaled or exceeded, immediately shut down the operation and evacuate the work area. Allow the levels to stabilize and reenter the work area to make a measurement. Restart work if levels are below the action levels. If the action level remains

TABLE 3
DUST EXPOSURE LIMIT CALCULATIONS

	Soil Concentrations Exceeding NYSDEC TAGM					
Parameter	**SEAD-24 (mg/kg)**	**SEAD-50/54 (mg/kg)**	**SEAD-67 (mg/kg)**	**Overall Maximum Concentration (mg/kg)**	**Exposure Limit(1) (mg/m^3)**	**EL_{mix} (mg/m^3)**
PAHs						
Benzo(a)anthracene	280	5200	610	5200	0.2	192
Benzo(a)pyrene	420	3700	830	3700	0.2	270
Benzo(b)fluoranthene		4400	1300	4400	0.2	227
Benzo(k)fluoranthene		4000		4000	0.2	250
Chrysene		5500	690	5500	0.2	182
Dibenz(a,h)anthracene	28	840	310	840	0.2	1190
Total PAH (concentration calculated as sum of individual PAHs)				**23640**	**0.2**	**42**
Metals						
Aluminum	25500			25500	15	2941
Antimony		7.1		7.1	0.5	352113
Arsenic	56.8	151		151	0.01	331
Beryllium	1.2			1.2	0.002	8333
Cadmium	8.2			8.2	0.005	3049
Calcium			139000	139000	5 (3)	180
Chromium	35.1	60.7		60.7	1	82372
Copper	324	35.2		324	1	15432
Iron	37700			37700	10 (3)	1326
Lead	422			422	0.05	592
Magnesium	43700	48300		48300	15 (3)	1553
Manganese	1770		1380	1770	1 (2)	2825
Mercury	0.15	0.37	4	4	0.1	125000
Nickel	535			535	1	9346
Potassium	2510		3160	3160	2 (2)(4)	3165
Zinc	1180	152		1180	15 (3)	63559

(1) OSHA 8-hour time-weighted average Permissible Exposure Limits (PEL)
For metals, PEL shown is lowest of compounds likely to be encountered on-site

(2) NIOSH REL TWA

(3) PELs for calcium, iron, magnesium, and zinc oxides and potassium hydroxide used

(4) EL_{mix} = (10e6 x EL)/(SC x SF) where

EL_{mix} = air concentration of total dust at which the contaminants of concern would be at their established exposure limit (mg/m3)

EL = Exposure limit of the contaminant of concern (mg/m3)

SC = Overall maximum soil concentration of the contaminant of concern (mg/kg)

SF = Safety Factor (a SF of 2 was used in these calculations) exceeded, reassess the situation. Upgrade personal protective equipment (PPE) prior to reentry of the area.

Periodic measurements will be made for total VOCs at the work face (e.g., top of well, drill cuttings, excavation spoils). If the total VOC levels at the work face are higher than action level but ambient levels are below action levels, proceed carefully and monitor more frequently. The level of personal protection will be upgraded if concentrations of volatile organic vapors in the breathing zone are between 5 and 50 ppm for a period of greater than 30 seconds.

6.4 WIND DIRECTION INDICATOR

A wind direction indicator (such as survey flagging tied to a stake) will be erected at every active work site. This will enable the site safety monitor and on-site personnel to determine upwind locations necessary for proper health and safety procedure implementation and, if necessary, evacuation procedures.

6.5 COMMUNITY AIR MONITORING PLAN

Real-time air monitoring, for volatile compounds and particulate levels at the perimeter of the work area is necessary if either of the following conditions are met:

a. At SWMUs where residences or occupied buildings are greater than ¼ mile away, and concentrations of organic vapors at the work zone exceeds 500ppm, providing that monitoring for worker Health and Safety is conducted at least every two hours.

b. At SWMUs where residences or occupied buildings are less than ¼ mile away.

The plan includes the following:

- Volatile organic compounds must be monitored at the downwind perimeter of the work area daily at 2-hour intervals. If total organic vapor levels exceed 5 ppm above background, work activities must be halted and monitoring continued under the provisions of a Vapor Emission Response Plan. All readings must be recorded and be available for State (DEC & DOC) personnel to review.

- Particulates should be continuously monitored upwind, downwind and within the work area at temporary particulate monitoring stations. If the downwind particulate level is 150ug/m3 or greater than the upwind particulate level, then dust suppression techniques must be employed. All readings must be recorded and be available for State (DEC & DOC) personnel to review.

6.5.1 Vapor Emission Response Plan

If the ambient air concentration of organic vapors exceeds 5ppm above background at the perimeter of the work area, activities will be halted and monitoring continued. If the organic vapor level decreases below 5 ppm above background, work activities can resume but more frequent intervals of monitoring, as directed by the Safety Officer, must be conducted. If the organic vapor levels are greater than 5 ppm over background but less than 25 ppm over background at the perimeter of the work area, activities can resume provided:

- The organic vapor level 200ft. downwind of the work area or half the distance to the nearest residential or commercial structure, whichever is less, is below 5 ppm over background, and

- More frequent intervals of monitoring, as directed by the Safety Officer, are conducted.

If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown. When work shutdown occurs, downwind air monitoring as directed by the Safety Officer will be implemented to ensure that vapor emission does not impact the nearest residential or commercial structure at levels exceeding those specified in the Major Vapor Emission section.

6.5.2 Major Vapor Emission

If any organic levels greater than 5 ppm over background are identified 200 feet downwind from the work area or half the distance to the nearest residential or commercial property, whichever is less, all work activities must be halted.

If, following the cessation of the work activities, or as the result of an emergency, organic levels persist above 5 ppm above background 200 feet downwind or half the distance to the nearest residential or commercial property from the work area, then the air quality must be monitored within 20 feet of the perimeter of the nearest residential or commercial structure (220-Foot Zone).

If efforts to abate the emission source are unsuccessful and if any of the following levels persist at 5 ppm above background for more than 30 minutes in the 20-Foot Zone, then the Major Vapor Emission Response Plan shall automatically be placed into effect.

However, the Major Emission Response Plan shall be immediately placed into effect if organic vapor levels are greater than 10ppm above background.

6.5.3 Major Vapor Emission Response Plan

Upon activation, the following activities will be undertaken:

1. All Emergency Response Contacts as listed in the Health and Safety Plan of the Work Plan will be contacted;

2. The local police authorities will immediately be contacted by the Safety Officer and advised of the situation; and

3. Frequent air monitoring will be conducted at 30-minute intervals within the 20-Foot Zone. If two successive readings below action levels are measured, air monitoring may be halted or modified by the Safety Officer.

7.0 PERSONAL PROTECTIVE EQUIPMENT

The selection and use of personal protective equipment at the subject site will be in accordance with the AE's Personal Protective Equipment Program, contained in **Attachment 4**. The unknown nature of hazardous waste site work and the possibility of changing conditions during the conduct of the work may require changes in the personal protective equipment. When changes in personal protective equipment become necessary, these changes shall be made in accordance with the action levels and criteria set forth in this plan and according to the established procedures contained in The AE's Personal Protective Equipment Program.

Routine site work at the Seneca site will be performed in Level D protection, augmented with overboots, inner surgical gloves, and chemical-resistant outer gloves. Level C respiratory protection with organic vapor/acid gas cartridges will be carried by all work crews to be donned when air monitoring indicates the need for respiratory protection. Required equipment for Levels B, C, and D are detailed in **Table 4**, Description of Personal Protective Equipment and Levels of Protection.

The organic vapor monitor will be the primary instrument for determining contaminant concentrations that may trigger a change in respiratory protection. Level C protection will be worn in situations where inhalation of fugitive dust containing metals or explosives is determined to be present in high levels. Action levels for changes in personnel protection equipment are shown in **Table 2 (Section 6)**.

In the event that personal protective equipment (PPE) is ripped or torn, work shall stop and PPE shall be removed and replaced as soon as possible. The minimum levels of protection to be worn and the equipment which shall be available for general site tasks are shown in **Table 5**.

TABLE 4

DESCRIPTION OF PERSONAL PROTECTIVE EQUIPMENT AND LEVELS OF PROTECTION

LEVEL D

HARD HAT
EYE PROTECTION - SAFETY GOGGLES, GLASSES, OR FACE SHIELD
SAFETY SHOES - STEEL TOE, LEATHER
(or)
SAFETY BOOTS - STEEL TOE, NEOPRENE
OVERBOOTS, INNER SURGICAL GLOVES, AND CHEMICAL-RESISTANT OUTER GLOVES
PROTECTIVE OVERALLS, EAR PLUGS

LEVEL C

LEVEL D PROTECTIVE EQUIPMENT PLUS:
RESPIRATORY PROTECTION - FULL FACEPIECE AIR PURIFYING RESPIRATOR (APR), CARTRIDGE OR CANISTER
SKIN PROTECTION - POLY-COATED TYVEK OR SARANEX COVERALL*
INNER LATEX GLOVES*
OUTER NITRILE GLOVES*
NEOPRENE BOOT COVERS*

LEVEL B

LEVEL C PROTECTIVE EQUIPMENT EXCEPT FOR:
RESPIRATORY PROTECTION - FULL FACEPIECE SELF-CONTAINED BREATHING APPARATUS (SCBA) INSTEAD OF APR

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* OTHER MATERIALS MAY BE SPECIFIED TO PROVIDE BETTER PROTECTION WHEN WORKING WITH CERTAIN TYPES OF CHEMICALS.

TABLE 5

MINIMUM LEVELS OF PROTECTION AND AVAILABLE UPGRADE PROTECTION FOR SITE TASKS

Activity	PPE Worn	PPE With Crew	Emergency PPE at Command Post
Excavation	D	C	B
Soil and Sediment Sampling	D	C	B
Air Sampling	D	C	B
Decontamination	D	-	B

8.0 SAFE WORK PRACTICES AND ENGINEERING CONTROLS

Safe work practices and engineering controls shall be implemented to comply with OSHA 29 CFR §1910.120 to limit employee exposure to hazardous substances or conditions. The use of personal protective equipment has limitations and presents hazards of its own, such as physical stress and interference with peripheral vision, calling for the consideration and implementation of work practices and engineering controls prior to beginning site tasks and before the use of personal protective equipment is instituted.

The safe work practices and engineering controls discussed below apply to general site procedures.

8.1 SAFE WORK PRACTICES

The following work practices are intended for use when site activities involve potential exposure to hazardous substances or conditions.

1. The buddy system will be utilized at all times within the exclusion zone.
2. Entry into and exit from zones within the site must be made via the established access control points.
3. Prescribed personal protective equipment must be worn as directed by the Site Health and Safety Office and Project Manager.
4. Assumptions will not be made concerning the nature of materials found on the site. Should any unusual situations occur (not covered by the Site Standard Operating Procedures), operations will cease and the Site Health and Safety Officer and the Project Manager will be contacted for further guidance.
5. Communication hand signals must be understood and reviewed daily.
6. Consultation with the Project Manager shall be made to avoid any uncertainties.
7. Ground fault circuit interrupters shall be used on all field electrical equipment. Improperly grounded/guarded tools shall be tagged out-of- service and the Project Manager shall be notified immediately.
8. If a piece of equipment fails or is found to be in need of repair, it will be immediately tagged out-of-service and the Project Manager shall be notified. This equipment will not be returned to service until repairs have been completed and the equipment tested by a competent individual.
9. Unsafe conditions shall be reported immediately.
10. Unusual odors, emissions, or signs of chemical reaction shall be reported immediately.
11. Workers will minimize contact with hazardous materials by:

   a. Avoiding areas of obvious contamination
   b. Using poly sheeting to help contain contaminants

12. Avoiding contact with toxic materials
13. Only essential personnel will be permitted in the work zones.
14. Whenever possible, personnel will be located upwind during material handling.
15. At the first sign of odors detected inside the facepiece of a respirator, or if the employee begins experiencing any signs or symptoms of exposure to site toxic material (this information will be discussed during the daily meeting and can be found on the appropriate Chemical Hazard Evaluation Sheets, **Attachment 1**), the employee will leave the area immediately and report the incident to the Health and Safety Officer and Project Manager.
16. Smoking will be allowed only in designated areas of the support zone.

8.2 PERSONAL HYGIENE PRACTICES

The following personal hygiene practices will apply to fieldwork conducted at the SEDA SWMU areas:

1. No smoking or chewing of tobacco or gum shall be allowed within the exclusion or decontamination zones.
2. No eating or drinking shall be allowed in the exclusion or decontamination zones.
3. On-site personnel shall remove protective clothing and wash face and hands prior to leaving the decontamination zones.
4. Disposable outerwear will be placed in drums located in the personnel decontamination area. Drums will be staged on-site at a central location for later disposal.

8.3 FIRE CONTROL

Fire extinguishers, suitable for Class A, B, and C fires (rated at least 1A, 10BC), will be available at sampling sites for use on small fires. All samples must be treated as flammable or explosive. The site safety officer will have available the telephone number of the nearest fire station and local law enforcement agencies in case of a major fire emergency.

8.4 SPILL CONTROL

In the event of a spill, the site safety officer will be notified immediately. The important factors are that no personnel are overexposed to vapors, gases, or mists and that the liquid does not ignite. Waste spillage must not be allowed to contaminate any local water source. Small dikes will be erected to contain spills, if necessary, until proper disposal can be completed. Subsequent to cleanup activities, the site safety officer will survey the area to ensure that no toxic or explosive vapors remain.

8.5 EXPLOSIVE FIRES

Under no circumstances will an attempt be made to fight an explosive fire. If a fire involving explosive materials should occur on the site, all personnel will immediately evacuate the site. Fire department personnel responding to the incident must be informed of the fact that the fire involves explosive materials.

8.6 CONFINED SPACE ENTRY

No confined space entry is planned for the investigations of the SWMUs. Excavations are not anticipated to exceed 2 feet in depth. If confined space entry becomes necessary during the implementation of the work, a confined space entry procedure will be appended to the site safety plan and will be instituted prior to allowing any confined space entry.

8.7 SITE INSPECTIONS

Site inspections will be conducted daily by the site safety officer to ensure that site work is accomplished in accordance with the approved safety plan, contract requirements, and federal regulations. Daily inspections will be documented.

8.8 ACCIDENT REPORTING AND RECORD KEEPING

Accidents and near miss incidents will be recorded on the accident report form contained in **Attachment 3** – On-Site Documentation Forms. Accident reports are to be completed by involved parties if possible. Accidents and near misses will be investigated by the site safety officer and the site manager. The investigation team shall make recommendations for preventing a recurrence of the accident or incident and submit the accident report to the project health and safety officer and the office health and safety representative. The accident report shall be retained on file at the site, in the project files, and in office health and safety files. All accidents or incidents that are recordable will be entered on the OSHA 200 log maintained in the AE's home office. In addition, Corps of Engineers contractors will submit an accident report on form ENG3394.

The office health and safety officer and the project health and safety officer shall review the accident report and approve or make additional recommendations for prevention of the future occurrence of the incident. The project health and safety officer shall ensure that remedial recommendations are carried out by the field staff.

9.0 DECONTAMINATION

Decontamination is the physical removal of contaminants from clothing and equipment or the chemical change of such contaminants to innocuous substances. Decontamination procedures will take place in the contamination reduction zone. Disposal is an available option in lieu of decontamination when decontamination is impractical.

The following decontamination procedures are intended to meet the requirements of 29 CFR §1910.120(k). No personnel or equipment shall enter the contaminated zone of the site until workers have acknowledged the decontamination procedures and operating procedures intended to minimize contamination. These procedures shall be monitored by the Site Health and Safety Officer to determine their effectiveness. Ineffective procedures will be corrected.

9.1 DECONTAMINATION FACILITIES

The main decontamination facilities at the SEDA SWMU areas will be located adjacent to the support zone. These decontamination facilities will be used for vehicle and heavy equipment decontamination and for personnel decontamination. Personnel decontamination must take place prior to leaving the decontamination area and prior to entering any personnel hygiene facilities or before eating, drinking, or smoking.

9.2 PERSONNEL DECONTAMINATION

Personnel decontamination will consist primarily of a segregated equipment drop, removal and disposal of any non-reusable protective equipment, and washing of hands and face. No heavy contamination of clothing is expected and disposable protective clothing will be disposed of as non-hazardous waste. However, if contamination is detected (i.e., elevated PID readings, visual evidence, or known contact with potentially contaminated liquids) personal protective equipment and cartridges from respirators will be bagged separately from daily garbage. Facilities for personnel and sampling equipment decontamination will be set up between the equipment decontamination pad and the site trailer. Personnel will not enter the office trailer without first going through decontamination, and hands and face must be thoroughly washed before eating, drinking, etc.

Level C Decontamination – The activities to be carried out at each station are described on **Table 6**, Measures for Level C Decontamination.

TABLE 6

MEASURES FOR LEVEL C DECONTAMINATION

Station 1:	Equipment Drop	Deposit equipment used on-site (tools, sampling devices, and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination. During hot weather operations, coo
Station 2:	Outer Garment, Boots and Gloves Wash and Rinse	Scrub outer boots, outer gloves and splash suit with decon solution or detergent water. Rinse off using copious amounts of water.
Station 3:	Outer Boots and Glove Removal	Remove outer boots and gloves. Deposit in container with plastic liner.
Station 4:	Canister or Mask	If worker leaves exclusive zone to change canister (or mask), this is the last step in the decontamination procedure. Worker's canister is exchanged, new outer gloves and boot covers donned, joints taped, and worker returns to duty.
Station 5:	Outer Garment Removal	Remove outer garment. Place on plastic for further cleaning or in barrel for disposal.
Station 6:	Face Piece Removal	Facepiece is removed. Avoid touching face with fingers. Facepiece deposited on plastic sheets.
Station 7:	Inner Boot and Glove Removal	Boots and inner gloves removed and deposited in separate containers lined with plastic.
Station 8:	Field Wash	Hands and face are thoroughly washed. Shower as soon as possible.

Level B Decontamination – The activities to be carried out at each station are described on **Table 7**, Measures for Level B Decontamination.

9.3 EQUIPMENT DECONTAMINATION

Equipment and vehicle decontamination will consist of steam cleaning. Solvent and Alconox and water washes will be performed when required for sampling or for heavy contamination. Gross contamination, such as caked mud and dirt on excavator buckets or grading blades will be removed at the work site and placed back in the excavation or drummed with other spoils if containment indicators (e.g., PID readings) warrant drumming of the soils.

Refer to the Field Sampling and Analysis Plan for the details of the management of investigation generated wastes.

9.4 PREVENTION OF CONTAMINATION

In an effort to minimize contact with waste and decrease the potential for contamination, the points outlined below will be adhered to during all phases of field investigation and sampling.

1. Personnel will make every effort not to walk through puddles, mud, any discolored surface, and/or any area of obvious contamination.
2. Personnel will not kneel or sit on the ground in the exclusion zone and/or in the Contamination Reduction Zone (CRZ).
3. Personnel will not place equipment on drums, containers, vehicles, or on the unprotected ground.
4. Where appropriate, personnel will wear disposable outer garments and use disposable equipment.

TABLE 7

MEASURES FOR LEVEL B DECONTAMINATION

Station 1:	Equipment Drop	Deposit equipment used on-site (tools, sampling devices, and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination. During hot weather operations, coo
Station 2:	Outer Garment, Boots	Scrub outer boots, outer gloves and splash suit with decon solution or detergent water. Rinse off using copious amounts of water.
Station 3:	Outer Boots and Glove Removal	Remove outer boots and gloves. Deposit in container with plastic liner.
Station 4:	Tank Change	If worker leaves exclusive zone to change canister (or mask), this is the last step in the decontamination procedure. Worker's canister air tank is exchanged, new outer gloves and boot covers donned, joints taped, and worker returns to duty.
Station 5:	SCBA Removal	SCBA backpack and facepiece is removed. Avoid touching face with finger. SCBA deposited on plastic sheets.
Station 6:	Outer Garment Removal	Remove outer garment. Place on plastic for further cleaning or in barrel for disposal.
Station 7:	Inner Boot and Glove Removal	Boots and inner gloves removed and deposited in separate containers lined with plastic.
Station 8:	Field Wash	Hands and face are thoroughly washed. Shower as soon as possible.

10.0 EMERGENCY RESPONSE PLAN

This Emergency Response Plan applies to site work at the Removal Action at SEADs-24, 50, 54, and 67. Copies of this plan are to be kept at the site command post and support areas. The list of emergency telephone numbers and directions to the nearest exit gate and nearest hospital will be prominently posted in the command post. Copies of the directions to the nearest hospital will be kept in all site vehicles.

This emergency response plan shall be coordinated with SEDA emergency response procedures prior to the beginning of site work.

10.1 ON-SITE EMERGENCIES

On site emergencies can range from minor cuts and scrapes to explosions, fires, and the release of toxic gases. Apparently minor incidents at hazardous waste sites can have serious consequences or may indicate the presence of a previously unknown health and safety hazard. Explosions, fires, and the release of toxic gases will not only involve site workers, but may affect the neighboring populations and the environment.

All incidents will be reported as soon as possible to the Site Manager and the Site Safety Officer who will determine the appropriate steps to be taken.

When the incident is minor, the work may continue. When an incident is considered serious, work will be discontinued until the emergency situation has been brought under control, the incident has been evaluated, and any conditions which may have contributed to the emergency have been mitigated.

All site incidents, including near misses, will be investigated and documented, using the Incident Report Form and Incident Follow-Up Report Form in **Attachment 3**, On-Site Documentation Forms.

10.2 OFF-SITE EMERGENCIES

In the unlikely event of a vapor release off-site, the contamination source will be secured, if possible.

Emergency response contacts will be notified in the following order:

1. Sheriff's Department
2. Safety Officer
3. SEDA Environmental Office
4. Project Manager

The phone numbers of these contacts are provided in Section 10.9 and will be posted in the site trailer.

The Sheriff's Department will be used in all emergencies that may involve exposure to people away from the work sites.

10.3 SITE PERSONNEL AND LINES OF AUTHORITY

A clear chain-of-command in emergency situations ensures clear and consistent communication between site personnel and, therefore, results in more effective response to the emergency situation. The duties of site personnel in emergency situations are outlined below:

The **Site Manager** will direct all emergency response operations, designate duties to other site personnel, and serve as liaison with government officials and emergency response teams.

The **Site Safety Officer** will make initial contact with off-site emergency response teams (first aid, fire, police, etc.), make recommendations on work stoppage, and provide for on-site first aid and rescue.

The **Command Post Supervisor** will be designated when no one is performing this function during normal site work. This person will maintain contact with off-site response teams and notify additional agencies or offices that need to be contacted.

Decontamination personnel will stand by to perform emergency decontamination. Decontamination personnel will also assist the safety officer in rescue operations when necessary.

Field personnel will assist in rescue operations or take over for decontamination personnel when they are required for other duties.

10.4 EMERGENCY SITE COMMUNICATIONS

Emergency communications will be maintained by use of air horns kept in the support areas and with each work crew. The emergency communications codes are given in **Table 8**, On-Site Emergency Communications.

10.5 EVACUATION PROCEDURES

Evacuation routes from work sites shall be designated during the Health and Safety kickoff meeting. Equipment shall be placed so as not to impede emergency escape and evacuation routes. A meeting spot will be established where all employees are to meet after an evacuation to allow for the identification and accounting.

10.6 EMERGENCY DECONTAMINATION AND FIRST AID

Decontamination procedures used in emergency situations will vary greatly with the severity and particulars of the situation. The AE Site Safety Officer is first aid/CPR certified and will provide advice on the medical and decontamination procedures to be used in each emergency situation. General guidelines for first aid and decontamination procedures are given below.

10.6.1 Inhalation Exposure

Remove the victim from the exposure area to an area with fresh air. Attempt rescue only if proper protective gear (Level B or C) is available for the rescue team. Remove protective clothing and respiratory protective gear as soon as possible to determine if the administration of CPR is necessary. If so, complete decontamination while CPR is being administered. Continue CPR until emergency medical unit arrives. If CPR is not required, complete decontamination and transport to hospital; administer other first-aid as indicated.

10.6.2 Contact Exposure

Remove victim from area and flush affected area with water only. Be careful not to spread the contamination to other parts of the body. Remove protective clothing and flush area with water only. Consult references to determine if soap and water wash is indicated. Do not remove a respirator until removal of contaminant from body is reasonably assured and the victim is well into a clean zone.

TABLE 8

ON-SITE EMERGENCY COMMUNICATIONS

AIR HORN SIGNAL	**ACTION**
THREE SHORT BLASTS	SHUT DOWN EQUIPMENT, STAND BY RADIO
ONE LONG BLAST	RETURN TO NEAREST SUPPORT ZONE
CONTINUOUS LONG BLASTS	EVACUATE SITE BY BEST, FASTEST ROUTE

HAND SIGNALS	**MEANING**
HAND GRIPPING THROAT	OUT OF AIR, CAN'T BREATHE
GRIP PARTNER'S WRIST	LEAVE AREA IMMEDIATELY; NO DEBATE
HANDS ON TOP OF HEAD	NEED ASSISTANCE
THUMBS UP	OK; I'M ALL RIGHT; I UNDERSTAND
THUMBS DOWN	NO; NEGATIVE

10.6.3 Physical Injury

If a physical injury occurs or worker collapses in a clean zone, first aid will be administered as indicated.

If a physical injury occurs in a contaminated zone, care must be taken to prevent contact of any contaminant with open wounds. The wound can provide easy access to the body for toxic chemicals that are not normally a skin absorption problem. Protective clothing will be removed carefully to avoid additional injury and avoid any exposure of the wound to contaminants on the clothing.

If a worker collapses or loses consciousness in a contaminated zone, remove protective clothing and respiratory protective gear as soon as possible to determine if the administration of CPR is necessary. If so, complete decontamination while CPR is being administered. Continue CPR until emergency medical units arrive. If CPR is not required, complete decontamination and transport to hospital: administer other first-aid as indicated. The field site will have at least two persons certified in CPR and first-aid per shift.

10.7 EMERGENCY MEDICAL TREATMENT AND FIRST AID

A first aid kit large enough to accommodate anticipated emergencies will be kept in the support zone. In addition, each work crew will carry a smaller first aid kit for minor injuries. If any injury should require advanced medical assistance, the victim will be transported to the hospital.

Each work site will have a vehicle for transportation to the hospital. Keys will be left in or near the ignition.

10.8 EMERGENCY AND PERSONAL PROTECTIVE EQUIPMENT

The support zone will have the following emergency equipment:

Self-Contained Breathing Apparatus (SCBA);
First Aid Kit;
Fire Extinguisher (A, B, C Type);
15-Minute Emergency Eyewash Station; and
Air Horn.

Each work crew will have at the work site the following emergency equipment:

First Aid Kit;
Fire Extinguisher (A, B, C Type);
Bolt Cutters;
Hand-Held Eyewash; and
Air Horn.

10.9 EMERGENCY TELEPHONE NUMBERS

Emergency telephone numbers for medical and chemical emergencies are given in **Table 9**, Emergency Telephone Numbers. These numbers will be displayed prominently near each site phone.

10.10 DIRECTIONS TO HOSPITAL

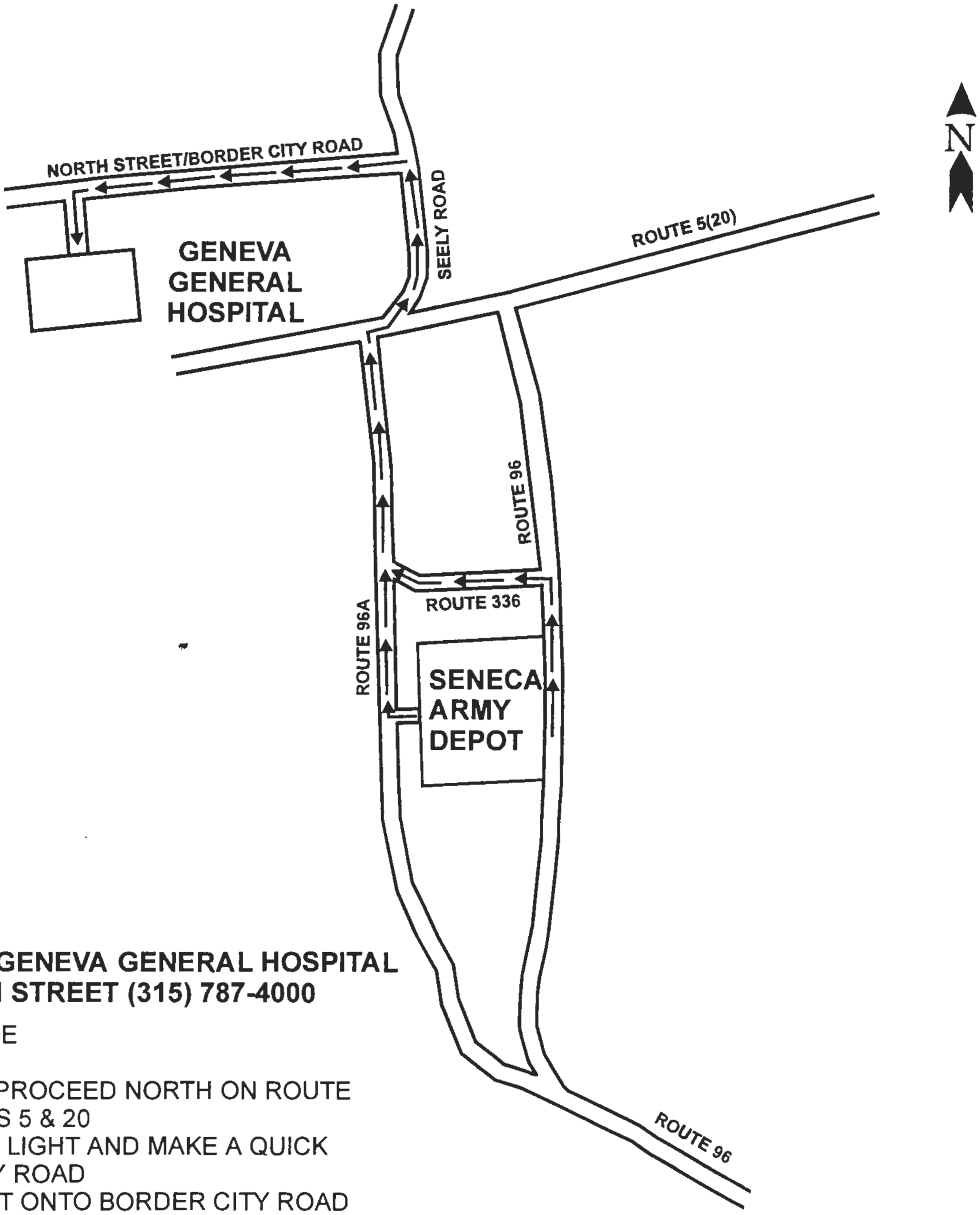
Directions to the nearest hospital are shown and described in **Figure 6**, Route to Geneva General Hospital. The map will be displayed in the command post and kept in every site vehicle. The nearest exits gates from SEDA are shown in **Figure 2** (**Section 2**). In most cases the exit gate will be locked and will require bolt cutters to cut the chain. **Work crews should include bolt cutters with their emergency equipment.**

TABLE 9

EMERGENCY TELEPHONE NUMBERS

Agency	Telephone Number
Police, Fire, & Ambulance Seneca County Sheriff Dispatch	1-315-539-9241
Geneva General Hospital 186-198 North Street Geneva, NY	1-315-798-4222
SEAD Security	1-607-869-1448
Poison Control Center (NJ)	1-800-962-1253
National Response Center/Chemtrec	1-800-424-9300
USEPA Emergency Response	1-215-596-1260
USEPA Hazardous Waste Hotline	1-800-621-3191

Responsible Person	Telephone Number	
	Work	Home
Mike Duchesneau (Parsons ES Project Manager)	781-401-2492	508-393-1824
Steve Absolom (SEDA Contact)	607-869-1450	
Brian Powell (Project H&S Officer)	315-451-9560	
Ed Grunwald (Parsons Corporate H&S Officer)	678-969-2394	770-594-9760
Medical Services Network (Dr. Mitchell)	1-800-874-4676, ext. 111	



DIRECTIONS TO GENEVA GENERAL HOSPITAL
196 NORTH STREET (315) 787-4000

FROM WEST SIDE

-EXIT SITE AND PROCEED NORTH ON ROUTE 96A TO ROUTES 5 & 20
-TURN RIGHT AT LIGHT AND MAKE A QUICK LEFT ON SEELY ROAD
-TAKE NEXT LEFT ONTO BORDER CITY ROAD WHICH TURNS INTO NORTH STREET IN GENEVA
-HOSPITAL IS ON LEFT

FROM EAST SIDE (POST 1)

-EXIT SITE AND PROCEED NORTH ON ROUTE 96 TO ROUTE 336
-TURN LEFT ONTO ROUTE 336 AND PROCEED ONTO ROUTE 96A
-PROCEED NORTH ON ROUTE 96A TO ROUTES 5 & 20
-TURN RIGHT AT LIGHT AND MAKE A QUICK LEFT ON SEELY ROAD
-TAKE NEXT LEFT ONTO BORDER CITY ROAD WHICH TURNS INTO NORTH STREET IN GENEVA
-HOSPITAL IS ON LEFT

NOTE:Not to scale

PARSONS
PARSONS ENGINEERING SCIENCE, INC.

CLIENT/PROJECT TITLE
SENECA ARMY DEPOT ACTIVITY

DEPT ENVIRONMENTAL ENGINEERING
DWG NO

FIGURE 6

MAP AND DIRECTIONS TO GENEVA HOSPITAL

SCALE NA
DATE MARCH 2001

R \PROJECT-GRAPHICS\SENECA\BASEMAP\HOSPITAL CDR

ATTACHMENT 1

MATERIAL SAFETY DATA SHEETS AND SAFETY CARDS

- Benzo(a)anthracene
- Benzo(a)pyrene
- Benzo(ghi)perylene
- Benzo(b)fluoranthene
- Benzo(k)fluoranthene
- Chrysene
- Dibenz(ah)anthracene
- alpha-Chlordane
- Endosulfan I
- 4,4'-DDT
- PCBs
- 2,4-DNT
- Aluminum
- Antimony
- Arsenic
- Beryllium
- Cadmium
- Calcium
- Chromium
- Copper
- Iron
- Lead
- Magnesium
- Manganese
- Mercury
- Nickel
- Potassium
- Zinc
- Asbestos

International Chemical Safety Cards

BENZ(a)ANTHRACENE

ICSC: 0385

BENZ(a)ANTHRACENE
1,2-Benzoanthracene
Benzo(a)anthracene
2,3-Benzphenanthrene
Naphthanthracene
$C_{18}H_{12}$
Molecular mass: 228.3

CAS # 56-55-3
RTECS # CV9275000
ICSC # 0385
EC # 601-033-00-9

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible.		Water spray, powder. In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION	Finely dispersed particles form explosive mixtures in air.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
EXPOSURE		AVOID ALL CONTACT!	
• **INHALATION**		Local exhaust or breathing protection.	Fresh air, rest.
• **SKIN**		Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
• **EYES**		Safety goggles, face shield, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• **INGESTION**	...	Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Sweep spilled substance into sealable containers: if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place (extra personal protection: complete protective clothing including self-contained breathing apparatus).	Well closed.	T symbol R: 45 S: 53-45

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0385

International Chemical Safety Cards

BENZ(a)ANTHRACENE

ICSC: 0385

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
COLOURLESS TO YELLOW-BROWN FLUORESCENT FLAKES OR POWDER.

PHYSICAL DANGERS:
Dust explosion possible if in powder or granular form, mixed with air.

CHEMICAL DANGERS:

OCCUPATIONAL EXPOSURE LIMITS (OELs):
TLV not established.

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation, through the skin and by ingestion.

INHALATION RISK:
Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly.

EFFECTS OF SHORT-TERM EXPOSURE:

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
This substance is probably carcinogenic to humans.

PHYSICAL PROPERTIES	Sublimation point: 435°C Melting point: 162°C Relative density (water = 1): 1.274	Solubility in water: none Vapour pressure, Pa at 20°C: 292 Octanol/water partition coefficient as log Pow: 5.61
ENVIRONMENTAL DATA	In the food chain important to humans, bioaccumulation takes place, specifically in seafood.	

NOTES

This substance is one of many polycyclic aromatic hydrocarbons - standards are usually established for them as mixtures, e.g., coal tar pitch volatiles. However, it may be encountered as a laboratory chemical in its pure form. Insufficient data are available on the effect of this substance on human health, therefore utmost care must be taken. Do NOT take working clothes home. Tetraphene is a common name.

ADDITIONAL INFORMATION

ICSC: 0385 **BENZ(a)ANTHRACENE**

ALDRICH CHEMICAL -- BENZO (A) PYRENE, 98%, B1008-0
MATERIAL SAFETY DATA SHEET
NSN: 681000N065303
Manufacturer's CAGE: 60928
Part No. Indicator: A
Part Number/Trade Name: BENZO (A) PYRENE, 98%, B1008-0

General Information

Company's Name: ALDRICH CHEMICAL CO INC
Company's P. O. Box: 355
Company's City: MILWAUKEE
Company's State: WI
Company's Country: US
Company's Zip Code: 53201
Company's Emerg Ph #: 414-273-3850
Company's Info Ph #: 414-273-3850
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SMJ
Date MSDS Prepared: 05JAN95
Safety Data Review Date: 23OCT95
MSDS Serial Number: BZRGR

Ingredients/Identity Information

Proprietary: NO
Ingredient: BENZO(A)PYRENE (CERCLA)
Ingredient Sequence Number: 01
Percent: 98
NIOSH (RTECS) Number: DJ3675000
CAS Number: 50-32-8
OSHA PEL: 0.2 MG/M3
ACGIH TLV: A2

Physical/Chemical Characteristics

Appearance And Odor: YELLOW GREEN POWDER.
Boiling Point: 923F,495C
Melting Point: >351F,>177C

Fire and Explosion Hazard Data

Extinguishing Media: WATER SPRAY, CARBON DIOXIDE, DRY CHEMICAL POWDER OR APPROPRIATE FOAM.
Special Fire Fighting Proc: WEAR NIOSH/MSHA APPROVED SCBA & FULL PROTECTIVE EQUIPMENT (FP N).
Unusual Fire And Expl Hazrds: NONE SPECIFIED BY MANUFACTURER.

Reactivity Data

Stability: YES
Cond To Avoid (Stability): NONE SPECIFIED BY MANUFACTURER.
Materials To Avoid: OXIDIZING AGENTS.
Hazardous Decomp Products: CARBON MONOXIDE, CARBON DIOXIDE.
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): NOT RELEVANT

Health Hazard Data

LD50-LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: YES
Route Of Entry - Ingestion: YES
Health Haz Acute And Chronic: ACUTE:HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. MAY CAUSE EYE IRRITATION. MAY CAUSE SKIN IRRITATION. SKIN LUNGS. TO THE BEST OF MANUFACTURER'S KNOWLEDGE, THE CHEMICAL, PHYSICAL & TOX PROPERTIES HAVE NOT BEEN THORO INVESTIGATED.
Carcinogenicity - NTP: YES
Carcinogenicity - IARC: YES

Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: BENZO (A) PYRENE:IARC MONO, SUPP, VOL 7, PG 56, 1987:GROUP 2A. NTP 7TH ANNUAL RPT ON CARCINS. 1994:ANTIC TO BE (SUP DAT)
Signs/Symptoms Of Overexp: SEE HEALTH HAZARDS.
Med Cond Aggravated By Exp: NONE SPECIFIED BY MANUFACTURER.
Emergency/First Aid Proc: EYES:FLUSH WITH COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINUTES. SKIN:FLUSH WITH COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING AND SHOES. INHALATION: REMOVE TO FRESH AIR. IF NOT BREATHING GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN. INGESTION:WASH OUT MOUTH WITH WATER PROVIDED PERSON IS CONSCIOUS. CALL A PHYSICIAN IMMEDIATELY.

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: EVACUTE AREA. WEAR NIOSH/MSHA APPROVED SCBA, RUBBER BOOTS AND HEAVY RUBBER GLOVES. WEAR DISPOSABLE COVERALLS AND DISCARD THEM AFTER USE. SWEEP UP, PLACE IN BAG & HOLD FOR WASTE DISP. VENT AREA & WASH SPILL SITE AFTER MATERIAL PICKUP IS COMPLETE.
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
Waste Disposal Method: DISSOLVE OR MIX THE MATERIAL WITH A COMBUSTIBLE SOLVENT AND BURN IN A CHEMICAL INCINERATOR EQUIPPED WITH AN AFTERBURNER AND SCRUBBER. OBSERVE ALL FEDERAL, STATE AND LOCAL ENVIRONMENTAL REGULATIONS.
Precautions-Handling/Storing: DO NOT BREATHE DUST. DO NOT GET IN EYES, ON SKIN, ON CLOTHING. CARCINOGEN. MUTAGEN. TERATOGEN. KEEP TIGHTLY CLOSED. STORE IN A COOL, DRY PLACE.
Other Precautions: NONE SPECIFIED BY MANUFACTURER.

Control Measures

Respiratory Protection: WEAR APPROPRIATE NIOSH/MSHA APPROVED RESPIRATOR.
Ventilation: USE ONLY IN A CHEMICAL FUME HOOD.
Protective Gloves: CHEMICAL-RESISTANT GLOVES.
Eye Protection: ANSI APPROVED CHEM WORKERS GOGGS (FP N).
Other Protective Equipment: ANSI APPROVED EMERGENCY EYE WASH AND DELUGE SHOWER (FP N). OTHER PROTECTIVE CLOTHING.
Work Hygienic Practices: WASH THOROUGHLY AFTER HANDLING.
Suppl. Safety & Health Data: EXPLAN OF CARCIN: CARCINOGEN. ANIMAL:SKIN, LUNG, LIVER.

Transportation Data

Disposal Data

Label Data

Label Required: YES
Technical Review Date: 23OCT95
Label Status: G
Common Name: BENZO (A) PYRENE, 98%, B1008-0
Chronic Hazard: YES
Signal Word: WARNING!
Acute Health Hazard-Moderate: X
Contact Hazard-Moderate: X
Fire Hazard-Slight: X
Reactivity Hazard-None: X
Special Hazard Precautions: TOXIC. ACUTE:HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. MAY CAUSE EYE IRRITATION. MAY CAUSE SKIN IRRITATION. CHRONIC:CANCER HAZARD. CONTAINS BENZO(A)PYRENE WHICH IS LISTED AS AN ANIMAL LUNG, SKIN AND LIVER CARCINOGEN (FP N). MAY ALTER GENETIC MATERIAL. TERATOGEN. TARGET ORGAN(S):SKIN, LUNGS. TO THE BEST OF MANUFACTURER'S KNOWLEDGE, THE CHEMICAL, PHYSICAL & TOX PROPERTIES HAVE NOT BEEN THOROUGHLY INVESTIGATED.
Protect Eye: Y
Protect Skin: Y
Protect Respiratory: Y
Label Name: ALDRICH CHEMICAL CO INC
Label P.O. Box: 355
Label City: MILWAUKEE

```
Label State: WI
Label Zip Code: 53201
Label Country: US
Label Emergency Number: 414-273-3850
```

International Chemical Safety Cards

BENZO(B)FLUORANTHENE

ICSC: 0720

BENZO(B)FLUORANTHENE
Benzo(e)acephenanthrylene
2,3-Benzofluoroanthene
$C_{20}H_{12}$
Molecular mass: 252.3

CAS # 205-99-2
RTECS # CU1400000
ICSC # 0720

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible.	NO open flames.	Water spray, powder.
EXPLOSION			
EXPOSURE		PREVENT DISPERSION OF DUST! STRICT HYGIENE! AVOID ALL CONTACT!	IN ALL CASES CONSULT A DOCTOR!
• **INHALATION**		Local exhaust or breathing protection.	Fresh air, rest.
• **SKIN**	MAY BE ABSORBED!	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention. Wear protective gloves when administering first aid.
• **EYES**		Safety goggles or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• **INGESTION**		Do not eat, drink, or smoke during work.	Wear protective gloves when inducing vomiting. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Sweep spilled substance into containers. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment.	Provision to contain effluent from fire extinguishing. Tightly closed.	Unbreakable packaging: put breakable packaging into closed unbreakable container.

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0720

International Chemical Safety Cards

BENZO(B)FLUORANTHENE

ICSC: 0720

IMPORTANT DATA	**PHYSICAL STATE; APPEARANCE:** COLOURLESS TO YELLOW CRYSTALS. **PHYSICAL DANGERS:** **CHEMICAL DANGERS:** Upon heating, toxic fumes are formed. **OCCUPATIONAL EXPOSURE LIMITS (OELs):** TLV not established.	**ROUTES OF EXPOSURE:** The substance can be absorbed into the body by inhalation of its aerosol and through the skin. **INHALATION RISK:** Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly. **EFFECTS OF SHORT-TERM EXPOSURE:** **EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:** This substance is possibly carcinogenic to humans.
PHYSICAL PROPERTIES	Melting point: 168°C Solubility in water: none	Vapour pressure, Pa at 20°C: <10 Octanol/water partition coefficient as log Pow: 6.04
ENVIRONMENTAL DATA	This substance may be hazardous to the environment; special attention should be given to the total environment. In the food chain important to humans, bioaccumulation takes place, specifically in oils and fats.	

NOTES

Depending on the degree of exposure, periodic medical examination is indicated. Data are insufficiently available on the effect of this substance on human health, therefore utmost care must be taken. Do NOT take working clothes home.

ADDITIONAL INFORMATION

ICSC: 0720 **BENZO(B)FLUORANTHENE**

International Chemical Safety Cards

BENZO(K)FLUORANTHENE

ICSC: 0721

BENZO(K)FLUOROANTHENE
11,12-Benzofluoroanthene
Dibenzo(b,j,k)fluorene
$C_{20}H_{12}$
Molecular mass: 252.3

CAS # 207-08-9
RTECS # DF6350000
ICSC # 0721

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible.	NO open flames.	Water spray, powder.
EXPLOSION			
EXPOSURE		PREVENT DISPERSION OF DUST! STRICT HYGIENE! AVOID ALL CONTACT!	IN ALL CASES CONSULT A DOCTOR!
• INHALATION		Local exhaust or breathing protection.	Fresh air, rest. Refer for medical attention.
• SKIN	MAY BE ABSORBED!	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention. Wear protective gloves when administering first aid.
• EYES		Safety goggles or eye protection in combination with breathing protection if powder.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• INGESTION		Do not eat, drink, or smoke during work.	Wear protective gloves when inducing vomiting. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Sweep spilled substance into containers. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment.	Provision to contain effluent from fire extinguishing. Separated from strong oxidants. Tightly closed.	

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0721

International Chemical Safety Cards

BENZO(K)FLUORANTHENE

ICSC: 0721

IMPORTANT DATA	**PHYSICAL STATE; APPEARANCE:** YELLOW CRYSTALS. **PHYSICAL DANGERS:** **CHEMICAL DANGERS:** Upon heating, toxic fumes are formed. Reacts with strong oxidants. **OCCUPATIONAL EXPOSURE LIMITS (OELs):** TLV not established.	**ROUTES OF EXPOSURE:** The substance can be absorbed into the body by inhalation of its aerosol and through the skin. **INHALATION RISK:** Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly. **EFFECTS OF SHORT-TERM EXPOSURE:** **EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:** This substance is possibly carcinogenic to humans.
PHYSICAL PROPERTIES	Boiling point: 480°C Melting point: 215.7°C	Solubility in water: none Octanol/water partition coefficient as log Pow: 6.84
ENVIRONMENTAL DATA	This substance may be hazardous to the environment; special attention should be given to the total environment. In the food chain important to humans, bioaccumulation takes place, specifically in oils and fats.	

NOTES

Data are insufficiently available on the effect of this substance on human health, therefore utmost care must be taken. Do NOT take working clothes home.

ADDITIONAL INFORMATION

ICSC: 0721 **BENZO(K)FLUORANTHENE**

IMPORTANT LEGAL NOTICE:

Chrysene, 98%
ACROS95251

**** SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION ****

MSDS Name: Chrysene, 98%
Catalog Numbers:
AC224140000, AC224140010, AC224140050, AC224145000
Synonyms:
1,2 Benzophenanthrene; Benzo(a)phenanthrene.

Company Identification (Europe): Acros Organics N.V.
Janssen Pharmaceuticalaan 3a
2440 Geel, Belgium

Company Identification (USA): Acros Organics
One Reagent Lane
Fairlawn, NJ 07410

For information in North America, call: 800-ACROS-01
For information in Europe, call: 0032(0) 14575211
For emergencies in the US, call CHEMTREC: 800-424-9300
For emergencies in Europe, call: 0032(0) 14575299

**** SECTION 2 - COMPOSITION, INFORMATION ON INGREDIENTS ****

CAS#	Chemical Name	%	EINECS#
218-01-9	Chrysene	98.0	205-923-4

Hazard Symbols: T
Risk Phrases: 45

**** SECTION 3 - HAZARDS IDENTIFICATION ****

EMERGENCY OVERVIEW

Appearance: very light beige.
Caution! Carcinogen. Mutagen. May cause eye and skin irritation. May cause respiratory and digestive tract irritation. May cause cancer in humans.
Target Organs: Liver, skin.

Potential Health Effects

Eye:
May cause eye irritation.

Skin:
May cause skin irritation.

Ingestion:
May cause gastrointestinal irritation with nausea, vomiting and diarrhea.

Inhalation:
May cause respiratory tract irritation.

Chronic:
May cause cancer in humans. May cause cancer according to animal studies.

**** SECTION 4 - FIRST AID MEASURES ****

Eyes:
Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.

Skin:
Get medical aid. Immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.

Ingestion:
Do NOT induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.

Inhalation:
Get medical aid immediately. Remove from exposure to fresh air immediately. If not breathing, give artificial respiration. If

breathing is difficult, give oxygen.

Notes to Physician:

Treat symptomatically and

**** SECTION 5 - FIRE FIGHTING MEASURES ****

General Information:

As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

Extinguishing Media:

In case of fire use water spray, dry chemical, carbon dioxide, or chemical foam.

**** SECTION 6 - ACCIDENTAL RELEASE MEASURES ****

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:

Vacuum or sweep up material and place into a suitable disposal container. Clean up spills immediately, observing precautions in the Protective Equipment section. Wear a self contained breathing apparatus and appropriate Personal protection. (See Exposure Controls, Personal Protection section). Provide ventilation.

**** SECTION 7 - HANDLING and STORAGE ****

Handling:

Wash thoroughly after handling. Wash hands before eating. Use only in a well ventilated area. Do not breathe dust, vapor, mist, or gas. Do not get on skin or in eyes. Do not ingest or inhale.

Storage:

Store in a cool, dry place. Store in a tightly closed container. Store in a cool, dry area away from incompatible substances.

**** SECTION 8 - EXPOSURE CONTROLS, PERSONAL PROTECTION ****

Engineering Controls:

Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Chrysene	as benzene solubles: 0.2 mg/m3 (listed under ** no name **).	none listed	benzene soluble fraction: 0.2 mg/m3 TWA (includes anthracene, BaP, phenanthrene, acridine, chrysene, and pyrene) (listed under ** no name **).

OSHA Vacated PELs:

Chrysene:

benzene soluble fraction: 0.2 mg/m3 TWA (anthracene, BaP, phenathrene, acridine, (listed under ** no name **)

Personal Protective Equipment

Eyes:

Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin:
Wear appropriate protective gloves to prevent skin exposure.
Clothing:
Wear appropriate protective clothing to prevent skin exposure.
Respirators:
Follow the OSHA respirator regulations found in 29CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

**** SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES ****

Physical State: Solid
Appearance: very light beige
Odor: Not available.
pH: Not available.
Vapor Pressure: Not available.
Vapor Density: Not available.
Evaporation Rate: Not available.
Viscosity: Not available.
Boiling Point: 448 deg C @ 760.00mm Hg
Freezing/Melting Point: 254 - 255 deg C
Autoignition Temperature: Not available.
Flash Point: Not available.
NFPA Rating:
Explosion Limits, Lower: Not available.
Upper: Not available.
Decomposition Temperature:
Solubility: insoluble
Specific Gravity/Density:
Molecular Formula: $C_{18}H_{12}$
Molecular Weight: 228.29

**** SECTION 10 - STABILITY AND REACTIVITY ****

Chemical Stability:
Stable under normal temperatures and pressures.
Conditions to Avoid:
Incompatible materials, dust generation.
Incompatibilities with Other Materials:
Strong oxidizing agents.
Hazardous Decomposition Products:
Carbon monoxide, carbon dioxide.
Hazardous Polymerization: Has not been reported.

**** SECTION 11 - TOXICOLOGICAL INFORMATION ****

RTECS#:
CAS# 218-01-9: GC0700000
LD50/LC50:
Not available.
Carcinogenicity:
Chrysene -
ACGIH: A3 - Animal Carcinogen
California: carcinogen; initial date 1/1/90
NIOSH: occupational carcinogen (listed as ** undefined **)
OSHA: Select carcinogen (listed as ** undefined **).
IARC: Group 3 carcinogen
Epidemiology:
No information available.
Teratogenicity:
No information available.
Reproductive Effects:
No information available.
Neurotoxicity:
No information available.
Mutagenicity:
Chrysene was mutagenic to S. Typhimurium in the presence of an exogenous metabolic system.

Other Studies:

Genotoxicity : Salmonella typhimurium TA97,TA98,TA100 with metabolic activation positive (Sakai.M.et al Mutat.Res1985); Saccharomyces cerrevisae (Miotic recombination) D3 strain 330mg/kg negative.

**** SECTION 12 - ECOLOGICAL INFORMATION ****

Ecotoxicity:

Water flea LC50 = 1.9 mg/L; 2 Hr.; UnspecifiedFish toxicity : LC50 (96hr) Neauthes arenacedentata >1ppm.(Rossi,S.S. et al Marine Pollut. Bull. 1978) Invertebrate toxicity : lethal treshold concentration (24hr) Daphnia Magna 0,7æg/l.(* Newsted,J.L. et al Environ. Toxicol. Chem. 1987) Bioaccumulation : 24hr Daphnia Magna log bioconcentration factor 3.7845 (*)

**** SECTION 13 - DISPOSAL CONSIDERATIONS ****

Chemical waste generators must determine whether a discarded chemical is classif
as a hazardous waste.
US EPA guidelines for the classification determination are listed in 40 CFR Part
Additionally, waste generators must consult state and local hazardous waste regu
ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series: CAS# 218-01-9: waste number U050.

**** SECTION 14 - TRANSPORT INFORMATION ****

US DOT
  No information available
Canadian TDG
  No information available.

**** SECTION 15 - REGULATORY INFORMATION ****

US FEDERAL
  TSCA
    CAS# 218-01-9 is listed on the TSCA inventory.
    Health & Safety Reporting List
      None of the chemicals are on the Health & Safety Reporting List.
    Chemical Test Rules
      None of the chemicals in this product are under a Chemical Test Rule.
    Section 12b
      None of the chemicals are listed under TSCA Section 12b.
    TSCA Significant New Use Rule
      None of the chemicals in this material have a SNUR under TSCA.
  SARA
    Section 302 (RQ)
      CAS# 218-01-9: final RQ = 100 pounds (45.4 kg)
    Section 302 (TPQ)
      None of the chemicals in this product have a TPQ.
    Section 313
      This material contains Chrysene (CAS# 218-01-9, 98 0%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 372.
  Clean Air Act:
    This material does not contain any hazardous air pollutants.
    This material does not contain any Class 1 Ozone depletors.
    This material does not contain any Class 2 Ozone depletors.
  Clean Water Act:
    None of the chemicals in this product are listed as Hazardous Substances under the CWA.
    CAS# 218-01-9 is listed as a Priority Pollutant under the Clean Water Act.
    None of the chemicals in this product are listed as Toxic Pollutants under the CWA.
  OSHA:
    None of the chemicals in this product are considered highly hazardous by OSHA.
STATE
  Chrysene can be found on the following state right to know lists:
  California, New Jersey, Florida, Pennsylvania, Minnesota,

Massachusetts.
The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:
WARNING: This product contains Chrysene, a chemical known to the state of California to cause cancer.
California No Significant Risk Level:
None of the chemicals in this product are listed.

European/International Regulations
European Labeling in Accordance with EC Directives
Hazard Symbols: T
Risk Phrases:
R 45 May cause cancer.
Safety Phrases:
S 53 Avoid exposure - obtain special instructions before use.
S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

WGK (Water Danger/Protection)
CAS# 218-01-9: No information available.

United Kingdom Occupational Exposure Limits

Canada
CAS# 218-01-9 is listed on Canada's DSL/NDSL List.
This product has a WHMIS classification of D2A.
CAS# 218-01-9 is not listed on Canada's Ingredient Disclosure List.

Exposure Limits
CAS# 218-01-9: OEL-AUSTRALIA;Carcinogen
OEL-BELGIUM;Carcinogen
OEL-GERMANY;Carcinogen
OEL-SWITZERLAND;Carcinogen
OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV
OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGI TLV

**** SECTION 16 - ADDITIONAL INFORMATION ****

MSDS Creation Date: 6/30/1999 Revision #2 Date: 8/02/2000

The information above is believed to be accurate and represents the best information currently available to us. However, 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 make their own investigations to determine the suitability of the information for their particular purposes. In no way shall the company be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if the company has been advised of the possibility of such damages.

International Chemical Safety Cards

DIBENZ(a,h)ANTHRACENE

ICSC: 0431

DIBENZO(a,h)ANTHRACENE
1,2:5,6-Dibenzanthracene
$C_{22}H_{14}$
Molecular mass: 278.4

CAS # 53-70-3
RTECS # HN2625000
ICSC # 0431
EC # 601-041-00-2

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible.	NO open flames.	Water spray, powder.
EXPLOSION			
EXPOSURE		AVOID ALL CONTACT!	
• **INHALATION**		Local exhaust or breathing protection.	Fresh air, rest.
• **SKIN**	Redness. Swelling. Itching.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
• **EYES**	Redness.	Face shield, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• **INGESTION**		Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Sweep spilled substance into sealable containers: if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place (extra personal protection: P3 filter respirator for toxic particles).	Well closed.	T symbol R: 45 S: 53-45

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0431

International Chemical Safety Cards

DIBENZ(a,h)ANTHRACENE

ICSC: 0431

I M P O R T A

PHYSICAL STATE; APPEARANCE:
COLOURLESS CRYSTALLINE POWDER.

PHYSICAL DANGERS:

CHEMICAL DANGERS:

OCCUPATIONAL EXPOSURE LIMITS (OELs):
TLV not established.

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation, through the skin and by ingestion.

INHALATION RISK:
Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly.

EFFECTS OF SHORT-TERM EXPOSURE:

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:

N T D A T A		The substance may have effects on the skin , resulting in photosensitization. This substance is probably carcinogenic to humans.
PHYSICAL PROPERTIES	Boiling point: 524°C Melting point: 267°C Relative density (water = 1): 1.28	Solubility in water: none Octanol/water partition coefficient as log Pow: 6.5
ENVIRONMENTAL DATA	In the food chain important to humans, bioaccumulation takes place, specifically in seafood.	

NOTES

This is one of many polycyclic aromatic hydrocarbons - standards are usually established for them as mixtures, e.g., coal tar pitch volatiles. However, it may be encountered as a laboratory chemical in its pure form. Insufficient data are available on the effect of this substance on human health, therefore utmost care must be taken. Do NOT take working clothes home. DBA is a commonly used name. This substance is one of many polycyclic aromatic hydrocarbons (PAH).

ADDITIONAL INFORMATION

ICSC: 0431 **DIBENZ(a,h)ANTHRACENE**

OCCUPATIONAL HEALTH SERVICES -- ALPHA-CHLORDANE OHS00776
MATERIAL SAFETY DATA SHEET
NSN: 681000N072391
Manufacturer's CAGE: 0G9K0
Part No. Indicator: A
Part Number/Trade Name: ALPHA-CHLORDANE OHS00776

General Information

Company's Name: OCCUPATIONAL HEALTH SERVICES INC
Company's Street: 11 WEST 42ND ST 12 FLOOR
Company's City: NEW YORK
Company's State: NY
Company's Country: US
Company's Zip Code: 10036
Company's Emerg Ph #: 615-366-2000
Company's Info Ph #: 800-445-3737;212-789-3535
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SMJ
Date MSDS Prepared: 03DEC90
Safety Data Review Date: 11JUN97
MSDS Serial Number: CDWTF
Hazard Characteristic Code: NK

Ingredients/Identity Information

Proprietary: NO
Ingredient: 4,7-METHANOINDAN, 1-ALPHA, 2-ALPHA, 4-BETA, 5,6,7 -BETA, 8,8-OCTACHLORO-3A-ALPHA 4,7,7A-ALPHA- TETRAHYDRO-; (ING 2)
Ingredient Sequence Number: 01
Percent: 100
NIOSH (RTECS) Number: PB9705000
CAS Number: 5103-71-9
OSHA PEL: N/K (FP N)
ACGIH TLV: N/K (FP N)

Proprietary: NO
Ingredient: ING 1:(ALPHA - CHLORDANE)
Ingredient Sequence Number: 02
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: SUPDAT:LT HEAD, NAUS, COUGH, CHEST COMPLAINTS, TREMORS, ARTHRALGIAS, FATG, THROMBOCYTOPENIC PURPURA, & MARKED (ING 4)
Ingredient Sequence Number: 03
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: ING 3:BRUISING, PANCYTOPENIA, APLASTIC, HEMOLYTIC, & MEGALOBLASTIC ANEMIAS, LEUKEMIA, & DEATH HAVE ALSO BEEN (ING 5)
Ingredient Sequence Number: 04
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: ING 4:RPTD. SKIN:RPTD CONT CAUSED EPISODES OF PARESTHESIA, TWITCHING OF RIGHT HAND & ARM, GRAND MAL SEIZURES, (ING 6)
Ingredient Sequence Number: 05
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: ING 5:& UNCON. OTHER EFTS MAY OCCUR AS DETAILED IN CHRONIC

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INHAL. INGEST:IN 2 YR FEEDING STUDY IN RATS, DIETARY (ING 7)
Ingredient Sequence Number: 06
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE
-------------------------------------
Proprietary: NO
Ingredient: ING 6:CONC OF 150 PPM PRDCED NOTED RETARDATION OF GROWTH,
LIVER & KIDNEY DMG, MYOCARDIAL DMG, & MILD INJURY TO (ING 8)
Ingredient Sequence Number: 07
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE
-------------------------------------
Proprietary: NO
Ingredient: ING 7:LUNGS. MARKED DMG TO LUNGS & INCR MORTALITY WERE
OBSERVED AT DIETARY CONCS OF 300 PPM. REPROD EFTS RPTD (ING 9)
Ingredient Sequence Number: 08
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE
-------------------------------------
Proprietary: NO
Ingredient: ING 8:IN ANIMALS INCL DECREASED VIABILITY OF OFFSPRING IN MICE
FED 100 MG/KG/DAY FOR 4 MONTHS; DECR FERTILITY (ING 10)
Ingredient Sequence Number: 09
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE
-------------------------------------
Proprietary: NO
Ingredient: ING 9:IN RATS & MICE; & EXCITABILITY & TREMORS IN OFFSPRING
WHEN KEPT W/TREATED MOTHERS, BUT NOT W/UNTREATED FEMALES.
Ingredient Sequence Number: 10
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE
-------------------------------------
Proprietary: NO
Ingredient: FIRST AID PROC:OR NORMAL SALINE, OCCASNLY LIFTING UPPER &
LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (ING 12)
Ingredient Sequence Number: 11
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE
-------------------------------------
Proprietary: NO
Ingredient: ING 11:AT LST 15 MINUTES. GET MED ATTN IMMED. INGEST:IF PERSON
IS CONSCIOUS & NOT CONVULSING, REMOVE BY GIVING (ING 13)
Ingredient Sequence Number: 12
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE
-------------------------------------
Proprietary: NO
Ingredient: ING 12:SYRUP OF IPECAC (IF VOMITING OCCURS, KEEP HEAD BELOW
THE HIPS TO PREVENT ASPIRATION). GIVE ACTIVATED (ING 14)
Ingredient Sequence Number: 13
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE
-------------------------------------
Proprietary: NO
Ingredient: ING 13:CHARCOAL FOLLOWED BY GASTRIC LAVAGE. FOLLOW WITH A
SALINE CATHARTIC. DO NOT GIVE FATS OR OILS. INTESTINAL(ING 15)
Ingredient Sequence Number: 14
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE
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Proprietary: NO
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Ingredient: ING 14:LAVAGE WITH 20% MANNITOL (200 ML) BY STOMACH TUBE IS ALSO USEFUL. GIVE ARTIFICIAL RESPIRATION WITH OXYG (ING 16)
Ingredient Sequence Number: 15
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: ING 15:IF RESPIRATION IS DEPRESSED. TREAT SYMPTOMATICALLY & SUPPORTIVELY. LAVAGE & ADMIN OF OXYG SHOULD BE (ING 17)
Ingredient Sequence Number: 16
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: ING 16:PERFORMED BY QUALIFIED MEDICAL PERSONNEL. GET MEDICAL ATTENTION IMMEDIATELY.
Ingredient Sequence Number: 17
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: SPILL PROC:FOR LATER DISPOSAL. KEEP UNNECESSARY PEOPLE AWAY. ISOLATE HAZARD AREA AND DENY ENTRY.
Ingredient Sequence Number: 18
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: RESP PROT:RESPIRATOR WITH A FULL FACEPIECE & ORGANIC VAPOR CARTRIDGE(S) IN COMBINATION WITH & HIGH EFFICIENCY (ING 20)
Ingredient Sequence Number: 19
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: ING 19:PARTICULATE FILTER. 500 MG/M3-ANY SUPPLIED-AIR RESPIRATOR WITH A HALF-MASK & OPERATED IN A PRESS-DEMAND (ING 21)
Ingredient Sequence Number: 20
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: ING 20:OR OTHER POSITIVE PRESS MODE. ESCAPE-ANY AIR-PURIFYING FULL FACEPIECE RESP (GAS MASK) W/CHIN-STYLE/FRONT (ING 22)
Ingredient Sequence Number: 21
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: ING 21:OR BACK-MOUNTED ORGANIC VAPOR CANISTER HAVING HIGH-EFFICIENCY PARTICULATE FILTER. ANY APPROP ESCAPE-TYPE (ING 23)
Ingredient Sequence Number: 22
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: ING 22:SELF-CONTAINED BREATHING APPARATUS.
Ingredient Sequence Number: 23
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

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Physical/Chemical Characteristics

Appearance And Odor: SOLID.
Boiling Point: 347F,175C
Melting Point: >223F,>106C
Vapor Pressure (MM Hg/70 F): 0.0001@20C
Specific Gravity: 1.59-1.63
Evaporation Rate And Ref: NOT KNOWN
Solubility In Water: INSOLUBLE

Fire and Explosion Hazard Data

Extinguishing Media: DRY CHEMICAL, CARBON DIOXIDE, WATER SPRAY/REGULAR FOAM. FOR LARGER FIRES, USE WATER SPRAY OR REGULAR FOAM.
Special Fire Fighting Proc: NIOSH APPRVD SCBA & FULL PROT EQUIP (FP N). MOVE CNTNR FROM FIRE AREA IF CAN BE DONE W/OUT RISK. EXTING USING AGENT SUITABLE FOR TYPE OF SURROUNDING (SUPDAT)
Unusual Fire And Expl Hazrds: NEGLIGIBLE FIRE HAZARD WHEN EXPOSED TO HEAT OR FLAME.

Reactivity Data

Stability: YES
Cond To Avoid (Stability): NONE SPECIFIED BY MANUFACTURER.
Materials To Avoid: ALKALIES (WEAK), OXIDIZERS (STRONG), PLASTICS, RUBBER, AND COATINGS.
Hazardous Decomp Products: MAY INCL HIGHLY TOXIC FUMES OF PHOSGENE, TOXIC & CORROSIVE FUMES OF CHLORIDES, AND OXIDES OF CARBON.
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): NOT RELEVANT.

Health Hazard Data

LD50-LC50 Mixture: LD50:(ORAL,RAT) 500 MG/KG
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: YES
Route Of Entry - Ingestion: YES
Health Haz Acute And Chronic: ACUTE:INHAL:SYMPS OF BLURRED VISION, COUGH, CONFUSN, ATAXIA, HDCH, WEAK, DIZZ, & DELIRIUM WERE RPTD FROM INHAL EXPOS TO CHLORDANE. SYMPS OF CNS STIMULATION MAY ALSO OCCUR AS DETAILED IN ACUTE INGEST. SKIN:MAY BE IRRITATING. ABSORP HAS CAUSED BLURRED VISION, CONFUSN, ATAXIA, HDCH, DIZZ, WEAK, & DELIRIUM(EFTS OF OVEREXP)
Carcinogenicity - NTP: NO
Carcinogenicity - IARC: YES
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: ALPHA-CHLORDANE:IARC MONO ON THE EVAL OF CARCIN RISK OF CHEM TO MAN, VOL 53, PG 115, 1991:GROUP 2B.
Signs/Symptoms Of Overexp: HLTH HAZ:IN SEV POISONING. CONVLS MAY DEVELOP & COMA & DEATH ARE POSS. EYE:MAY BE IRRITATING. INGEST:MAY CAUSE ABDOM PAIN, NAUS, VOMIT, & DIARR. STIMULATES CNS W/CONVLS SOMETIMES APPEARING AS FIRST SYMP OF POISONING. SYMPS OF HDCH, BLURRED VISION, HYPEREXCITABILITY, MUSCLE TWITCHING, TREMOR, INCOORDINATION, & (SUPDAT)
Med Cond Aggravated By Exp: PERSONS WITH CONVULSIVE DISORDERS ARE AT INCREASED RISK FROM EXPOSURE.
Emergency/First Aid Proc: INHAL:REMOVE TO FRESH AIR IMMED. IF BRTHG STOPPED, GIVE ARTF RESP. MAINTAIN AIRWAY & BLOOD PRES & ADMIN OXYG IF AVAIL. KEEP WARM & AT REST. TREAT SYMPTOMATICALLY & SUPPORTIVELY. GET MED ATTN. SKIN:REMOVE CONTAMD CLTHG & SHOES IMMED. WASH AFFECTED AREA W/SOAP DETERGENT & LG AMTS OF WATER UNTIL NO EVID OF CHEM REMAINS (APPROX 15-20 MINS). GET MED ATTN IMMED. EYE:WASH IMMED W/LG AMTS OF WATER(ING 11)

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: DO NOT TOUCH SPILLED MATL. STOP LEAK IF W/OUT RISK. SM SPILLS-TAKE UP W/SAND/OTHER ABSORB MATL & PLACE INTO CNTNRS FOR LATER DISP. SM DRY SPILLS-W/CLEAN SHOVEL PLACE MATL INTO CLEAN, DRY CNTNR & COVER. LARGER SPILLS, DIKE FAR AHEAD OF SPILL (ING 18)
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
Waste Disposal Method: OBSERVE ALL FEDERAL, STATE & LOC REGS WHEN STORING/DISPOSING OF SUBSTANCE. FOR ASSISTANCE, CONT DISTRICT DIRECTOR OF ENVIR PROT AGENCY. DISP SHOULD BE I/A/W 40 CFR 165 REC PROCEDURES FOR DISP & STORAGE OF PESTICIDES & PESTICIDE CONTAINERS.

Precautions-Handling/Storing: STORE AWAY FROM INCOMPATIBLE SUBSTANCES. STORE I/A/W 40 CFR 185 REC PROCEDURES FOR DISP & STORAGE OF PESTICIDES & PESTICIDE CONTAINERS.
Other Precautions: MAY BURN BUT DOES NOT IGNITE READILY. PREVENT DISPERSION OF DUST IN AIR. DO NOT ALLOW SPILLED MATERIAL TO CONTAMINATE WATER SOURCES.

Control Measures

Respiratory Protection: RESP SELECTED MUST BE NIOSH APPRVD. 5 MG/M3-ANY CHEM CARTRIDGE RESP W/ORG VAP CARTRIDGE(S) IN COMBINATION W/DUST, MIST, & FUME FILTER. 12.5 MG/M3-ANY SUPPLIED-AIR RESP OPERATED IN CONTINUOUS FLOW MODE. 25 MG/M3-ANY CHEM CARTRIDGE (ING 19)
Ventilation: PROVIDE LOCAL EXHAUST VENTILATION AND/OR GENERAL DILUTION VENTILATION TO MEET PUBLISHED EXPOSURE LIMIT.
Protective Gloves: IMPERVIOUS GLOVES (FP N).
Eye Protection: ANSI APPRVD CHEM WORKERS GOGGLES (FP N).
Other Protective Equipment: ANSI APPRVD EYE WASH & DELUGE SHOWER (FP N). PROTECTIVE (IMPERVIOUS) CLTHG & EQUIP TO PVNT SKIN CONTACT W/SUBSTANCE.
Work Hygienic Practices: NONE SPECIFIED BY MANUFACTURER.
Suppl. Safety & Health Data: FIRE FIGHT PROC:FIRE. AVOID BRTHG VAPS & DUSTS. KEEP UPWIND. EFTS OF OVEREXP:ATAXIA MAY ALSO OCCUR. IN SEV CASES OF POISONING, COMA & DEATH ARE POSS. EEG PATTERNS SUGGEST THAT DEATH IS DUE TO RESP ARREST BETWEEN/DURING CONVULSIVE EPISODES. CHRONIC:INHAL:IN ADDN TO SYMPS OF ACUTE EXPOS, CHRONIC EXPOS HAS CAUSED (ING 2)

Transportation Data

Disposal Data

Label Data

Label Required: YES
Technical Review Date: 11JUN97
Label Date: 11JUN97
Label Status: G
Common Name: ALPHA-CHLORDANE OHS00776
Chronic Hazard: YES
Signal Word: DANGER!
Acute Health Hazard-Severe: X
Contact Hazard-Severe: X
Fire Hazard-Slight: X
Reactivity Hazard-None: X
Special Hazard Precautions: ACUTE:INHAL:SYMPS OF BLURRED VISION, COUGH, CONFUSN, ATAXIA, HDCH, WEAK, DIZZ, & DELIRIUM. SYMPS OF CNS STIMULATION MAY ALSO OCCUR AS DETAILED IN ACUTE INGEST. SKIN:MAY BE IRRITATING. ABSORP HAS CAUSED BLURRED VISION, CONFUSN, ATAXIA, HDCH, DIZZ, WEAK, & DELIRIUM IN SEV POISONING. CONVLS MAY DEVELOP & COMA & DEATH ARE POSS. EYE CONT:MAY BE IRRITATING. INGEST:MAY CAUSE ABDOM PAIN, NAUS, VOMIT, DIARR & MAY STIMULATE CANCER HAZARD. THIS PROD IS LISTED AS AN ANIMAL LIVER CARCINOGEN (FP N). CAUSES LIVER & KIDNEY DMG IN LAB ANIMALS STUDIES. REPRO EFTS RPTD IN LAB ANIMALS.
Protect Eye: Y
Protect Skin: Y
Protect Respiratory: Y
Label Name: OCCUPATIONAL HEALTH SERVICES INC
Label Street: 11 WEST 42ND ST 12 FLOOR
Label City: NEW YORK
Label State: NY
Label Zip Code: 10036
Label Country: US
Label Emergency Number: 615-366-2000

International Chemical Safety Cards

ENDOSULFAN (MIXED ISOMERS)

ICSC: 0742

ENDOSULFAN (MIXED ISOMERS)
(1,4,5,6,7,7-Hexachloro-8,9,10-trinorborn-5-en-2,3-ylenedimethyl)sulfite
$C_9H_6Cl_6O_3S$
Molecular mass: 407

CAS # 115-29-7
RTECS # RB9275000
ICSC # 0742
UN # 2761
EC # 602-052-00-5

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Not combustible. Liquid formulations containing organic solvents may be flammable. Gives off irritating or toxic fumes (or gases) in a fire.		In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION	Explosion hazard will depend on formulation solvent or on the characteristics of the dust.		In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		PREVENT DISPERSION OF DUST! STRICT HYGIENE!	
• **INHALATION**	(see Ingestion).	Local exhaust or breathing protection.	Fresh air, rest. Refer for medical attention.
• **SKIN**	MAY BE ABSORBED!	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention.
• **EYES**		Face shield or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• **INGESTION**	Blue lips or fingernails. Convulsions. Diarrhoea. Dizziness. Headache. Nausea. Unconsciousness. Vomiting. Weakness.	Do not eat, drink, or smoke during work.	Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Rest. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Collect leaking liquid in sealable containers. Do NOT wash away into sewer. Sweep spilled substance into sealable containers. Carefully collect remainder, then remove to safe place (extra personal protection: complete protective clothing including self-contained breathing apparatus).	Separated from strong bases, acids, food and feedstuffs, ferrous material. Cool. Dry.	Do not transport with food and feedstuffs. T symbol R: 23/24/25-36/38 S: 2-13-44 UN Hazard Class: 6.1 UN Packing Group: II Marine pollutant.

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0742

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International Chemical Safety Cards

ENDOSULFAN (MIXED ISOMERS)

ICSC: 0742

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
COLOURLESS CRYSTALS. TECHNICAL PRODUCT: BROWN CRYSTALLINE FLAKES.

PHYSICAL DANGERS:

CHEMICAL DANGERS:
The substance decomposes on heating producing toxic and corrosive fumes: hydrogen chloride, sulfur oxides. Reacts with bases causing toxic (sulfur dioxides fumes) hazard.

OCCUPATIONAL EXPOSURE LIMITS (OELs):
TLV: ppm: 0.1 mg/m^3 (as TWA) (skin) (ACGIH 1991-1992).

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation, through the skin and by ingestion.

INHALATION RISK:
Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance may cause effects on the central nervous system , resulting in irritability and convulsions. Exposure at high levels may result in death. Medical observation is indicated.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:

PHYSICAL PROPERTIES

Melting point: 70-100°C
Relative density (water = 1): 1.75
Solubility in water: none
Vapour pressure, Pa at 80°C: 1.2
Octanol/water partition coefficient as log Pow: 3.55-3.62

ENVIRONMENTAL DATA

This substance may be hazardous to the environment; special attention should be given to fish and other water organisms.

NOTES

The substance is a mixture of alpha-isomer (melting point: 108-110°C) and beta-isomer (melting point: 208-210°C). Carrier solvents used in commercial formulations may change physical and toxicological properties. Do NOT take working clothes home. Beosit. Benzoepin. Cyclodan. Malix. Thifor. Thimul. Thiodan. Thionex. Thiosulfan among others are trade names.

Transport Emergency Card: TEC (R)-51G52

ADDITIONAL INFORMATION

ICSC: 0742 **ENDOSULFAN (MIXED ISOMERS)**

IMPORTANT LEGAL NOTICE:

International Chemical Safety Cards

DDT

ICSC: 0034

DDT
Dichlorodiphenyltrichloroethane
1,1,1-Trichloro-2,2-bis(p-chlorophenyl)ethane
2,2-bis(p-Chlorophenyl)-1,1,1-trichloroethane
$C_{14}H_9Cl_5$
Molecular mass: 354.5

CAS # 50-29-3
RTECS # KJ3325000
ICSC # 0034
UN # 2761
EC # 602-045-00-7

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible. Liquid formulations containing organic solvents may be flammable. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames.	Powder, water spray, foam, carbon dioxide.
EXPLOSION	Risk of fire and explosion if formulations contain flammable/explosive solvents.		In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		PREVENT DISPERSION OF DUST! STRICT HYGIENE!	IN ALL CASES CONSULT A DOCTOR!
• **INHALATION**	Cough.	Avoid inhalation of fine dust and mist. Local exhaust or breathing protection.	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
• **SKIN**		Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
• **EYES**		Safety goggles, or eye protection in combination with breathing protection if powder.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• **INGESTION**	Tremors. Convulsions. Diarrhoea. Dizziness. Vomiting. Numbness. Paresthesias. Hyperexcitability.	Do not eat, drink, or smoke during work.	Rinse mouth. Give a slurry of activated charcoal in water to drink. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Rest. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Do NOT wash away into sewer. Sweep spilled substance into sealable non-metallic containers: if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place (extra personal protection: P3 filter respirator for toxic particles).	Provision to contain effluent from fire extinguishing. Separated from strong bases, iron, aluminum and its salts, food and feedstuffs.	Do not transport with food and feedstuffs. Do NOT keep in iron or aluminum containers. T symbol N symbol R: 25-40-48/25-50/53 S: (1/2-)22-36/37-45-60-61 UN Hazard Class: 6.1 UN Packing Group: III Severe marine pollutant.

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0034

Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities

International Chemical Safety Cards

DDT

ICSC: 0034

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
COLOURLESS CRYSTALS OR WHITE POWDER.

PHYSICAL DANGERS:

CHEMICAL DANGERS:
On combustion, forms toxic and corrosive fumes including hydrogen chloride. Reacts with organic and inorganic bases, aluminum, iron.

OCCUPATIONAL EXPOSURE LIMITS (OELs):
TLV: ppm: 1 mg/m^3 (as TWA) (ACGIH 1993-1994).

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation and through the skin, and by ingestion.

INHALATION RISK:
Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly especially if powdered.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance irritates the eyes, the skin and the respiratory tract. The substance may cause effects on the central nervous system , resulting in convulsions and respiratory failure. Exposure may result in death. Medical observation is indicated.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
The substance may have effects on the central nervous system, liver. This substance is possibly carcinogenic to humans. Animal tests show that this substance possibly causes toxic effects upon human reproduction.

PHYSICAL PROPERTIES

Boiling point: 260°C
Melting point: 109°C
Relative density (water = 1): 1.5
Solubility in water: none
Octanol/water partition coefficient as log Pow: 6.36-6.38

ENVIRONMENTAL DATA

The substance is very toxic to aquatic organisms. This substance may be hazardous to the environment; special attention should be given to birds. In the food chain important to humans, bioaccumulation takes place, specifically in milk and aquatic organisms.

NOTES

Explosive limits are unknown in literature. Depending on the degree of exposure, periodic medical examination is indicated. Carrier solvents used in commercial formulations may change physical and toxicological properties. Do NOT take working clothes home. Agritan, Azotox, Anofex, Ixodex, Gesapon, Gesarex, Gesarol, Guesapon, and Neocid are trade names.

Transport Emergency Card: TEC (R)-61G53b

ADDITIONAL INFORMATION

ICSC: 0034 **DDT**

IMPORTANT LEGAL NOTICE:

Neither the CEC or the IPCS nor any person acting on behalf of the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use.

International Chemical Safety Cards

POLYCHLORINATED BIPHENYL (AROCLOR 1254)

ICSC: 0939

POLYCHLORINATED BIPHENYL (AROCLOR 1254)
Chlorobiphenyl (54% chlorine)
Chlorodiphenyl (54% chlorine)
PCB
Molecular mass: 327 (average)

CAS # 11097-69-1
RTECS # TQ1360000
ICSC # 0939
UN # 2315
EC # 602-039-00-4

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Not combustible. Irritating and toxic gases may be generated in a fire.		Powder, carbon dioxide.
EXPLOSION			
EXPOSURE		PREVENT GENERATION OF MISTS! STRICT HYGIENE!	
• INHALATION		Ventilation.	Fresh air, rest. Refer for medical attention.
• SKIN	MAY BE ABSORBED! Dry skin. Redness. Chloracne (further see Inhalation).	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention.
• EYES	Redness. Pain.	Safety goggles, face shield.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• INGESTION	Headache. Numbness. Fever.	Do not eat, drink, or smoke during work.	Rest. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Consult an expert! Collect leaking liquid in sealable containers. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT let this chemical enter the environment (extra personal protection: complete protective clothing including self-contained breathing apparatus).	Separated from food and feedstuffs. Cool. Dry. Keep in a well-ventilated room.	Unbreakable packaging; put breakable packaging into closed unbreakable container. Do not transport with food and feedstuffs. Xn symbol R: 33 S: 35 Note: C UN Hazard Class: 9 UN Packing Group: II

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0939

Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities

International Chemical Safety Cards

POLYCHLORINATED BIPHENYL (AROCLOR 1254)

ICSC: 0939

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
LIGHT YELLOW VISCOUS LIQUID.

PHYSICAL DANGERS:

CHEMICAL DANGERS:
The substance decomposes in a fire producing irritating and toxic gases.

OCCUPATIONAL EXPOSURE LIMITS (OELs):
TLV: ppm; 0.5 mg/m^3 (skin) (ACGIH 1991-1992).

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation of its aerosol, through the skin and by ingestion.

INHALATION RISK:
A harmful contamination of the air will be reached rather slowly on evaporation of this substance at 20°C.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance irritates the eyes (see Notes).

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
Repeated or prolonged contact with skin may cause dermatitis chloracne. The substance may have effects on the liver. Animal tests show that this substance possibly causes toxic effects upon human reproduction.

PHYSICAL PROPERTIES

Relative density (water = 1): 1.5
Solubility in water: none
Vapour pressure, Pa at 25°C: 0.01
Octanol/water partition coefficient as log Pow: 6.30 (estimated)

ENVIRONMENTAL DATA

In the food chain important to humans, bioaccumulation takes place, specifically in water organisms. It is strongly advised not to let the chemical enter into the environment.

NOTES

Changes into a resinous state (pour point) at 10°C. Distillation range: 365°-390°C. No open cup flash point to boiling. The symptoms other than the chloracne and liver effects may be in part due to contaminants of the PCB.

Transport Emergency Card: TEC (R)-914

ADDITIONAL INFORMATION

ICSC: 0939 **POLYCHLORINATED BIPHENYL (AROCLOR 1254)**

IMPORTANT LEGAL NOTICE:

International Chemical Safety Cards

DINITROTOLUENE (MIXED ISOMERS)

ICSC: 0465

DINITROTOLUENE (MIXED ISOMERS)
DNT (mixed isomers)
Methyl dinitrobenzene (mixed isomers)
Dinitrotoluol (mixed isomers)
$C_7H_6N_2O_4/C_6H_3(CH_3)(NO_2)_2$
Molecular mass: 182.1

CAS # 25321-14-6
RTECS # XT1300000
ICSC # 0465
UN # 2038 (see Notes)
EC # 609-007-00-9

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible.	NO open flames, NO sparks, and NO smoking.	Powder, water spray, foam, carbon dioxide.
EXPLOSION	Finely dispersed particles form explosive mixtures in air.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	Combat fire from a sheltered position.
EXPOSURE		PREVENT DISPERSION OF DUST! AVOID ALL CONTACT!	
• **INHALATION**	Drowsiness. Nausea. Vomiting. Weakness. (see Ingestion).	Local exhaust or breathing protection.	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
• **SKIN**	MAY BE ABSORBED! Blue lips or fingernails. Blue skin (further see Inhalation).	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention.
• **EYES**		Safety goggles, face shield.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• **INGESTION**	Blue lips or fingernails. Blue skin. Dizziness. Headache. Laboured breathing. Symptoms of delayed effects.	Do not eat, drink, or smoke during work.	Rinse mouth. Give large quantities of water. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention. Wear protective gloves when inducing vomiting.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Evacuate danger area! Sweep spilled substance into containers; if appropriate, moisten first to prevent dusting. Wash away remainder with plenty of water, then remove to safe place (extra personal protection: self-contained breathing apparatus).	Fireproof. Separated from strong oxidants, strong bases, food and feedstuffs, metals such as tin and zinc.	Do not transport with food and feedstuffs. T symbol R: 23/24/25-33 S: (1/2-)28-37-45 Note: C UN Hazard Class: 6.1 UN Packing Group: II

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0465

Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities

International Chemical Safety Cards

DINITROTOLUENE (MIXED ISOMERS)

ICSC: 0465

I M P O R T A N T D A T A

PHYSICAL STATE; APPEARANCE:
YELLOW, CRYSTALLINE POWDER OR A VISCOUS, OILY LIQUID IN MOLTEN STATE , WITH CHARACTERISTIC ODOUR.

PHYSICAL DANGERS:
Dust explosion possible if in powder or granular form, mixed with air.

CHEMICAL DANGERS:
Heating may cause violent combustion or explosion. The substance decomposes on heating producing toxic gases and fumes (carbon monoxide - see ICSC # 0023 and nitrogen oxides). Reacts violently with strong oxidants, strong bases and metals such as tin and zinc, causing fire and explosion hazard. Attacks some forms of plastics, rubber, and coatings.

OCCUPATIONAL EXPOSURE LIMITS (OELs):
TLV: ppm; 1.5 mg/m^3 (as TWA) (skin) (ACGIH 1995-1996).

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation and through the skin, and by ingestion.

INHALATION RISK:
Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance may cause effects on the the blood , resulting in the formation of methaemoglobin. Exposure could cause lowering of consciousness. Exposure to high concentrations may result in death. The effects may be delayed. Medical observation is indicated.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
The substance may have effects on the liver. May impair male fertility.

PHYSICAL PROPERTIES

Boiling point (decomposes): 250-300°C
Melting point: 54-93°C
Relative density (water = 1): 1.3 (liquid)
Solubility in water, g/100 ml: <0.03
Vapour pressure, kPa at 20°C: 0.13
Relative vapour density (air = 1): 6.28
Relative density of the vapour/air-mixture at 20°C (air = 1): 1.01
Flash point: 207°C c.c.
Octanol/water partition coefficient as log Pow: 2.0

ENVIRONMENTAL DATA

NOTES

Commercial grades of DNT typically consist of a mixture of all 6 isomers, but mainly 2,4-DNT(78%) and 2,6-DNT(19%). Other UN-number: 1600 (molten). Explosive limits are unknown in literature. Use of alcoholic beverages enhances the harmful effect. Check for peroxides prior to distillation; eliminate if found. Protective Clothing made of Saranex(TM) recommended.

Transport Emergency Card: TEC (R)-764
NFPA Code: H3; F1; R3;

ADDITIONAL INFORMATION

ICSC: 0465 **DINITROTOLUENE (MIXED ISOMERS)**

IMPORTANT LEGAL NOTICE:
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MSDS *Material Safety Data Sheet*

From: **Mallinckrodt Baker, Inc.**
222 Red School Lane
Phillipsburg, NJ 08865

J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

ALUMINUM POWDER

MSDS Number: A2712 --- ***Effective Date: 11/17/99***

1. Product Identification

Synonyms: Aluminum, aluminum metallic powder; CI 77000
CAS No.: 7429-90-5
Molecular Weight: 26.98
Chemical Formula: Al
Product Codes: 0446

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Aluminum Metal	7429-90-5	90 - 100%	Yes

3. Hazards Identification

Emergency Overview

WARNING! FLAMMABLE SOLID. DUST MAY FORM FLAMMABLE OR EXPLOSIVE MIXTURE WITH AIR, ESPECIALLY WHEN DAMP. HARMFUL IF INHALED. CAUSES IRRITATION TO EYES AND RESPIRATORY TRACT. MAY AFFECT LUNGS. MAY CAUSE SKIN IRRITATION.

J.T. Baker SAF-T-DATA$^{(tm)}$ Ratings (Provided here for your convenience)

Health Rating: 1 - Slight
Flammability Rating: 3 - Severe (Flammable)
Reactivity Rating: 2 - Moderate
Contact Rating: 1 - Slight
Lab Protective Equip: GOGGLES; LAB COAT; CLASS D EXTINGUISHER
Storage Color Code: Red (Flammable)

Potential Health Effects

Inhalation:
Causes irritation to the respiratory tract. Symptoms may include coughing, shortness of breath.
Ingestion:
Not considered toxic although aluminum chloride may form slowly in the digestive tract with nausea, vomiting, other gastrointestinal effects in extreme cases.
Skin Contact:
May cause irritation with redness and pain.
Eye Contact:
Causes irritation, redness, and pain.
Chronic Exposure:
Pulmonary fibrosis from chronic inhalation has been reported. Chronic exposure has also produced numbness in fingers and (in one case) brain effects.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye problems or impaired respiratory function may be more susceptible to the effects of the substance.

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
Ingestion:
Give several glasses of water to drink to dilute. If large amounts were swallowed, get medical advice.
Skin Contact:
Wash exposed area with soap and water. Get medical advice if irritation develops.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting upper and lower eyelids occasionally. Get medical attention.

5. Fire Fighting Measures

Fire:
Autoignition temperature: 760C (1400F)
Explosive limits not determined. Aluminum powder is flammable and can burn violently in the presence of oxidizing substances and certain metal oxides. Bulk powder, when moistened with water, spontaneously heats. Hazard increases as fineness increases. Reactions with strong acids and alkalis causes the release of flammable hydrogen gas.
Explosion:
Fine dust dispersed in air in sufficient concentrations, and in the presence of an ignition source is a potential dust explosion hazard. Minimum explosible concentration: 0.04 oz/ft3. An explosion occurred after mixing sodium hydrosulfite, aluminum powder, potassium carbonate and benzaldehyde. Sensitive to static discharge.
Fire Extinguishing Media:
Smother with a suitable dry powder. Do not use water. Do not use halogenated extinguishing media. Pressure from the extinguishing media may cause severe dusting.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Remove all sources of ignition. Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Clean up spills in a manner that does not disperse dust into the air. Use non-sparking tools and equipment. Avoid contact with water. Pick up spill for recovery or

disposal and place in a closed container.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Isolate from any source of heat or ignition. Protect from moisture. Avoid dust formation and control ignition sources. Employ grounding, venting and explosion relief provisions in accord with accepted engineering practices in any process capable of generating dust and/or static electricity. Empty only into inert or non-flammable atmosphere. Emptying contents into a non-inert atmosphere where flammable vapors may be present could cause a flash fire or explosion due to electrostatic discharge. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
-OSHA Permissible Exposure Limit (PEL):
15 mg/m3 (TWA) total dust and 5 mg/m3 (TWA)
respirable fraction for Aluminum metal as Al
-ACGIH Threshold Limit Value (TLV):
10 mg/m3 (TWA) Aluminum metal dusts

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded, a half-face dust/mist respirator may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece dust/mist respirator may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency, or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:
Wear protective gloves and clean body-covering clothing.

Eye Protection:
Use chemical safety goggles. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
Fine, free-flowing, silvery powder.
Odor:
Odorless.
Solubility:
Insoluble in water.
Density:
2.70
pH:
No information found.
% Volatiles by volume @ 21C (70F):
0
Boiling Point:
2327C (4221F)
Melting Point:
660C (1220F)

Vapor Density (Air=1):
No information found.
Vapor Pressure (mm Hg):
1 @ 1284C (2343F)
Evaporation Rate (BuAc=1):
No information found.

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage. Reacts with some acids and caustic solutions to produce hydrogen.
Hazardous Decomposition Products:
Toxic metal fumes may form when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Mercury, halocarbons, halogens, water (with bulk aluminum powder) strong oxidizing agents, some acids, bases and many other materials. An explosion occurred after mixing sodium hydrosulfite, aluminum powder, potassium carbonate and benzaldehyde.
Conditions to Avoid:
Moisture, heat, flames, ignition sources and incompatibles.

11. Toxicological Information

No LD50/LC50 information found relating to normal routes of occupational exposure.

```
--------\Cancer Lists\---------------------------------------------------
                                           ---NTP Carcinogen---
Ingredient                                 Known    Anticipated     IARC Category
------------------------------------       -----    -----------     -------------
Aluminum Metal (7429-90-5)                  No          No              None
```

12. Ecological Information

Environmental Fate:
No information found.
Environmental Toxicity:
No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste facility. Although not a listed RCRA hazardous waste, this material may exhibit one or more characteristics of a hazardous waste and require appropriate analysis to determine specific disposal requirements. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: ALUMINUM, POWDER UNCOATED, (NON-PYROPHORIC)
Hazard Class: 4.3
UN/NA: UN1396
Packing Group: II
Information reported for product/size: 500G

International (Water, I.M.O.)

Proper Shipping Name: ALUMINUM, POWDER UNCOATED, (NON-PYROPHORIC)
Hazard Class: 4.3
UN/NA: UN1396
Packing Group: II
Information reported for product/size: 500G

International (Air, I.C.A.O.)

Proper Shipping Name: ALUMINUM, POWDER UNCOATED, (NON-PYROPHORIC)
Hazard Class: 4.3
UN/NA: UN1396
Packing Group: II
Information reported for product/size: 500G

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\---------------------------------

Ingredient	TSCA	EC	Japan	Australia
Aluminum Metal (7429-90-5)	Yes	Yes	No	Yes

--------\Chemical Inventory Status - Part 2\---------------------------------

		--Canada--		
Ingredient	Korea	DSL	NDSL	Phil.
Aluminum Metal (7429-90-5)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\----------------

	-SARA 302-		------SARA 313------	
Ingredient	RQ	TPQ	List	Chemical Catg.
Aluminum Metal (7429-90-5)	No	No	Yes	No

--------\Federal, State & International Regulations - Part 2\----------------

		-RCRA-	-TSCA-
Ingredient	CERCLA	261.33	8(d)
Aluminum Metal (7429-90-5)	No	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: Yes Pressure: No
Reactivity: Yes (Pure / Solid)

Australian Hazchem Code: 4Y
Poison Schedule: No information found.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **1** Flammability: **3** Reactivity: **1**
Label Hazard Warning:
WARNING! FLAMMABLE SOLID. DUST MAY FORM FLAMMABLE OR EXPLOSIVE MIXTURE WITH AIR, ESPECIALLY WHEN DAMP. HARMFUL IF INHALED. CAUSES IRRITATION TO EYES AND RESPIRATORY TRACT. MAY AFFECT LUNGS. MAY CAUSE SKIN IRRITATION.
Label Precautions:
Keep away from heat, sparks and flame.
Avoid breathing dust.
Keep container closed.
Wash thoroughly after handling.
Do not contact with water.
Use only with adequate ventilation.
Label First Aid:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention. In case of eye contact, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician. In case of skin contact, flush skin with plenty of water for at least 15 minutes. Call a physician if irritation develops.
Product Use:
Laboratory Reagent.
Revision Information:
No changes.
Disclaimer:
****

Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.
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Prepared by: Strategic Services Division
Phone Number: (314) 539-1600 (U.S.A.)

MSDS *Material Safety Data Sheet*

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

From: **Mallinckrodt Baker, Inc.**
222 Red School Lane
Phillipsburg, NJ 08865

J.T.Baker

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

Antimony

MSDS Number: A7152 --- *Effective Date: 08/02/00*

1. Product Identification

Synonyms: Stibium, C.I. 77050
CAS No.: 7440-36-0
Molecular Weight: 121.75
Chemical Formula: Sb
Product Codes: 0848

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Antimony	7440-36-0	90 - 100%	Yes

3. Hazards Identification

Emergency Overview

POISON! DANGER! MAY BE FATAL IF INHALED. CAUSES IRRITATION. TARGET ORGAN (S): Respiratory system, cardiovascular system, eyes, skin.

J.T. Baker SAF-T-DATA$^{(tm)}$ Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Poison)
Flammability Rating: 1 - Slight
Reactivity Rating: 2 - Moderate
Contact Rating: 1 - Slight
Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES
Storage Color Code: Blue (Health)

Potential Health Effects

Inhalation:
Is harmful may be fatal.
Ingestion:
None identified.
Skin Contact:
Prolonged contact may cause dermatitis.
Eye Contact:
None identified.
Chronic Exposure:
Kidney damage, liver damage.
Aggravation of Pre-existing Conditions:
No information found.

4. First Aid Measures

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Prompt action is essential.
Ingestion:
If large amounts were swallowed, give water to drink and get medical advice.
Skin Contact:
In case of contact, flush skin with water.
Eye Contact:
In case of eye contact, immediately flush with plenty of water for at least 15 minutes.

5. Fire Fighting Measures

Fire:
Not expected to be a fire hazard.
Explosion:
Can be an explosion hazard, especially when heated.
Fire Extinguishing Media:
Use extinguishing media appropriate for surrounding fire.
Special Information:
No information found.

6. Accidental Release Measures

Wear self-contained breathing apparatus and full protective clothing. With clean shovel, carefully place material into clean, dry container and cover; remove from area. Flush spill area with water.

7. Handling and Storage

Keep container tightly closed. Store in secure poison area. Keep product out of light. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

-OSHA Permissible Exposure Limit (PEL):
0.5 mg/m3 (TWA)

-ACGIH Threshold Limit Value (TLV):
0.5 mg/m3 (TWA)

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):
For conditions of use where exposure to the substance is apparent, consult an industrial hygienist. For emergencies, or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:
Use chemical safety goggles and/or full face shield where dusting or splashing of solutions is possible. Maintain eye wash fountain and quick-drench facilities in work area.

---

9. Physical and Chemical Properties

Appearance:
Silvery-white metal.
Odor:
No information found.
Solubility:
Negligible (< 0.1%)
Specific Gravity:
6.68
pH:
No information found.
% Volatiles by volume @ 21C (70F):
0
Boiling Point:
1635C (2975F)
Melting Point:
630C (1166F)
Vapor Density (Air=1):
4.2
Vapor Pressure (mm Hg):
Not applicable.
Evaporation Rate (BuAc=1):
No information found.

---

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
No information found.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Strong oxidizing agents, strong acids, halogen acids, chlorine, fluorine.
Conditions to Avoid:
Heat, Light.

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11. Toxicological Information

--------\Cancer Lists\--

	---NTP Carcinogen---		
Ingredient	Known	Anticipated	IARC Category
Antimony (7440-36-0)	No	No	None

12. Ecological Information

Environmental Fate:
No information found.
Environmental Toxicity:
No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Not regulated.

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\---------------------------------

Ingredient	TSCA	EC	Japan	Australia
Antimony (7440-36-0)	Yes	Yes	No	Yes

--------\Chemical Inventory Status - Part 2\---------------------------------

		--Canada--		
Ingredient	Korea	DSL	NDSL	Phil.
Antimony (7440-36-0)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\----------------

	-SARA 302-		------SARA 313------	
Ingredient	RQ	TPQ	List	Chemical Catg.
Antimony (7440-36-0)	No	No	Yes	Antimony com

--------\Federal, State & International Regulations - Part 2\----------------

		-RCRA-	-TSCA-
Ingredient	CERCLA	261.33	8(d)
Antimony (7440-36-0)	5000	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No

```
Reactivity: No          (Pure / Solid)
```

Australian Hazchem Code: No information found.
Poison Schedule: No information found.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

Label Hazard Warning:
POISON! DANGER! MAY BE FATAL IF INHALED. CAUSES IRRITATION. TARGET ORGAN(S): Respiratory system, cardiovascular system, eyes, skin.
Label Precautions:
Avoid contact with eyes, skin, clothing.
Do not breathe dust. Keep in tightly closed container. Use with adequate ventilation. Wash thoroughly after handling.
Label First Aid:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Prompt action is essential. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse.
Product Use:
Laboratory Reagent.
Revision Information:
No changes.
Disclaimer:
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Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.
****

Prepared by: Strategic Services Division
Phone Number: (314) 539-1600 (U.S.A.)

International Chemical Safety Cards

ARSENIC

ICSC: 0013

ARSENIC
Grey arsenic
Metallic arsenic
As
Atomic mass: 74.9

CAS # 7440-38-2
RTECS # CG0525000
ICSC # 0013
UN # 1558
EC # 033-001-00-X

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames. NO contact with strong oxidizers. NO contact with hot surfaces.	Powder, water spray, foam, carbon dioxide.
EXPLOSION	Risk of fire and explosion is slight if in the form of fine powder or dust when exposed to hot surfaces or flames.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
EXPOSURE		AVOID ALL CONTACT!	IN ALL CASES CONSULT A DOCTOR!
• **INHALATION**	Cough. Diarrhoea. Shortness of breath. Sore throat. Vomiting. Weakness. Grey skin.	Closed system and ventilation.	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
• **SKIN**	Redness.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse skin with plenty of water or shower.
• **EYES**	Redness.	or eye protection in combination with breathing protection if powder.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• **INGESTION**	Diarrhoea. Nausea. Sore throat. Unconsciousness. Vomiting (further see Inhalation).	Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Evacuate danger area! Sweep spilled substance into sealable containers. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment (extra personal protection: complete protective clothing including self-contained breathing apparatus).	Provision to contain effluent from fire extinguishing. Separated from strong oxidants, acids, halogens, food and feedstuffs. Well closed. Keep in a well-ventilated room.	Do not transport with food and feedstuffs. T symbol R: 23/25 S: (1/2-)20/21-28-45 UN Hazard Class: 6.1 UN Packing Group: II Marine pollutant.

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0013

Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities © IPCS CEC 1993

International Chemical Safety Cards

ARSENIC

ICSC: 0013

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
ODOURLESS, BRITTLE, GREY, METALLIC-LOOKING CRYSTALS.

PHYSICAL DANGERS:

CHEMICAL DANGERS:
Upon heating, toxic fumes are formed. Reacts violently with strong oxidants and halogens causing fire and explosion hazard. Reacts with nitric acid, hot sulfuric acid. Toxic arsine gas may be formed in contact with acid or acidic substances and certain metals, such as galvanized or light metals.

OCCUPATIONAL EXPOSURE LIMITS (OELs):
TLV: ppm; 0.01 mg/m^3 (as TWA) A1 (ACGIH 1994-1995).

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation of its aerosol, through the skin and by ingestion.

INHALATION RISK:
Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance irritates the eyes, the skin and the respiratory tract. The substance may cause effects on the circulatory system, nervous system, kidneys and gastrointestinal tract , resulting in convulsions, kidney impairment, severe hemorrhage, losses of fluids, and electrolytes, shock and death. Exposure may result in death. The effects may be delayed. Medical observation is indicated.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
Repeated or prolonged contact with skin may cause dermatitis. Repeated or prolonged contact may cause skin sensitization. The substance may have effects on the mucous membranes, skin, kidneys, liver , resulting in neuropathy, pigmentation disorders, perforation of nasal septum and tissue lesions. This substance is carcinogenic to humans.

PHYSICAL PROPERTIES	Sublimation point: 613°C Relative density (water = 1): 5.7	Solubility in water: none
ENVIRONMENTAL DATA	The substance is toxic to aquatic organisms. It is strongly advised not to let the chemical enter into the environment because it persists in the environment.	

NOTES

The substance is combustible but no flash point is available in literature. Depending on the degree of exposure, periodic medical examination is indicated. Do NOT take working clothes home. Refer also to cards for specific arsenic compounds, e.g., Arsenic pentoxide (ICSC # 0377), Arsenic trichloride (ICSC # 0221), Arsenic trioxide (ICSC # 0378), Arsine (ICSC # 0222).

ADDITIONAL INFORMATION

ICSC: 0013 **ARSENIC**

IMPORTANT LEGAL NOTICE:

Neither the CEC or the IPCS nor any person acting on behalf of the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use.

International Chemical Safety Cards

BERYLLIUM

ICSC: 0226

BERYLLIUM
Glucinium
(powder)
Be
Atomic mass: 9.0

CAS # 7440-41-7
RTECS # DS1750000
ICSC # 0226
UN # 1567
EC # 004-001-00-7

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible.	NO open flames.	Special powder, dry sand, NO other agents.
EXPLOSION	Finely dispersed particles form explosive mixtures in air.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
EXPOSURE		PREVENT DISPERSION OF DUST! AVOID ALL CONTACT!	IN ALL CASES CONSULT A DOCTOR!
• **INHALATION**	Cough. Shortness of breath. Sore throat. Weakness. Symptoms may be delayed (see Notes).	Local exhaust. Breathing protection.	Fresh air, rest. Refer for medical attention.
• **SKIN**	Redness.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse skin with plenty of water or shower.
• **EYES**	Redness. Pain.	Face shield or eye protection in combination with breathing protection if powder.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• **INGESTION**		Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth. Do NOT induce vomiting. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Evacuate danger area! Consult an expert! Carefully collect the spilled substance into containers; if appropriate moisten first, then remove to safe place. Do NOT let this chemical enter the environment (extra personal protection: complete protective clothing including self-contained breathing apparatus).	Separated from strong acids, bases, chlorinated solvents, food and feedstuffs.	Unbreakable packaging; put breakable packaging into closed unbreakable container. Do not transport with food and feedstuffs. T+ symbol R: 49-25-26-36/37/38-43-48/23 S: 53-45 Note: E UN Hazard Class: 6.1 UN Subsidiary Risks: 4.1 UN Packing Group: II

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0226

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International Chemical Safety Cards

BERYLLIUM

ICSC: 0226

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
GREY TO WHITE METAL OR POWDER.

PHYSICAL DANGERS:
Dust explosion possible if in powder or granular form, mixed with air.

CHEMICAL DANGERS:
Reacts with strong acids and strong bases forming combustible gas (HYDROGEN - see ICSC # 0001). Forms shock sensitive mixtures with some chlorinated solvents, such as carbon tetrachloride and trichloroethylene.

OCCUPATIONAL EXPOSURE LIMITS (OELs):
TLV (as TWA): ppm; 0.002 mg/m^3 A2 (Suspected Human Carcinogen) (ACGIH 1994-1995).

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation of its aerosol and by ingestion.

INHALATION RISK:
Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly when dispersed.

EFFECTS OF SHORT-TERM EXPOSURE:
The aerosol of this substance irritates the respiratory tract. Inhalation of dust or fumes may cause chemical pneumonitis. Exposure may result in death. The effects may be delayed. Medical observation is indicated.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
Repeated or prolonged contact may cause skin sensitization. Lungs may be affected by repeated or prolonged exposure to dust particles , resulting in chronic beryllium disease (cough, weight loss, weakness). This substance is carcinogenic to humans.

PHYSICAL PROPERTIES

Boiling point: above 2500°C
Melting point: 1287°C
Relative density (water = 1): 1.9
Solubility in water: none

ENVIRONMENTAL DATA

The substance is very toxic to aquatic organisms.

NOTES

Depending on the degree of exposure, periodic medical examination is indicated.

Transport Emergency Card: TEC (R)-61G10
NFPA Code: H3; F1; R0

ADDITIONAL INFORMATION

ICSC: 0226 **BERYLLIUM**

IMPORTANT LEGAL NOTICE:

Neither the CEC or the IPCS nor any person acting on behalf of the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use.

Please reduce your browser font size for better viewing and printing.

MSDS Material Safety Data Sheet

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 202-483-7616

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

J.T.Baker

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

CADMIUM OXIDE

MSDS Number: C0132 --- *Effective Date: 11/17/99*

1. Product Identification

Synonyms: None
CAS No.: 1306-19-0
Molecular Weight: 128.41
Chemical Formula: CdO
Product Codes: 1234

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Cadmium Oxide	1306-19-0	99 - 100%	Yes

3. Hazards Identification

Emergency Overview

DANGER! CONTAINS CADMIUM. CANCER HAZARD. AVOID CREATING DUST. CAN CAUSE LUNG AND KIDNEY DISEASE. CAN CAUSE CANCER. Risk of cancer depends upon duration and level of exposure. MAY BE FATAL IF SWALLOWED OR INHALED. MAY CAUSE IRRITATION TO SKIN AND EYES. AFFECTS BLOOD AND PROSTATE. MAY AFFECT THE REPRODUCTIVE SYSTEM.

J.T. Baker SAF-T-DATA$^{(tm)}$ Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Cancer Causing)
Flammability Rating: 0 - None
Reactivity Rating: 0 - None
Contact Rating: 3 - Severe (Life)
Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES
Storage Color Code: Blue (Health)

Potential Health Effects

Inhalation:
Cadmium absorption is most efficient via respiratory tract. Inhalation of dust may produce irritation, headache, metallic taste and/or cough. Severe exposures may produce shortness of breath, chest pain, and flu-like symptoms with weakness, fever, headache, chills, sweating, nausea and muscular pain. Can cause pulmonary edema, liver and kidney damage and death. Symptoms from inhalation may be delayed for as much as 24 hours.

Ingestion:
Toxic. Ingested cadmium salts may cause severe and sometimes fatal poisonings. Symptoms can include severe nausea, vomiting, diarrhea, abdominal pains, choking, dizziness, and salivation. Kidney and liver dysfunction may occur. Although as little as 10 - 20 mg of soluble cadmium salts have produced severe toxic symptoms when ingested, death probably requires several hundred mg by oral route.

Skin Contact:
May cause irritation with redness and pain.

Eye Contact:
May cause irritation, redness and pain.

Chronic Exposure:
Chronic exposure to cadmium, even at relatively low concentrations, may result in kidney damage, anemia, pulmonary fibrosis, emphysema, perforation of the nasal septum, loss of smell, male reproductive effects, and an increased risk of cancer of the lung and of the prostate. Decrease in bone density, renal stones, and other evidence of disturbed calcium metabolism may be observed.

Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders, eye problems, blood disorders, prostate problems, or impaired liver, kidney or respiratory function may be more susceptible to the effects of the substance.

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Ingestion:
Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Skin Contact:
Wipe off excess material from skin then immediately flush skin with plenty of soap and water for at least 15 minutes. Remove contaminated clothing and shoes. Get medical attention immediately. Wash clothing before reuse. Thoroughly clean shoes before reuse.

Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

Note to Physician:
See 29 CFR 1910.1027, Appendix A for additional treatment information.

5. Fire Fighting Measures

Fire:
Not considered to be a fire hazard.

Explosion:
Not considered to be an explosion hazard.

Fire Extinguishing Media:
Use any means suitable for extinguishing surrounding fire.

Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. If involved in a fire, this material can emit very toxic fumes of cadmium.

6. Accidental Release Measures

Ventilate area of leak or spill. Keep unnecessary and unprotected people away from area of spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Pick up and place in a suitable container for reclamation or disposal, using a method that does not generate dust. Do not flush to the sewer. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Wear special protective equipment (Sec. 8) for maintenance break-in or where exposures may exceed established exposure levels. Wash hands, face, forearms and neck when exiting restricted areas. Shower, dispose of outer clothing, change to clean garments at the end of the day. Avoid cross-contamination of street clothes. Wash hands before eating and do not eat, drink, or smoke in workplace. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
-OSHA Threshold Limit Value (PEL):
5 ug/m3 of Cadmium (TWA), 2.5 ug/m3 (Action Level)
-ACGIH Threshold Limit Value (TLV) :
0.01 mg/m3 total dust, 0.002 mg/m3 respirable fraction for
cadmium and compounds, as Cd;
listed as A2, suspected human carcinogen.

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded, a half-face high efficiency dust/mist respirator may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece high efficiency dust/mist respirator may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres. See OSHA 1910.1027 for additional respirator information.

Skin Protection:
Wear protective gloves and clean body-covering clothing.

Eye Protection:
Use chemical safety goggles. Maintain eye wash fountain and quick-drench facilities in work area.

Other Control Measures:
Eating, drinking, and smoking should not be permitted in areas where solids or liquids containing cadmium compounds are handled, processed, or stored. See OSHA substance-specific standard for more information on personal protective equipment, engineering and work practice controls, medical surveillance, record keeping, and reporting requirements. (29 CFR 1910.1027).

9. Physical and Chemical Properties

Appearance:
Fine, brown crystals or powder.
Odor:
Odorless.
Solubility:
Insoluble in water.
Density:
8.15
pH:
No information found.
% Volatiles by volume @ 21C (70F):
0
Boiling Point:
1559C (2838F) Sublimes.
Melting Point:
950C (1742F) crystals decompose; < 1426C (< 2598F) powder.
Vapor Density (Air=1):
No information found.
Vapor Pressure (mm Hg):
1.3 mbar @ 1000C
Evaporation Rate (BuAc=1):
No information found.

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
Toxic cadmium oxide fumes may be formed at high temperatures (> 900C).
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Explodes when heated with magnesium. Cadmium dust presents a fire/explosion hazard if reacted with oxidizing agents, metals, hydrogen azide, zinc, selenium, or tellurium.
Conditions to Avoid:
Dusting and incompatibles.

11. Toxicological Information

Toxicological Data:
Oral rat LD50: 72 mg/kg; inhalation mouse LC50: 250 mg/m3/2-hour; Investigated as a tumorigen, mutagen, reproductive effector.
Reproductive Toxicity:
Reproductive effects recorded on humans. May cause teratogenic effects.

```
--------\Cancer Lists\------------------------------------------------------
                                              ---NTP Carcinogen---
Ingredient                                    Known    Anticipated    IARC Category
------------------------------------          -----    -----------    -------------
Cadmium Oxide (1306-19-0)                      No          Yes              1
```

12. Ecological Information

Environmental Fate:
No information found.
Environmental Toxicity:
No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste facility. Although not a listed RCRA hazardous waste, this material may exhibit one or more characteristics of a hazardous waste and require appropriate analysis to determine specific disposal requirements. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: CADMIUM COMPOUND, N.O.S. (CADMIUM OXIDE)
Hazard Class: 6.1
UN/NA: UN2570
Packing Group: III
Information reported for product/size: 50LB

International (Water, I.M.O.)

Proper Shipping Name: CADMIUM COMPOUND, N.O.S. (CADMIUM OXIDE)
Hazard Class: 6.1
UN/NA: UN2570
Packing Group: III
Information reported for product/size: 50LB

International (Air, I.C.A.O.)

Proper Shipping Name: CADMIUM COMPOUND, N.O.S. (CADMIUM OXIDE)
Hazard Class: 6.1
UN/NA: UN2570
Packing Group: III
Information reported for product/size: 50LB

15. Regulatory Information

```
--------\Chemical Inventory Status - Part 1\---------------------------------
Ingredient                                       TSCA  EC   Japan  Australia
-----------------------------------------------  ----  ---  -----  ---------
Cadmium Oxide (1306-19-0)                         Yes  Yes   Yes       Yes

--------\Chemical Inventory Status - Part 2\---------------------------------
                                                            --Canada--
Ingredient                                       Korea  DSL   NDSL  Phil.
-----------------------------------------------  -----  ---   ----  -----
Cadmium Oxide (1306-19-0)                         Yes   Yes   No     Yes

--------\Federal, State & International Regulations - Part 1\----------------
                                           -SARA 302-    ------SARA 313------
Ingredient                                 RQ    TPQ     List  Chemical Catg.
-----------------------------------------  ---   -----   ----  --------------
Cadmium Oxide (1306-19-0)                  100   100*    No    Cadmium comp

--------\Federal, State & International Regulations - Part 2\----------------
                                                      -RCRA-     -TSCA-
Ingredient                                 CERCLA     261.33      8(d)
-----------------------------------------  ------     ------     ------
```

Cadmium Oxide (1306-19-0)	1	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: No (Pure / Solid)

WARNING:
THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

Australian Hazchem Code: 2X
Poison Schedule: S6
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **3** Flammability: **0** Reactivity: **0**
Label Hazard Warning:
DANGER! CONTAINS CADMIUM. CANCER HAZARD. AVOID CREATING DUST. CAN CAUSE LUNG AND KIDNEY DISEASE. CAN CAUSE CANCER. Risk of cancer depends upon duration and level of exposure. MAY BE FATAL IF SWALLOWED OR INHALED. MAY CAUSE IRRITATION TO SKIN AND EYES. AFFECTS BLOOD AND PROSTATE. MAY AFFECT THE REPRODUCTIVE SYSTEM.
Label Precautions:
Do not breathe dust.
Do not get in eyes, on skin, or on clothing.
Keep container closed.
Do not enter storage areas unless adequately ventilated.
Use only with adequate ventilation.
Wash thoroughly after handling.
Label First Aid:
If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, wipe off excess material from skin then immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases get medical attention immediately.
Product Use:
Laboratory Reagent.
Revision Information:
New 16 section MSDS format, all sections have been revised.
Disclaimer:

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Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.

****

Prepared by: Strategic Services Division
Phone Number: (314) 539-1600 (U.S.A.)

MSDS *Material Safety Data Sheet*

From: **Mallinckrodt Baker, Inc.**
222 Red School Lane
Phillipsburg, NJ 08865

J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

CALCIUM METAL

MSDS Number: C0253 --- *Effective Date: 11/17/99*

1. Product Identification

Synonyms: Calcium metal crystalline
CAS No.: 7440-70-2
Molecular Weight: 40.08
Chemical Formula: Ca
Product Codes: 1262

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Calcium	7440-70-2	90 - 100%	Yes

3. Hazards Identification

Emergency Overview

DANGER! FLAMMABLE SOLID. WATER REACTIVE. CORROSIVE. HARMFUL OR FATAL IF SWALLOWED. HARMFUL IF INHALED OR ABSORBED THROUGH SKIN. CONTACT MAY CAUSE BURNS TO ALL BODY TISSUE.

J.T. Baker SAF-T-DATA$^{(tm)}$ Ratings (Provided here for your convenience)

Health Rating: 1 - Slight
Flammability Rating: 2 - Moderate
Reactivity Rating: 2 - Moderate
Contact Rating: 1 - Slight
Lab Protective Equip: GOGGLES; LAB COAT; CLASS D EXTINGUISHER
Storage Color Code: Red (Flammable)

Potential Health Effects

Inhalation:
Inhalation produces damaging effects on the mucous membranes and upper respiratory tract. Symptoms may include irritation of the nose and throat, and labored breathing. May cause lung edema, a medical emergency.
Ingestion:
Irritant due to formation of caustic lime by reaction with moisture. Large amounts may have a corrosive effect. Abdominal pain or stricture, possible nausea, vomiting, diarrhea are symptoms.
Skin Contact:
Corrosive. Symptoms of redness, pain, and severe burn can occur.
Eye Contact:
Corrosive. Causes redness, pain; possible burns and damage to eye tissues.
Chronic Exposure:
Prolonged inhalation of dust or fume may cause severe mucous membrane irritation, chemical pneumonitis.
Aggravation of Pre-existing Conditions:
No information found.

4. First Aid Measures

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Keep patient quiet in half upright position. Get medical attention immediately.
Ingestion:
If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
Wipe off excess material from skin then immediately flush skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:
Flammable solid, water reactive. Can react vigorously with water, steam, acids to release flammable/explosive hydrogen. Dangerous in presence of oxidants. Liquid calcium can react violently.
Explosion:
Possible explosion hazard from generated hydrogen or intimate contact with strong oxidizers. Contact with alkali hydroxides or carbonates may cause detonation.
Fire Extinguishing Media:
Use dry soda ash, dry salt, sand, graphite powder or metal-fire-extinguishing dry powder such as Met-L-X (R). Do not use water, foam, carbon dioxide, dry chemical, or chlorinated fire extinguishers.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Water spray may be used to keep fire exposed containers cool. Do not allow contact of calcium with water. Finely divided calcium exposed to moist air may ignite spontaneously.

6. Accidental Release Measures

Collect spilled material quickly and transfer to a container of kerosene, light oil or similar hydrocarbon fluid for recovery. Minimize exposure to air. Do not use water on metal. If the spilled calcium has come into contact with water, proceed cautiously. The reaction can rapidly proceed to self-ignition of hydrogen

and spattering of molten calcium. Evacuate the area, put on protective equipment and proceed as with a metal fire. Waste calcium should be packaged under a hydrocarbon fluid and sent to an approved disposal facility.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Keep away from water or locations where water may be needed for fire. Avoid high temperatures. Store under nitrogen or kerosene. Never store under halogenated hydrocarbons. A detached fire-resistive building is recommended for quantity storage. Isolate from air, acids, and oxidizing materials. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
None established.
Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures as low as possible. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
For conditions of use where exposure to the dust or mist is apparent, a full-face dust/mist respirator should be worn. For emergencies or instances where the exposure levels are not known, use a full-face positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.
Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.
Eye Protection:
Use chemical safety goggles and/or full face shield where dusting or splashing of solutions is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
Silver-gray granules or lumps.
Odor:
Odorless.
Solubility:
Reacts with water with evolution of hydrogen.
Density:
1.54
pH:
Water solution alkaline (pH > 7).
% Volatiles by volume @ 21C (70F):
0
Boiling Point:
1440C (2624F)
Melting Point:
850C (1562F)
Vapor Density (Air=1):
1.4
Vapor Pressure (mm Hg):
10 @ 983C (1801F)
Evaporation Rate (BuAc=1):
Not applicable.

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage. Water reactive.
Hazardous Decomposition Products:
Hydrogen, caustic calcium oxide and calcium hydroxide.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Air, asbestos cement, halogens, lead dichloride phosphorus pentoxide, silicon, sodium, mixed oxides, sulfur, water, acids, alcohols. Contact with alkali hydroxides or carbonates may cause detonation.
Conditions to Avoid:
Air, heat, flames, ignition sources and incompatibles.

11. Toxicological Information

No LD50/LC50 information found relating to normal routes of occupational exposure.

--------\Cancer Lists\---

	---NTP Carcinogen---		
Ingredient	Known	Anticipated	IARC Category
Calcium (7440-70-2)	No	No	None

12. Ecological Information

Environmental Fate:
No information found.
Environmental Toxicity:
No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: CALCIUM
Hazard Class: 4.3
UN/NA: UN1401
Packing Group: II
Information reported for product/size: 500G

International (Water, I.M.O.)

Proper Shipping Name: CALCIUM, METAL
Hazard Class: 4.3
UN/NA: UN1401
Packing Group: II
Information reported for product/size: 500G

International (Air, I.C.A.O.)

Proper Shipping Name: CALCIUM, METAL
Hazard Class: 4.3
UN/NA: UN1401
Packing Group: II
Information reported for product/size: 500G

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\---------------------------------

Ingredient	TSCA	EC	Japan	Australia
Calcium (7440-70-2)	Yes	Yes	No	Yes

--------\Chemical Inventory Status - Part 2\---------------------------------

		--Canada--		
Ingredient	Korea	DSL	NDSL	Phil.
Calcium (7440-70-2)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\----------------

	-SARA 302-		------SARA 313------	
Ingredient	RQ	TPQ	List	Chemical Catg.
Calcium (7440-70-2)	No	No	No	No

--------\Federal, State & International Regulations - Part 2\----------------

		-RCRA-	-TSCA-
Ingredient	CERCLA	261.33	8(d)
Calcium (7440-70-2)	No	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: Yes Pressure: No
Reactivity: Yes (Pure / Solid)

Australian Hazchem Code: 4W
Poison Schedule: No information found.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **3** Flammability: **1** Reactivity: **2** Other: **Water reactive**
Label Hazard Warning:
DANGER! FLAMMABLE SOLID. WATER REACTIVE. CORROSIVE. HARMFUL OR FATAL IF SWALLOWED. HARMFUL IF INHALED OR ABSORBED THROUGH SKIN. CONTACT MAY CAUSE BURNS TO ALL BODY TISSUE.
Label Precautions:
Do not get in eyes, on skin, or on clothing.
Do not breathe dust.

Use only with adequate ventilation.
Store in a tightly closed container.
Wash thoroughly after handling.
Remove and wash contaminated clothing promptly.
Do not allow contact with water, acids, or moisture.
Keep away from heat, sparks and flame.

Label First Aid:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, wipe off excess material from skin then immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. In all cases get medical attention immediately.

Product Use:

Laboratory Reagent.

Revision Information:

No changes.

Disclaimer:

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Prepared by: Strategic Services Division
Phone Number: (314) 539-1600 (U.S.A.)

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

MSDS Material Safety Data Sheet

From: **Mallinckrodt Baker, Inc.**
222 Red School Lane
Phillipsburg, NJ 08865

J.T.Baker

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

CHROMIUM CHLORIDE

MSDS Number: C4312 --- *Effective Date: 12/09/96*

1. Product Identification

Synonyms: Chromium (III) chloride, hexahydrate (1:3:6); Chromic chloride hexahydrate; Chromium trichloride hexahydrate; Chromium Chloride, 6-Hydrate
CAS No.: 10025-73-7
Molecular Weight: 266.48
Chemical Formula: CrCl3.6H2O
Product Codes: 1588

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Chromic Chloride	10025-73-7	90 - 100%	Yes

3. Hazards Identification

Emergency Overview

WARNING! HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT.

J.T. Baker SAF-T-DATA$^{(tm)}$ Ratings (Provided here for your convenience)

Health Rating: 1 - Slight
Flammability Rating: 0 - None
Reactivity Rating: 2 - Moderate
Contact Rating: 2 - Moderate
Lab Protective Equip: GOGGLES; LAB COAT
Storage Color Code: Orange (General Storage)

Potential Health Effects

Inhalation:
Causes irritation to the respiratory tract. Symptoms may include coughing, shortness of breath. May cause headache, dyspnea, and fever. May also cause tracheobronchial irritation and pulmonary edema.
Ingestion:
Causes irritation to the gastrointestinal tract. Large oral doses may cause dizziness intense thirst, abdominal pain, vomiting, and shock. Death may occur from renal failure. Chromium compounds in the 3+ state have a much lower toxicity than those in the 6+ state.
Skin Contact:
Causes irritation to skin. Symptoms include redness, itching, and pain. Prolonged contact may cause skin ulcerations.
Eye Contact:
Causes irritation, redness, and pain. Prolonged contact may cause eye damage.
Chronic Exposure:
Prolonged or repeated skin exposure may cause dermatitis. Prolonged or repeated inhalation of dust may cause perforation of the nasal septum.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin conditions or impaired respiratory function may be more susceptible to the effects of this substance.

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
Ingestion:
Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention.
Skin Contact:
Immediately flush skin with plenty of soap and water for at least 15 minutes. Remove contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:
Not considered to be a fire hazard.
Explosion:
Not considered to be an explosion hazard.
Fire Extinguishing Media:
Use any means suitable for extinguishing surrounding fire.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Sweep up and containerize for reclamation or disposal. Vacuuming or wet sweeping may be used to avoid dust dispersal. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
-OSHA Permissible Exposure Limit (PEL):
for Cr(III) compounds = 0.5mg/m3 (TWA)

-ACGIH Threshold Limit Value (TLV):
for Cr(III) compounds = 0.5 mg/m3 (TWA), A4 - Not classifiable as a human carcinogen
Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded, a half-face dust/mist respirator may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece dust/mist respirator may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency, or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.
Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.
Eye Protection:
Use chemical safety goggles and/or full face shield where dusting or splashing of solutions is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
Greenish-black or violet crystals.
Odor:
Odorless.
Solubility:
Soluble in water.
Specific Gravity:
1.85
pH:
No information found.
% Volatiles by volume @ 21C (70F):
0
Boiling Point:
> 1300C (> 2372F) Dissociates
Melting Point:
1152C (2106F)
Vapor Density (Air=1):
No information found.
Vapor Pressure (mm Hg):
No information found.
Evaporation Rate (BuAc=1):
No information found.

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
Emits toxic fumes of chlorine when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Strong oxidizing agents, lithium and nitrogen.
Conditions to Avoid:
Incompatibles.

11. Toxicological Information

Toxicological Data:
Oral rat LD50: 1790 mg/kg (hydrated form).
Oral rat LD50: 1870 mg/kg (anhydrous form). Investigated as a tumorigen, mutagen, reproductive effector.
Carcinogenicity:
ACGIH classification: Group A4 - Not classifiable as a human carcinogen.

--------\Cancer Lists\--

	---NTP Carcinogen---		
Ingredient	Known	Anticipated	IARC Category
Chromic Chloride (10025-73-7)	No	No	3

12. Ecological Information

Environmental Fate:
When released into the soil, this material may leach into groundwater. When released into water, this material is not expected to evaporate significantly. This material is not expected to significantly bioaccumulate. When released into the air, this material may be removed from the atmosphere to a moderate extent by wet deposition.
Environmental Toxicity:
No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Not regulated.

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\---------------------------------

Ingredient	TSCA	EC	Japan	Australia
Chromic Chloride (10025-73-7)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\---------------------------------

		--Canada--		
Ingredient	Korea	DSL	NDSL	Phil.
Chromic Chloride (10025-73-7)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\----------------

	-SARA 302-		------SARA 313------	
Ingredient	RQ	TPQ	List	Chemical Catg.
Chromic Chloride (10025-73-7)	1	1*	No	Chromium com

--------\Federal, State & International Regulations - Part 2\----------------

		-RCRA-	-TSCA-
Ingredient	CERCLA	261.33	8(d)
Chromic Chloride (10025-73-7)	1	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: No (Mixture / Solid)

Australian Hazchem Code: No information found.
Poison Schedule: No information found.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **1** Flammability: **0** Reactivity: **0**
Label Hazard Warning:
WARNING! HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT.
Label Precautions:
Avoid contact with eyes, skin and clothing.
Avoid breathing dust.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Label First Aid:
If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases, get medical attention.
Product Use:
Laboratory Reagent.
Revision Information:
New 16 section MSDS format, all sections have been revised.
Disclaimer:
****

****

Prepared by: Strategic Services Division
Phone Number: (314) 539-1600 (U.S.A.)

MSDS *Material Safety Data Sheet*

From: **Mallinckrodt Baker, Inc.**
222 Red School Lane
Phillipsburg, NJ 08865

J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

Ferric Oxide

MSDS Number: F1306 --- *Effective Date: 06/30/98*

1. Product Identification

Synonyms: Iron (III) Oxide; Red Iron Oxide; C.I. 77491; Iron Sesquioxide
CAS No.: 1309-37-1
Molecular Weight: 159.69
Chemical Formula: Fe_2O_3
Product Codes: 2024

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Iron Oxide, Fe_2O_3	1309-37-1	98 - 100%	Yes

3. Hazards Identification

Emergency Overview

WARNING! HARMFUL IF INHALED. AFFECTS RESPIRATORY SYSTEM. MAY CAUSE IRRITATION TO EYES AND RESPIRATORY TRACT.

J.T. Baker SAF-T-DATA$^{(tm)}$ Ratings (Provided here for your convenience)

Health Rating: 1 - Slight
Flammability Rating: 0 - None
Reactivity Rating: 1 - Slight
Contact Rating: 1 - Slight
Lab Protective Equip: GOGGLES; LAB COAT
Storage Color Code: Orange (General Storage)

Potential Health Effects

Inhalation:
May cause irritation to the respiratory tract. Symptoms may include coughing and shortness of breath.
Ingestion:
Extremely large oral dosages may produce gastrointestinal disturbances.
Skin Contact:
No adverse effects expected.
Eye Contact:
May cause mechanical irritation.
Chronic Exposure:
Long-term inhalation exposure to iron has resulted in mottling of the lungs, a condition referred to as siderosis. This is considered a benign pneumoconiosis and does not ordinarily cause significant physiological impairment. Long term eye exposures may stain the eyes and leave a "rust ring".
Aggravation of Pre-existing Conditions:
Persons with impaired respiratory function may be more susceptible to the effects of the substance.

4. First Aid Measures

Inhalation:
Remove to fresh air. Get medical attention for any breathing difficulty.
Ingestion:
If large amounts were swallowed, give water to drink and get medical advice.
Skin Contact:
Wash exposed area with soap and water. Get medical advice if irritation develops.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting upper and lower eyelids occasionally. Get medical attention if irritation persists.

5. Fire Fighting Measures

Fire:
Not expected to be a fire hazard.
Explosion:
No information found.
Fire Extinguishing Media:
Use any means suitable for extinguishing surrounding fire.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Pick up and place in a suitable container for reclamation or disposal, using a method that does not generate dust.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
- OSHA Permissible Exposure Limit (PEL) -
Iron oxide fume: 10 mg/m3
- ACGIH Threshold Limit Value (TLV) -
Iron oxide dust and fume (Fe_2O_3) as Fe: 5 mg/m3 (TWA), inhalable particulate;
for particulate matter containing no asbestos and < 1% crystalline silica.
A4 - Not classifiable as a human carcinogen.
Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded, a half-face dust/mist respirator may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece dust/mist respirator may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency, or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.
Skin Protection:
Wear protective gloves and clean body-covering clothing.
Eye Protection:
Use chemical safety goggles. Maintain eye wash fountain and quick-drench facilities in work area.

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9. Physical and Chemical Properties

Appearance:
Reddish-brown powder.
Odor:
No information found.
Solubility:
Negligible (< 0.1%)
Specific Gravity:
5.24
pH:
No information found.
% Volatiles by volume @ 21C (70F):
0
Boiling Point:
No information found.
Melting Point:
1565C (2849F)
Vapor Density (Air=1):
Not applicable.
Vapor Pressure (mm Hg):
Not applicable.
Evaporation Rate (BuAc=1):
No information found.

---

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
No information found.

Hazardous Polymerization:
Will not occur.
Incompatibilities:
Carbon monoxide, hydrazine, calcium hypochloride, performic acid, bromine pentafluoride.
Conditions to Avoid:
Incompatibles.

11. Toxicological Information

No LD50/LC50 information found relating to normal routes of occupational exposure. Investigated as a tumorigen.

--------\Cancer Lists\--

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Iron Oxide, Fe2O3 (1309-37-1)	No	No	3

12. Ecological Information

Environmental Fate:
No information found.
Environmental Toxicity:
No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Not regulated.

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\---------------------------------

Ingredient	TSCA	EC	Japan	Australia
Iron Oxide, Fe2O3 (1309-37-1)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\---------------------------------

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Iron Oxide, Fe2O3 (1309-37-1)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\----------------

-SARA 302- ------SARA 313------

Ingredient	RQ	TPQ	List	Chemical Catg.
Iron Oxide, Fe2O3 (1309-37-1)	No	No	No	No

--------\Federal, State & International Regulations - Part 2\----------------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Iron Oxide, Fe2O3 (1309-37-1)	No	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: No (Pure / Solid)

Australian Hazchem Code: No information found.
Poison Schedule: No information found.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **1** Flammability: **0** Reactivity: **0**
Label Hazard Warning:
WARNING! HARMFUL IF INHALED. AFFECTS RESPIRATORY SYSTEM. MAY CAUSE IRRITATION TO EYES AND RESPIRATORY TRACT.
Label Precautions:
Avoid contact with eyes, skin and clothing.
Wash thoroughly after handling.
Avoid breathing dust.
Keep container closed.
Use only with adequate ventilation.
Label First Aid:
If inhaled, remove to fresh air. Get medical attention for any breathing difficulty. In case of eye contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation develops or persists.
Product Use:
Laboratory Reagent.
Revision Information:
MSDS Section(s) changed since last revision of document include: 3, 4, 5, 6, 7, 8, 9, 10, 11, 16.
Disclaimer:

Prepared by: Strategic Services Division
Phone Number: (314) 539-1600 (U.S.A.)

International Chemical Safety Cards

LEAD

ICSC: 0052

LEAD
Lead metal
Plumbum
(powder)
Pb
Atomic mass: 207.2

CAS # 7439-92-1
RTECS # OF7525000
ICSC # 0052

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Not combustible. Finely divided lead powder is flammable. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames, NO sparks, and NO smoking (if in powder form).	In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION	Finely dispersed particles form explosive mixtures in air.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
EXPOSURE		PREVENT DISPERSION OF DUST! STRICT HYGIENE! AVOID EXPOSURE OF (PREGNANT) WOMEN! AVOID EXPOSURE OF ADOLESCENTS AND CHILDREN!	IN ALL CASES CONSULT A DOCTOR!
• **INHALATION**	Abdominal cramps. Drowsiness. Headache. Nausea. Vomiting. Weakness. Wheezing. Pallor. Hemoglobinuria. Collapse.	Ventilation (not if powder). Avoid inhalation of fine dust and mist. Local exhaust or breathing protection.	Fresh air, rest. Refer for medical attention.
• **SKIN**			
• **EYES**			
• **INGESTION**	Abdominal cramps (further see Inhalation).	Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Sweep spilled substance into containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment (extra personal protection: P2 filter respirator for harmful particles).	Separated from strong oxidants, strong bases, strong acids, food and feedstuffs.	

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0052

Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities

International Chemical Safety Cards

LEAD

ICSC: 0052

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
BLUISH-WHITE OR SILVERY-GREY SOLID IN VARIOUS FORMS. TURNS TARNISHED ON EXPOSURE TO AIR.

PHYSICAL DANGERS:
Dust explosion possible if in powder or granular form, mixed with air.

CHEMICAL DANGERS:
Upon heating, toxic fumes are formed. Reacts with hot concentrated nitric acid, boiling concentrated hydrochloric and sulfuric acids. Attacked by pure water and by weak organic acids in the presence of oxygen.

OCCUPATIONAL EXPOSURE LIMITS (OELs):
TLV: ppm; 0.15 mg/m^3 (as TWA) (ACGIH 1993-1994).

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation of its aerosol and by ingestion.

INHALATION RISK:
Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance may cause effects on the gastrointestinal tract, blood, central nervous system and kidneys , resulting in colics, shock, anemia, kidney damage and encephalopathy. Exposure may result in death. The effects may be delayed. Medical observation is indicated.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
The substance may have effects on the gastrointestinal tract, nervous system, blood, kidneys and immune system , resulting in severe lead colics, paralysis of muscle groups of the upper extremities (forearm, wrist and fingers), anemia, mood and personality changes, retarded mental development, and irreversible nephropathy. May cause retarded development of the new-born. Danger of cumulative effect.

PHYSICAL PROPERTIES	Boiling point: 1740°C Melting point: 327.5°C	Relative density (water = 1): 11.34 Solubility in water: none
ENVIRONMENTAL DATA	This substance may be hazardous to the environment; special attention should be given to air and water. In the food chain important to humans, bioaccumulation takes place, specifically in plants and water organisms, especially shellfish.	

NOTES

Explosive limits are unknown in literature. Use of alcoholic beverages enhances the harmful effect. Depending on the degree of exposure. periodic medical examination is indicated. Do NOT take working clothes home. Refer also to cards for specific lead compounds. e.g.. lead chromate (ICSC # 0003). lead(II) oxide (ICSC # 0288).

Transport Emergency Card: TEC (R)-61G12b

ADDITIONAL INFORMATION

ICSC: 0052 **LEAD**

MSDS *Material Safety Data Sheet*

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

Mallinckrodt
CHEMICALS

J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

MAGNESIUM METAL, POWDER

MSDS Number: M0088 --- *Effective Date: 12/08/96*

1. Product Identification

Synonyms: Magnesium powder
CAS No.: 7439-95-4
Molecular Weight: 24.30
Chemical Formula: Mg
Product Codes: 5894

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Magnesium Metal	7439-95-4	99 - 100%	Yes

3. Hazards Identification

Emergency Overview

WARNING! FLAMMABLE SOLID. DANGEROUS WHEN WET. HIGHLY REACTIVE. MAY IGNITE SPONTANEOUSLY ON CONTACT WITH WATER OR DAMP MATERIALS MAY CAUSE IRRITATION TO SKIN, EYES, AND RESPIRATORY TRACT.

Potential Health Effects

Inhalation:
Inhalation of dusts or fumes may irritate the respiratory tract and may cause metal fume fever. Symptoms may include coughing, chest pain, fever, and leukocytosis.

Ingestion:
Magnesium metal does not have well-characterized toxicity. May cause abdominal pain and diarrhea.

Skin Contact:
Particles embedded in the skin may cause eruptions. Molten magnesium may cause serious skin burns.

Eye Contact:
High concentrations of dust may cause mechanical irritation. Watching a magnesium fire can cause eye injury.

Chronic Exposure:
No information found.

Aggravation of Pre-existing Conditions:
Existing wounds contaminated with magnesium are very slow to heal.

---

4. First Aid Measures

Inhalation:
Remove to fresh air. Get medical attention for any breathing difficulty.

Ingestion:
If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Skin Contact:
Remove any contaminated clothing. Wash skin with soap or mild detergent and water for at least 15 minutes. Get medical attention if irritation develops or persists.

Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting upper and lower eyelids occasionally. Get medical attention if irritation persists.

---

5. Fire Fighting Measures

Fire:
Autoignition temperature: 473C (883F) When heated in air to a temperature near its melting point, magnesium may ignite and burn. Dangerous in the form of dust or flakes, and when exposed to flame or by violent chemical reaction with oxidizing agents. Magnesium may react with moisture or acids to evolve hydrogen gas, which is a highly dangerous fire or explosion hazard. Autoignition temperature is for Magnesium turnings or ribbon.

Explosion:
Fine dust dispersed in air in sufficient concentrations, and in the presence of an ignition source is a potential dust explosion hazard. Minimum explosible concentration 0.030 grams/liter. Water used on molten magnesium will produce hydrogen gas and may cause an explosion.

Fire Extinguishing Media:
Use metal extinguishing powders such as G-1(tm) graphite powder, Met-L-X(tm) powder, powdered talc, dry graphite, powdered sodium chloride, soda ash, or dry sand. Warning! Do not use foam, chlorinated products such as Halon(tm), carbon dioxide, or water to extinguish magnesium fires, because dangerous reactions will occur. Use of water on molten magnesium will produce hydrogen gas and may cause an explosion.

Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Fire fighters should protect their eyes and skin from flying particles. In order to prevent eye injury, do not look directly at magnesium fires.

---

6. Accidental Release Measures

Remove all sources of ignition. Ventilate the area of the spill or leak. Wear appropriate personal protective equipment as specified in Section 8. Collect the spilled material and transfer to a clean, dry metal covered container for recovery or disposal. Do not use water in the collection process. If the spilled magnesium has come into contact with water, proceed with caution. Hydrogen gas may be generated, which may cause a fire or explosion. Evacuate the area, put on fire fighting protective equipment and proceed as with a metal fire.

7. Handling and Storage

Keep in tightly closed container. Store in a cool, dry, ventilated area. Protect against physical damage. Store finely divided powder, chips or shavings in detached fire-resistant building, protected from moisture and away from oxidizers, chlorine, bromine, iodine, acids, and all possible sources of ignition. Heavier sections may be stored in the open. Storage and use areas should be No Smoking areas. Use non-sparking type tools and equipment, including explosion proof ventilation. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
None established.

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures as low as possible. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):
For conditions of use where exposure to the dust or mist is apparent, a half-face dust/mist respirator may be worn. For emergencies or instances where the exposure levels are not known, use a full-face positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:
Use chemical safety goggles and/or full face shield where dusting or splashing of solutions is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
Silver solid.

Odor:
Odorless.

Solubility:
Insoluble in water.

Specific Gravity:
1.74 @ 20C (68F) (solid)

pH:

No information found.

% Volatiles by volume @ 21C (70F):
0

Boiling Point:
1100C (2012F)

Melting Point:
649C (1200F)

Vapor Density (Air=1):
No information found.

Vapor Pressure (mm Hg):
1.0 @ 621C (1150F)

Evaporation Rate (BuAc=1):
No information found.

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage. Slowly oxidizes in moist air.

Hazardous Decomposition Products:
Toxic gases and vapors may be released if involved in a fire.

Hazardous Polymerization:
Will not occur.

Incompatibilities:
Magnesium reacts dangerously with many substances, including oxidizers, carbonates, cyanides, chlorinated hydrocarbons, sulfates, acids, and other metals. Please refer to the NFPA publication "Fire Protection Guide on Hazardous Materials" most recent edition for details. Reacts with acids to form hydrogen gas.

Conditions to Avoid:
Moisture, heat, flames, ignition sources and incompatibles.

11. Toxicological Information

No LD50/LC50 information found relating to normal routes of occupational exposure.

--------\Cancer Lists\--

	---NTP Carcinogen---		
Ingredient	Known	Anticipated	IARC Category
Magnesium Metal (7439-95-4)	No	No	None

12. Ecological Information

Environmental Fate:
No information found.

Environmental Toxicity:
No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: MAGNESIUM, POWDER
Hazard Class: 4.3, 4.2
UN/NA: UN1418
Packing Group: II
Information reported for product/size: 500G

International (Water, I.M.O.)

Proper Shipping Name: MAGNESIUM POWDER
Hazard Class: 4.3, 4.2
UN/NA: UN1418
Packing Group: II
Information reported for product/size: 500G

15. Regulatory Information

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 --------\Chemical Inventory Status - Part 1\---------------------------------
 Ingredient                                      TSCA  EC   Japan  Australia
 -----------------------------------------------  ----  ---  -----  ---------
 Magnesium Metal (7439-95-4)                      Yes  Yes   No       Yes

 --------\Chemical Inventory Status - Part 2\---------------------------------
                                                        --Canada--
 Ingredient                                      Korea  DSL   NDSL  Phil.
 -----------------------------------------------  -----  ---   ----  -----
 Magnesium Metal (7439-95-4)                      Yes   Yes   No     Yes

 --------\Federal, State & International Regulations - Part 1\----------------
                                           -SARA 302-    ------SARA 313------
 Ingredient                                 RQ    TPQ     List  Chemical Catg.
 -----------------------------------------  ---   -----   ----  --------------
 Magnesium Metal (7439-95-4)                No    No      No         No

 --------\Federal, State & International Regulations - Part 2\----------------
                                                      -RCRA-    -TSCA-
 Ingredient                                 CERCLA     261.33    8(d)
 -----------------------------------------  ------     ------    ------
 Magnesium Metal (7439-95-4)                No         No        No


Chemical Weapons Convention:  No     TSCA 12(b):  No     CDTA:  No
SARA 311/312:  Acute: Yes      Chronic: No   Fire: Yes Pressure: No
Reactivity: Yes         (Pure / Solid)
```

Australian Hazchem Code: 4[Y]
Poison Schedule: No information found.

WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

---

16. Other Information

NFPA Ratings: Health: 0 **Flammability:** 1 **Reactivity:** 2

Label Hazard Warning:
WARNING! FLAMMABLE SOLID. DANGEROUS WHEN WET. HIGHLY REACTIVE. MAY IGNITE SPONTANEOUSLY ON CONTACT WITH WATER OR DAMP MATERIALS MAY CAUSE IRRITATION TO SKIN, EYES, AND RESPIRATORY TRACT.

Label Precautions:
Keep away from heat, sparks and flame. Do not allow contact with water, acids, or moisture. Avoid contact with eyes, skin and clothing. Avoid breathing dust. Keep container closed. Use with adequate ventilation. Wash thoroughly after handling.

Label First Aid:
If inhaled, remove to fresh air. Get medical attention for any breathing difficulty. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Get medical attention if irritation develops or persists.

Product Use:
Laboratory Reagent.

Revision Information:
Pure. New 16 section MSDS format, all sections have been revised.

Disclaimer:
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Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.
****

Prepared by: Strategic Services Division
Phone Number: (314) 539-1600 (U.S.A.)

MSDS *Material Safety Data Sheet*

From: **Mallinckrodt Baker, Inc.**
222 Red School Lane
Phillipsburg, NJ 08865

J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

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CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

Manganese Oxide

MSDS Number: M0720 --- *Effective Date: 03/27/98*

1. Product Identification

Synonyms: Manganic oxide; Manganese tetroxide; Manganese sesquioxide; C.I. 77727; Manganomanganic oxide
CAS No.: 1317-35-7
Molecular Weight: 228.81
Chemical Formula: Mn3O4
Product Codes: 2548

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Manganese Tetroxide	1317-35-7	90 - 100%	Yes

3. Hazards Identification

Emergency Overview

WARNING! HARMFUL IF SWALLOWED OR INHALED. AFFECTS CENTRAL NERVOUS SYSTEM, BLOOD AND KIDNEYS. MAY CAUSE IRRITATION TO SKIN, EYES, AND RESPIRATORY TRACT.

J.T. Baker SAF-T-DATA$^{(tm)}$ Ratings (Provided here for your convenience)

Health Rating: 1 - Slight
Flammability Rating: 0 - None
Reactivity Rating: 0 - None
Contact Rating: 1 - Slight
Lab Protective Equip: GOGGLES; LAB COAT
Storage Color Code: Orange (General Storage)

Potential Health Effects

Inhalation:
May cause irritation to the respiratory tract. Inhalation can cause a flu-like illness (metal fume fever). This 24- to 48-hour illness is characterized by chills, fever, aching muscles, dryness in the mouth and throat and headache. May cause pleuritus and/or severe or fatal pneumonia.

Ingestion:
May cause abdominal pain and nausea. Although they are poorly absorbed through the intestines, inorganic manganese salts may produce hypoglycemia and decreased calcium blood levels should absorption occur.
Skin Contact:
May cause irritation with redness and pain. Small particles embedded into the skin can cause localized inflammatory reactions.
Eye Contact:
May cause irritation, redness and pain.
Chronic Exposure:
Chronic manganese poisoning can result from excessive inhalation and ingestion exposure and involves impairment of the central nervous system. Early symptoms include sluggishness, sleepiness, and weakness in the legs. Advanced cases have shown fixed facial expression, emotional disturbances, spastic gait, and falling. Illness closely resembles Parkinson's Disease. Kidney effects, blood changes and manganese psychosis also may occur as a result of chronic exposure. Chronic inhalation exposure can cause lung damage.
Aggravation of Pre-existing Conditions:
Persons with impaired respiratory function, psychiatric or neurological disturbances, and nutritional deficiencies may be more susceptible to the effect of this substance.

---

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
Ingestion:
Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention.
Skin Contact:
Immediately flush skin with plenty of soap and water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention if irritation develops.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting upper and lower eyelids occasionally. Get medical attention if irritation persists.

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5. Fire Fighting Measures

Fire:
Not considered to be a fire hazard.
Explosion:
Not considered to be an explosion hazard.
Fire Extinguishing Media:
Use any means suitable for extinguishing surrounding fire.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

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6. Accidental Release Measures

Ventilate area of leak or spill. Keep unnecessary and unprotected people away from area of spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Pick up and place in a suitable container for reclamation or disposal, using a method that does not generate dust.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
- OSHA Permissible Exposure Limit (PEL):
5 mg/m3 Ceiling for manganese compounds as Mn

- ACGIH Threshold Limit Value (TLV):
0.2 mg/m3 (TWA) for manganese, elemental and inorganic compounds as Mn

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded, a half-face dust/mist respirator may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece dust/mist respirator may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency, or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:
Wear protective gloves and clean body-covering clothing.

Eye Protection:
Use chemical safety goggles and/or full face shield where dusting or splashing of solutions is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
Brown to black Powder.
Odor:
Odorless.
Solubility:
Negligible (< 0.1%)
Density:
4.7
pH:
No information found.
% Volatiles by volume @ 21C (70F):
0
Boiling Point:
No information found.
Melting Point:
1564C (2847F)
Vapor Density (Air=1):

Not applicable.
Vapor Pressure (mm Hg):
Not applicable.
Evaporation Rate (BuAc=1):
No information found.

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
Oxides of manganese may form when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Reacts vigorously with strong reducing agents, acids, or bases.
Conditions to Avoid:
Incompatibles.

11. Toxicological Information

No LD50/LC50 information found relating to normal routes of occupational exposure. Investigated as a reproductive effector.

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--------\Cancer Lists\------------------------------------------------------
                                             ---NTP Carcinogen---
Ingredient                                    Known    Anticipated    IARC Category
------------------------------------          -----    -----------    -------------
Manganese Tetroxide (1317-35-7)                No         No              None
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12. Ecological Information

Environmental Fate:
No information found.
Environmental Toxicity:
No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Not regulated.

15. Regulatory Information

\Chemical Inventory Status - Part 1\

Ingredient	TSCA	EC	Japan	Australia
Manganese Tetroxide (1317-35-7)	Yes	Yes	Yes	Yes

\Chemical Inventory Status - Part 2\

		--Canada--		
Ingredient	Korea	DSL	NDSL	Phil.
Manganese Tetroxide (1317-35-7)	Yes	Yes	No	Yes

\Federal, State & International Regulations - Part 1\

	-SARA 302-		------SARA 313------	
Ingredient	RQ	TPQ	List	Chemical Catg.
Manganese Tetroxide (1317-35-7)	No	No	No	Manganese co

\Federal, State & International Regulations - Part 2\

		-RCRA-	-TSCA-
Ingredient	CERCLA	261.33	8(d)
Manganese Tetroxide (1317-35-7)	No	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: No (Pure / Solid)

Australian Hazchem Code: No information found.
Poison Schedule: No information found.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **1** Flammability: **0** Reactivity: **0**
Label Hazard Warning:
WARNING! HARMFUL IF SWALLOWED OR INHALED. AFFECTS CENTRAL NERVOUS SYSTEM, BLOOD AND KIDNEYS. MAY CAUSE IRRITATION TO SKIN, EYES, AND RESPIRATORY TRACT.
Label Precautions:
Wash thoroughly after handling.
Avoid breathing dust.
Keep container closed.
Use with adequate ventilation.
Avoid contact with eyes, skin and clothing.
Label First Aid:
If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Get medical attention if irritation develops or persists.
Product Use:
Laboratory Reagent.
Revision Information:
MSDS Section(s) changed since last revision of document include: 1, 3, 4, 6, 7, 8, 9, 10, 11, 16.
Disclaimer:

* * *

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Prepared by: Strategic Services Division
Phone Number: (314) 539-1600 (U.S.A.)

Please reduce your browser font size for better viewing and printing.

MSDS *Material Safety Data Sheet*

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 202-483-7616

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

MALLINCKRODT J.T.Baker

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

MERCURY

MSDS Number: M1599 --- ***Effective Date: 11/17/99***

1. Product Identification

Synonyms: Quicksilver; hydrargyrum; Liquid Silver
CAS No.: 7439-97-6
Molecular Weight: 200.59
Chemical Formula: Hg
Product Codes:
J.T. Baker: 2564, 2567, 2569, 2572
Mallinckrodt: 1278, 1280, 1288

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Mercury	7439-97-6	90 - 100%	Yes

3. Hazards Identification

Emergency Overview

DANGER! CORROSIVE. CAUSES BURNS TO SKIN, EYES, AND RESPIRATORY TRACT. MAY BE FATAL IF SWALLOWED OR INHALED. HARMFUL IF ABSORBED THROUGH SKIN. AFFECTS THE KIDNEYS AND CENTRAL NERVOUS SYSTEM. MAY CAUSE ALLERGIC SKIN REACTION.

J.T. Baker SAF-T-DATA$^{(tm)}$ Ratings (Provided here for your convenience)

Health Rating: 4 - Extreme (Poison)
Flammability Rating: 0 - None
Reactivity Rating: 1 - Slight
Contact Rating: 3 - Severe (Life)
Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES

Storage Color Code: Blue (Health)

Potential Health Effects

Inhalation:
Mercury vapor is highly toxic via this route. Causes severe respiratory tract damage. Symptoms include sore throat, coughing, pain, tightness in chest, breathing difficulties, shortness of breath, headache, muscle weakness, anorexia, gastrointestinal disturbance, ringing in the ear, liver changes, fever, bronchitis and pneumonitis. Can be absorbed through inhalation with symptoms similar to ingestion.

Ingestion:
May cause burning of the mouth and pharynx, abdominal pain, vomiting, corrosive ulceration, bloody diarrhea. May be followed by a rapid and weak pulse, shallow breathing, paleness, exhaustion, tremors and collapse. Delayed death may occur from renal failure. Gastrointenstinal uptake of mercury is less than 5% but its ability to penetrate tissues presents some hazard. Initial symptoms may be thirst, possible abdominal discomfort.

Skin Contact:
Causes irritaton and burns to skin. Symptoms include redness and pain. May cause skin allergy and sensitization. Can be absorbed through the skin with symptoms to parallel ingestion.

Eye Contact:
Causes irritation and burns to eyes. Symptoms include redness, pain, blurred vision; may cause serious and permanent eye damage.

Chronic Exposure:
Chronic exposure through any route can produce central nervous system damage. May cause muscle tremors, personality and behavior changes, memory loss, metallic taste, loosening of the teeth, digestive disorders, skin rashes, brain damage and kidney damage. Can cause skin allergies and accumulate in the body. Repeated skin contact can cause the skin to turn gray in color. A suspected reproductive hazard; may damage the developing fetus and decrease fertility in males and females.

Aggravation of Pre-existing Conditions:
Persons with nervous disorders, or impaired kidney or respiratory function, or a history of allergies or a known sensitization to mercury may be more susceptible to the effects of the substance.

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Ingestion:
Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Skin Contact:
Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention immediately. Wash clothing before reuse. Thoroughly clean shoes before reuse.

Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:
Not considered to be a fire hazard.

Explosion:
Not considered to be an explosion hazard.

Fire Extinguishing Media:
Use any means suitable for extinguishing surrounding fire. Do not allow water runoff to enter sewers or waterways.

Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Undergoes hazardous reactions in the presence of heat and sparks or ignition. Smoke may contain toxic mercury or

mercuric oxide. Smoke may contain toxic mercury or mercuric oxide.

6. Accidental Release Measures

Ventilate area of leak or spill. Clean-up personnel require protective clothing and respiratory protection from vapor. Spills: Pick up and place in a suitable container for reclamation or disposal in a method that does not generate misting. Sprinkle area with sulfur or calcium polysulfide to suppress mercury. Do not flush to sewer. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker CINNASORB(R) and RESISORB(R) are recommended for spills of this product.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Isolate from any source of heat or ignition. Do not use or store on porous work surfaces (wood, unsealed concrete, etc.). Follow strict hygiene practices. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
- OSHA Acceptable Ceiling Concentration:
mercury and mercury compounds: 0.1 mg/m3 (TWA), skin
- ACGIH Threshold Limit Value (TLV):
inorganic and metallic mercury, as Hg: 0.025 mg/m3 (TWA) skin, A4 Not classifiable as a human carcinogen.
- ACGIH Biological Exposure Indices:
total inorganic mercury in urine (preshift): 35 ug/g creatinine;
total inorganic mercury in blood (end of shift): 15 ug/l.

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded, a half-face respirator with a mercury vapor or chlorine gas cartridge may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece respirator with a mercury vapor or chlorine gas cartridge may be worn up to 50 times the exposure limit, or the maximum use concentraiton specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-face piece positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
Silver-white, heavy, mobile, liquid metal.
Odor:
Odorless.
Solubility:
Insoluble in water.
Density:
13.55
pH:
No information found.
% Volatiles by volume @ 21C (70F):
100
Boiling Point:
356.7C (675F)
Melting Point:
-38.87C (-38F)
Vapor Density (Air=1):
7.0
Vapor Pressure (mm Hg):
0.0018 @ 25C (77F)
Evaporation Rate (BuAc=1):
4

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
At high temperatures, vaporizes to form extremely toxic fumes.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Acetylenes, ammonia, ethylene oxide, chlorine dioxide, azides, metal oxides, methyl silane, lithium, rubidium, oxygen, strong oxidants, metal carbonyls.
Conditions to Avoid:
Heat, flames, ignition sources, metal surfaces and incompatibles.

11. Toxicological Information

Toxicological Data:
Investigated as a tumorigen, mutagen, reproductive effector.
Reproductive Toxicity:
All forms of mercury can cross the placenta to the fetus, but most of what is known has been learned from experimental animals. See Chronic Health Hazards.
Carcinogenicity:
EPA / IRIS classification: Group D1 - Not classifiable as a human carcinogen.

--------\Cancer Lists\--

	---NTP Carcinogen---		
Ingredient	Known	Anticipated	IARC Category
Mercury (7439-97-6)	No	No	3

12. Ecological Information

Environmental Fate:
This material has an experimentally-determined bioconcentration factor (BCF) of greater than 100. This

material is expected to significantly bioaccumulate.
Environmental Toxicity:
This material is expected to be toxic to aquatic life. The LC50/96-hour values for fish are less than 1 mg/l.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: RQ, MERCURY
Hazard Class: 8
UN/NA: UN2809
Packing Group: III
Information reported for product/size: 2.5KG

International (Water, I.M.O.)

Proper Shipping Name: MERCURY
Hazard Class: 8
UN/NA: UN2809
Packing Group: III
Information reported for product/size: 2.5KG

International (Air, I.C.A.O.)

Proper Shipping Name: MERCURY
Hazard Class: 8
UN/NA: UN2809
Packing Group: III
Information reported for product/size: 2.5KG

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\---------------------------------

Ingredient	TSCA	EC	Japan	Australia
Mercury (7439-97-6)	Yes	Yes	No	Yes

--------\Chemical Inventory Status - Part 2\---------------------------------

		--Canada--		
Ingredient	Korea	DSL	NDSL	Phil.
Mercury (7439-97-6)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\----------------

	-SARA 302-		------SARA 313------	
Ingredient	RQ	TPQ	List	Chemical Catg.
Mercury (7439-97-6)	No	No	Yes	No

--------\Federal, State & International Regulations - Part 2\----------------

		-RCRA-	-TSCA-
Ingredient	CERCLA	261.33	8(d)

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  ---------------------------------------  ------    ------    ------
  Mercury (7439-97-6)                      1         U151      No

Chemical Weapons Convention:  No     TSCA 12(b):  No     CDTA:  No
SARA 311/312:  Acute: Yes      Chronic: Yes  Fire: No  Pressure: No
Reactivity: No          (Pure / Liquid)
```

WARNING:
THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM.

Australian Hazchem Code: 2Z
Poison Schedule: S7
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **3** Flammability: **0** Reactivity: **0**
Label Hazard Warning:
DANGER! CORROSIVE. CAUSES BURNS TO SKIN, EYES, AND RESPIRATORY TRACT. MAY BE FATAL IF SWALLOWED OR INHALED. HARMFUL IF ABSORBED THROUGH SKIN. AFFECTS THE KIDNEYS AND CENTRAL NERVOUS SYSTEM. MAY CAUSE ALLERGIC SKIN REACTION.
Label Precautions:
Do not get in eyes, on skin, or on clothing.
Do not breathe vapor.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Label First Aid:
If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. In all cases get medical attention immediately.
Product Use:
Laboratory Reagent.
Revision Information:
No changes.
Disclaimer:
****

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****

Prepared by: Strategic Services Division
Phone Number: (314) 539-1600 (U.S.A.)

MSDS *Material Safety Data Sheet*

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

J.T.Baker

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

Nickel, Shot

MSDS Number: N2790 --- *Effective Date: 04/15/99*

1. Product Identification

Synonyms: None
CAS No.: 7440-02-0
Molecular Weight: 58.6934
Chemical Formula: Ni
Product Codes: 2748

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Nickel	7440-02-0	90 - 100%	Yes

3. Hazards Identification

Emergency Overview

WARNING! HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. MAY CAUSE ALLERGIC SKIN OR RESPIRATORY REACTION. MAY CAUSE NASAL OR LUNG DAMAGE. POSSIBLE CANCER HAZARD. MAY CAUSE CANCER BASED ON ANIMAL DATA. Risk of cancer depends on duration and level of exposure.

J.T. Baker SAF-T-DATA$^{(tm)}$ Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Cancer Causing)
Flammability Rating: 0 - None
Reactivity Rating: 0 - None
Contact Rating: 3 - Severe (Life)
Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES
Storage Color Code: Blue (Health)

Potential Health Effects

Inhalation:
Can cause headaches, dizziness, and difficult breathing. Finer dust particulates may irritate the respiratory tract. Symptoms may include coughing, sore throat, and shortness of breath. Inhalation of nickel and nickel compounds is associated with nasal and lung damage and cancer.
Ingestion:
May cause irritation to the gastro-intestinal tract. Large oral dose may cause nausea, vomiting, abdominal pain and diarrhea.
Skin Contact:
Causes irritation, redness, pain. May cause allergic dermatitis. Nickel is a contact allergen and sensitizer.
Eye Contact:
Causes irritation, redness, and pain.
Chronic Exposure:
Prolonged exposure to excessive concentrations of dust may cause chronic pulmonary disorders. Nickel and certain nickel compounds are considered carcinogenic and noted for producing nasal and lung cancer.
Aggravation of Pre-existing Conditions:
Skin contact with some nickel compounds in sensitive individuals may cause dermatitis (nickel itch).

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
Ingestion:
Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention.
Skin Contact:
Immediately flush skin with plenty of soap and water. Remove contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:
Not considered to be a fire hazard.
Flammable as dust or fume.
Explosion:
Not considered to be an explosion hazard.
Fire Extinguishing Media:
Smother with dry sand, dry clay, dry earth, graphite, or dry ground limestone. Use flooding quantities of water, or foam, dry chemical, carbon dioxide.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Toxic gases and vapors such as nickel carbonyl may be released in a fire involving nickel.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Sweep up and containerize for reclamation or disposal. Vacuuming or wet sweeping may be used to avoid dust dispersal. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response

Center is (800) 424-8802.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Wear special protective equipment (Sec. 8) for maintenance break-in or where exposures may exceed established exposure levels. Wash hands, face, forearms and neck when exiting restricted areas. Shower, dispose of outer clothing, change to clean garments at the end of the day. Avoid cross-contamination of street clothes. Wash hands before eating and do not eat, drink, or smoke in workplace. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
For Nickel, Metal and Insoluble Compounds, as Ni:
- OSHA Permissible Exposure Limits (PEL) -
1 mg/m3 (TWA).
For Nickel, Elemental / Metal:
- ACGIH Threshold Limit Value (TLV) -
1.5 mg/m3 (TWA), A5 - Not suspected as a human carcinogen.
For Nickel, Insoluble Compounds, as Ni:
- ACGIH Threshold Limit Value (TLV) -
0.2 mg/m3 (TWA), A1 - Confirmed human carcinogen
Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded, a half-face dust/mist respirator may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece dust/mist respirator may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency, or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.
Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.
Eye Protection:
Use chemical safety goggles and/or full face shield where dusting or splashing of solutions is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
Gray pellets.
Odor:
Odorless.
Solubility:
Insoluble in water.
Specific Gravity:
8.90
pH:
No information found.
% Volatiles by volume @ 21C (70F):

0
Boiling Point:
2732C (4950F) (Calculated)
Melting Point:
1453C (2647F)
Vapor Density (Air=1):
Not applicable.
Vapor Pressure (mm Hg):
1 @ 1810C (3290F)
Evaporation Rate (BuAc=1):
No information found.

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage. Burns in oxygen, forming NiO.
Hazardous Decomposition Products:
Toxic gases and vapors such as nickel carbonyl may be released.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
For Nickel: Aluminum, aluminum trichloride, ethylene, p-dioxan, hydrogen, methanol, non-metals, oxidants, sulfur compounds. Slowly attacked by dilute hydrochloric or sulfuric acid; readily attacked by nitric acid. Not attacked by fused alkali hydroxides.
Conditions to Avoid:
Incompatibles.

11. Toxicological Information

No LD50/LC50 information found relating to normal routes of occupational exposure. Investigated as a tumorigen, mutagen, reproductive effector.

```
--------\Cancer Lists\------------------------------------------------------
                                           ---NTP Carcinogen---
Ingredient                                 Known    Anticipated    IARC Category
------------------------------------       -----    -----------    -------------
Nickel (7440-02-0)                          No          Yes             2B
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12. Ecological Information

Environmental Fate:
This material is not expected to significantly bioaccumulate.
Environmental Toxicity:
No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Not regulated.

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\---------------------------------

Ingredient	TSCA	EC	Japan	Australia
Nickel (7440-02-0)	Yes	Yes	No	Yes

--------\Chemical Inventory Status - Part 2\---------------------------------

		--Canada--		
Ingredient	Korea	DSL	NDSL	Phil.
Nickel (7440-02-0)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\----------------

	-SARA 302-		------SARA 313------	
Ingredient	RQ	TPQ	List	Chemical Catg.
Nickel (7440-02-0)	No	No	Yes	No

--------\Federal, State & International Regulations - Part 2\----------------

		-RCRA-	-TSCA-
Ingredient	CERCLA	261.33	8(d)
Nickel (7440-02-0)	100	No	No

```
Chemical Weapons Convention:  No     TSCA 12(b):  No     CDTA:  No
SARA 311/312:  Acute: Yes     Chronic: Yes  Fire: No  Pressure: No
Reactivity: No          (Pure / Solid)
```

WARNING:
THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

Australian Hazchem Code: No information found.
Poison Schedule: No information found.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **2** Flammability: **0** Reactivity: **0**
Label Hazard Warning:
WARNING! HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. MAY CAUSE ALLERGIC SKIN OR RESPIRATORY REACTION. MAY CAUSE NASAL OR LUNG DAMAGE. POSSIBLE CANCER HAZARD. MAY CAUSE CANCER BASED ON ANIMAL DATA. Risk of cancer depends on duration and level of exposure.
Label Precautions:
Wash thoroughly after handling.
Do not breathe dust.
Do not get in eyes, on skin, or on clothing.
Keep container closed.
Use only with adequate ventilation.
Label First Aid:
If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by

mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of skin contact, immediately flush skin with plenty of soap and water. Remove contaminated clothing and shoes. Wash clothing before reuse. In case of eye contact, immediately flush eyes with plenty of water for at least 15 minutes. In all cases, get medical attention.

Product Use:

Laboratory Reagent.

Revision Information:

MSDS Section(s) changed since last revision of document include: 8.

Disclaimer:

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****

Prepared by: Strategic Services Division
Phone Number: (314) 539-1600 (U.S.A.)

Please reduce your browser font size for better viewing and printing.

MSDS *Material Safety Data Sheet*

From: **Mallinckrodt Baker, Inc.**
222 Red School Lane
Phillipsburg, NJ 08865

MALLINCKRODT J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 202-483-7616

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

ZINC METAL POWDER

MSDS Number: Z0858 --- *Effective Date: 11/17/99*

1. Product Identification

Synonyms: Powdered zinc; blue powder; CI77945; CI Pigment Black 16
CAS No.: 7440-66-6
Molecular Weight: 65.37
Chemical Formula: Zn
Product Codes:
J.T. Baker: 4282
Mallinckrodt: 8681

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Zinc	7440-66-6	96 - 97%	Yes
Zinc Oxide	1314-13-2	0 - 3%	Yes
Lead	7439-92-1	0 - 0.3%	Yes

3. Hazards Identification

Emergency Overview

WARNING! HARMFUL IF SWALLOWED OR INHALED. MAY CAUSE IRRITATION TO SKIN, EYES, AND RESPIRATORY TRACT. MAY FORM COMBUSTIBLE DUST CONCENTRATIONS IN AIR. WATER REACTIVE. MAY AFFECT THE GUM TISSUE, CENTRAL NERVOUS SYSTEM, KIDNEYS, BLOOD AND REPRODUCTIVE SYSTEM (lead component).

J.T. Baker SAF-T-DATA$^{(tm)}$ Ratings (Provided here for your convenience)

Health Rating: 1 - Slight
Flammability Rating: 3 - Severe (Flammable)

Reactivity Rating: 2 - Moderate
Contact Rating: 1 - Slight
Lab Protective Equip: GOGGLES; LAB COAT; CLASS D EXTINGUISHER
Storage Color Code: Orange (General Storage)

Potential Health Effects

Inhalation:
No adverse effects expected but dust may cause mechanical irritation. The effects may be expected to resemble those of inhaling an inert dust; possible difficulty in breathing, sneezing, coughing. When heated, the fumes are highly toxic and may cause fume fever.
Ingestion:
Extremely large oral dosages may produce gastrointestinal disturbances, due both to mechanical effects and the possibility of reaction with gastric juice to produce zinc chloride. Pain, stomach cramps and nausea could occur in aggravated cases.
Skin Contact:
May cause irritation.
Eye Contact:
May cause irritation.
Chronic Exposure:
No adverse health effects expected.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or impaired respiratory function may be more susceptible to the effects of the substance.

4. First Aid Measures

Inhalation:
Remove to fresh air. Get medical attention for any breathing difficulty.
Ingestion:
Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person.
Skin Contact:
Wipe off excess material from skin then immediately flush skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting upper and lower eyelids occasionally. Get medical attention if irritation persists.

5. Fire Fighting Measures

Fire:
Autoignition temperature: ca. 460C (ca. 860F)
The listed autoignition temperature is for Zinc powder (layer); dust cloud is ca. 680C (1255F). Zinc powder is not pyrophoric but will burn in air at elevated temperatures. Bulk dust in damp state may heat spontaneously and ignite on exposure to air. Releases flammable hydrogen gas upon contact with acids or alkali hydroxides. Contact with strong oxidizers may cause fire.
Explosion:
Fine dust dispersed in air in sufficient concentrations, and in the presence of an ignition source is a potential dust explosion hazard.
Fire Extinguishing Media:
Smother with a suitable dry powder (sodium chloride, magnesium oxide, Met-L-X).
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Remove all sources of ignition and provide mild ventilation in area of spill. Substance may be pyrophoric and self-ignite. Clean-up personnel require protective clothing, goggles and dust/mist respirators. Sweep or vacuum up the spill in a manner that does not disperse zinc powder in the air and place the zinc in a closed container for recovery or disposal. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Keep in a tightly closed container. Protect from physical damage. Store in a cool, dry, ventilated area away from sources of heat, moisture and incompatibilities. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
None for Zinc metal.
-OSHA Permissible Exposure Limit (PEL):
10 mg/m3 (TWA), for zinc oxide fume
-ACGIH Threshold Limit Value (TLV):
5 mg/m3 (TWA), 10 mg/m3 (STEL) for zinc oxide fume.

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded, a full facepiece respirator with dust/mist filter may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:
Wear protective gloves and clean body-covering clothing.

Eye Protection:
Use chemical safety goggles. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
Gray or bluish-gray powder.

Odor:
Odorless.

Solubility:
Insoluble in water.

Density:
7.14

pH:
No information found.

% Volatiles by volume @ 21C (70F):
0

Boiling Point:
907C (1665F)
Melting Point:
419C (786F)
Vapor Density (Air=1):
No information found.
Vapor Pressure (mm Hg):
1 @ 487C (909F)
Evaporation Rate (BuAc=1):
No information found.

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage. Moist zinc dust can react exothermically and ignite spontaneously in air.
Hazardous Decomposition Products:
Hydrogen in moist air, zinc oxide with oxygen at high temperature. Zinc metal, when melted, produces zinc vapor which oxidizes and condenses in air to form zinc fume.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Zinc powder can react violently with water, sulfur and halogens. Dangerous or potentially dangerous with strong oxidizing agents, lower molecular weight chlorinated hydrocarbons, strong acids and alkalis.
Conditions to Avoid:
Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Zinc: Irritation skin, human: 300 ug/3D-I mild; investigated as a mutagen.

--------\Cancer Lists\--

	---NTP Carcinogen---		
Ingredient	Known	Anticipated	IARC Category
Zinc (7440-66-6)	No	No	None
Zinc Oxide (1314-13-2)	No	No	None
Lead (7439-92-1)	No	No	2B

12. Ecological Information

Environmental Fate:
No information found.
Environmental Toxicity:
No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Not regulated.

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\---------------------------------

Ingredient	TSCA	EC	Japan	Australia
Zinc (7440-66-6)	Yes	Yes	No	Yes
Zinc Oxide (1314-13-2)	Yes	Yes	Yes	Yes
Lead (7439-92-1)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\---------------------------------

		--Canada--		
Ingredient	Korea	DSL	NDSL	Phil.
Zinc (7440-66-6)	Yes	Yes	No	Yes
Zinc Oxide (1314-13-2)	Yes	Yes	No	Yes
Lead (7439-92-1)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\----------------

	-SARA 302-		------SARA 313------	
Ingredient	RQ	TPQ	List	Chemical Catg.
Zinc (7440-66-6)	No	No	Yes	No
Zinc Oxide (1314-13-2)	No	No	No	Zinc compoun
Lead (7439-92-1)	No	No	Yes	No

--------\Federal, State & International Regulations - Part 2\----------------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Zinc (7440-66-6)	1000	No	No
Zinc Oxide (1314-13-2)	No	No	No
Lead (7439-92-1)	10	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: No Fire: Yes Pressure: No
Reactivity: Yes (Mixture / Solid)

WARNING:
THIS PRODUCT CONTAINS CHEMICALS KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER AND BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM.

Australian Hazchem Code: 4Y
Poison Schedule: S6
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **1** Flammability: **1** Reactivity: **1** Other: **Water reactive**
Label Hazard Warning:
WARNING! HARMFUL IF SWALLOWED OR INHALED. MAY CAUSE IRRITATION TO SKIN, EYES, AND RESPIRATORY TRACT. MAY FORM COMBUSTIBLE DUST CONCENTRATIONS IN AIR. WATER REACTIVE. MAY AFFECT THE GUM TISSUE, CENTRAL NERVOUS SYSTEM, KIDNEYS, BLOOD AND REPRODUCTIVE SYSTEM (lead component).

Label Precautions:
Avoid breathing dust.
Avoid contact with eyes, skin and clothing.
Keep away from heat and flame.
Keep container closed.
Use with adequate ventilation.
Wash thoroughly after handling.

Label First Aid:
If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. Get medical attention for any breathing difficulty. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Get medical attention if irritation develops or persists.

Product Use:
Laboratory Reagent.

Revision Information:
No changes.

Disclaimer:
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Prepared by: Strategic Services Division
Phone Number: (314) 539-1600 (U.S.A.)

MANVILLE SALES -- COMPRESSED ASBESTOS SHEET - ASBESTOS SHEET, COMPRESSED
MATERIAL SAFETY DATA SHEET
NSN: 5330005859501
Manufacturer's CAGE: 75165
Part No. Indicator: A
Part Number/Trade Name: COMPRESSED ASBESTOS SHEET

General Information

Item Name: ASBESTOS SHEET, COMPRESSED
Company's Name: MANVILLE SALES CORP
Company's Street: 717 17TH ST
Company's City: DENVER
Company's State: CO
Company's Country: US
Company's Zip Code: 80127
Record No. For Safety Entry: 004
Tot Safety Entries This Stk#: 004
Status: SE
Date MSDS Prepared: 30SEP92
Safety Data Review Date: 30SEP92
Supply Item Manager: KZ
MSDS Preparer's Name: DGSC-SSH
Preparer's Company: DEFENSE GENERAL SUPPLY CENTER
Preparer's St Or P. O. Box: 8000 JEFFERSON DAVIS HWY
Preparer's City: RICHMOND
Preparer's State: VA
Preparer's Zip Code: 23297-5000
MSDS Serial Number: BNVYW
Specification Number: HH-P-46
Spec Type, Grade, Class: CL 1
Hazard Characteristic Code: T6
Unit Of Issue: SH
Unit Of Issue Container Qty: 1
Type Of Container: STD COML PKG
Net Unit Weight: UNKNOWN

Ingredients/Identity Information

Proprietary: NO
Ingredient: ASBESTOS, CHRYSOTILE
Ingredient Sequence Number: 01
Percent: UNKNOWN
NIOSH (RTECS) Number: CI6478500
CAS Number: 12001-29-5
OSHA PEL: 0.2 FIBERS/CC
ACGIH TLV: 2 FIBERS/CC; A1;9192
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: RUBBER, SYNTHETIC OR NATURAL
Ingredient Sequence Number: 02
Percent: UNKNOWN
NIOSH (RTECS) Number: 1000238RU
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED
Other Recommended Limit: NONE RECOMMENDED

Physical/Chemical Characteristics

Appearance And Odor: 50" BY 50" BY 0.062" COMPRESSED ASBESTOS SHEET.
Decomposition Temperature: >900F,>482C
Evaporation Rate And Ref: NOT APPLICABLE
Solubility In Water: NEGLIGIBLE
Percent Volatiles By Volume: NONE
Autoignition Temperature: NONE

Fire and Explosion Hazard Data

Flash Point: NONE

Extinguishing Media: MATERIAL IS NOT FLAMMABLE ; USE MEDIA APPROPRIATE FOR SURROUNDING FIRE.

Special Fire Fighting Proc: COMBUSTION PRODUCTS OF THIS MATERIAL MAY BE TOXIC. USE A SELF-CONTAINED BREATHING APPARATUS WHEN FIGHTING FIRES INVOLVING CHEMICAL PRODUCTS.

Unusual Fire And Expl Hazrds: NONE

Reactivity Data

Stability: YES

Cond To Avoid (Stability): NOT APPLICABLE

Materials To Avoid: NONE

Hazardous Decomp Products: AIRBORNE ASBESTOS DUST

Hazardous Poly Occur: NO

Conditions To Avoid (Poly): NOT APPLICABLE

Health Hazard Data

LD50-LC50 Mixture: NOT APPLICABLE

Route Of Entry - Inhalation: YES

Route Of Entry - Skin: NO

Route Of Entry - Ingestion: NO

Health Haz Acute And Chronic: PROLONGED OR REPEATED EXPOSURE TO AIRBORNE ASBESTOS FIBERS FROM SANDING, CUTTING, SCRAPPING, FILING, ETC. MAY LEAD TO ASBESTOSIS AND MESOTHELIOMA. SMOKING COMBINED WITH FIBER INHALATION GREATLY INCREASES LUNG CANCER RISK.

Carcinogenicity - NTP: YES

Carcinogenicity - IARC: YES

Carcinogenicity - OSHA: YES

Explanation Carcinogenicity: OVEREXPOSURE TO AIRBORNE CONCENTRATIONS OF ASBESTOS MAY LEAD TO ASBESTOSIS AND MESOTHELIOMA.

Signs/Symptoms Of Overexp: INHALATION OF AIRBORNE DUST CONTAINING ASBESTOS FIBERS ON REPEATED EXPOSURE MAY CAUSE OR CAN LEAD TO ASBESTOSIS / MESOTHELIOMA; DUST MAY CAUSE EYE IRRITATION.

Med Cond Aggravated By Exp: PERSONS WITH RESPIRATORY DISEASE OR PERSONS WHO SMOKE MAY BE AT INCREASED RISK FROM EXPOSURE TO DUST CONTAINING ASBESTOS FIBERS.

Emergency/First Aid Proc: INHALATION: REMOVE TO FRESH AIR. GET MEDICAL ATTENTION. EYE: PROMPTLY FLUSH WITH RUNNING WATER FOR 15 MINUTES WHILE LIFTING EYELID. GET MEDICAL ATTENTION. SKIN: PROMPTLY FLUSH WITH SOAP AND WATER. REMOVE CONTAMINATED CLOTHING. GET MEDICAL ATTENTION IF IRRITATION PERSISTS. INGESTION: GET MEDICAL ATTENTION AS REQUIRED.

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: USE PROPER PERSONAL PROTECTION. VACUUM OR WET CLEAN IF DUST IS INVOLVED. ANY VACUUM SYSTEM SHOULD BE EQUIPPED WITH AN OUTLET "HEPA" FILTER TO PREVENT REINTRODUCING ASBESTOS FIBERS TO THE ATMOSPHERE.

Neutralizing Agent: NOT APPLICABLE

Waste Disposal Method: DUST SHOULD BE HANDLED AS A HAZARDOUS AIR POLLUTANT I/A/W 40CFR61 SUBPART "M" PERTAINING TO ASBESTOS. USE LANDFILLS APPROVED FOR ASBESTOS DISPOSAL. INDICATE IF ITEM UNDER CONSIDERATION FOR DISPOSAL IS "FRIABLE OR NON-FRIABLE".

Precautions-Handling/Storing: HANDLE IN A MATTER TO MINIMIZE FORMATION OR RETENTION OF AIRBORNE DUST. USE PROPER PERSONAL PROTECTION FOR TASK AT HAND.

Other Precautions: AS MANUFACTURED, ENCAPSULATED ASBESTOS DOES NOT PRESENT A HAZARD. HOWEVER, IF DUST IS GENERATED BY SANDING, GRINDING, SCRAPPING OR OTHER ABRADING ACTIONS, ASBESTOS FIBERS MAY BECOME AIRBORNE.

Control Measures

Respiratory Protection: EXPOSURE TO AIRBORNE ASBESTOS SHALL NOT EXCEED 0.2 FIBERS PER CUBIC CENTIMETER OF AIR AS AN 8-HOUR TWA. USE NIOSH APPROVED FULL FACEPIECE AIR PURIFYING RESPIRATOR EQUIPPED WITH HEPA FILTER OR AIR SUPPLIED RESPIRATOR IN PRESSURE DEMAND MODE.

Ventilation: LOCAL EXHAUST IS RECOMMENDED IN OPERATIONS WHERE DUST IS GENERATED SUCH AS CUTTING, GRINDING, SCRAPPING, ETC.

Protective Gloves: SELECT TYPE REQUIRED FOR WORK BEING DONE

Eye Protection: SAFETY GLASSES W/SIDE SHIELDS OR GOGGLES

Other Protective Equipment: WORK CLOTHES OR COVERALLS.
Work Hygienic Practices: WASH THOROUGHLY AFTER HANDLING AND BEFORE EATING, DRINKING OR SMOKING. LAUNDER CONTAMINATED CLOTHING BEFORE REUSE.
Suppl. Safety & Health Data: CONTAINS ASBESTOS FIBERS. AVOID CREATING DUST. CANCER AND LUNG DISEASE HAZARD. AVOID BREATHING AIRBORNE ASBESTOS FIBERS.

Transportation Data

Trans Data Review Date: 92274
DOT PSN Code: PVR
DOT Symbol: I
DOT Proper Shipping Name: WHITE ASBESTOS
DOT Class: 9
DOT ID Number: UN2590
DOT Pack Group: III
DOT Label: CLASS 9
IMO PSN Code: BRN
IMO Proper Shipping Name: ASBESTOS, WHITE
IMO Regulations Page Number: 9024
IMO UN Number: 2590
IMO UN Class: 9
IMO Subsidiary Risk Label: -
IATA PSN Code: ZNV
IATA UN ID Number: 2590
IATA Proper Shipping Name: WHITE ASBESTOS
IATA UN Class: 9
IATA Label: MISCELLANEOUS
AFI PSN Code: ZNV
AFI Prop. Shipping Name: WHITE ASBESTOS
AFI Class: 9
AFI ID Number: UN2590
AFI Pack Group: III
AFI Basic Pac Ref: 13-12
Additional Trans Data: NONE

Disposal Data

Label Data

Label Required: YES
Technical Review Date: 30SEP92
MFR Label Number: NOT APPLICABLE
Label Status: F
Common Name: COMPRESSED ASBESTOS SHEET
Signal Word: DANGER!
Acute Health Hazard-Severe: X
Contact Hazard-None: X
Fire Hazard-None: X
Reactivity Hazard-None: X
Special Hazard Precautions: CONTAINS ASBESTOS FIBERS. AVOID CREATING DUST. AVOID BREATHING AIRBORNE ASBESTOS FIBERS. PROLONGED OR REPEATED OVEREXPOSURE TO AIRBORNE ASBESTOS FIBERS MAY LEAD TO ASBESTOSIS AND MESOTHELIOMA. SMOKING COMBINED WITH FIBER INHALATION GREATLY INCREASES RISK OF CANCER AND LUNG DISEASE. SELECT AND USE A NIOSH/MSHA APPROVED RESPIRATOR FOR ASBESTOS IN ACCORDANCE WITH 29CFR1910.1001 AND 1910.1101 WHEN EXPOSURE LEVELS EXCEED THE OSHA PEL OF 0.2 FIBERS PER CUBIS CENTIMETER OF AIR IN AN 8 HOUR TIME WEIGHTED AVERAGE.
Protect Eye: Y
Protect Skin: Y
Protect Respiratory: Y
Label Name: MANVILLE SALES CORP
Label Street: 717 17TH ST
Label City: DENVER
Label State: CO
Label Zip Code: 80127
Label Country: US

ATTACHMENT 2

STANDARD OPERATING PROCEDURES FOR EMERGENCIES DUE TO

- COLD AND STRESS MONITORING
- HEAT AND STRESS MONITORING

DRAFT

COLD STRESS

Field operations during winter months can create a variety of hazards for the employee. Frostbite, frostnip, and hypothermia can be experienced and, if not remedied, cause severe health effects and even death. Therefore, it is important that all employees are able to recognize the symptoms of these conditions and correct the problem as quickly as possible.

A. THE EFFECTS OF COLD

Persons working outdoors in temperatures at or below freezing may experience frostbite. Extreme cold for a short time may cause severe injury to the body surface or result in profound generalized cooling, causing death. Extremities such as fingers, toes, and ears are most susceptible.

Prolonged exposure to extreme cold produces the following symptoms: shivering, numbness, low body temperature, drowsiness, and marked muscular weakness.

Two factors influence the development of a cold injury: ambient temperature and wind velocity. Windchill is used to describe the chilling effect of moving air in combination with low temperatures. Table 1 shows a windchill chart. As a general rule, the greatest incremental gain in windchill occurs when a wind velocity increases from 5 mph to 10 mph. Additionally, water conducts heat 240 times faster than air. Therefore, the body cools dramatically when personal protective equipment is removed and clothing underneath is perspiration-soaked.

There are three categories of cold-injury: frostnip, frostbite, and hypothermia.

1. Frostnip

Frostnip is the initial symptom of frostbite and is characterized by a whitened area of the skin accompanied by a burning or painful feeling.

Emergency Care

Warm the affected area either by body heat or warm (not hot) water.

2. Frostbite

Frostbite is local tissue damage caused by exposure to low temperatures. Ice crystals form, either superficially or deeply, in the fluids and underlying soft tissue of the skin. The nose, cheeks, ears, fingers, and toes are most commonly affected.

Frostbite Symptoms

- Skin is cold, hard, white, and numb.

- Skin may be blistering.

DRAFT

- Victim may not be in pain.
- In advanced cases victim experiences mental confusion.
- Judgment impairment.
- Victim will stagger.
- Eyesight failure.
- Unconsciousness.
- Shock symptoms, followed by death.

Frostbite Emergency Care

Cover the frozen area and warm the victim with extra clothing and blankets. Bring the victim indoors (if possible) and allow victim to drink warm liquids.

Rewarm the frozen area quickly by immersion in warm (not hot) water. The best temperature is between 102 and 105°F. This procedure may take up to thirty minutes. The victim will experience greater and greater pain as tissues thaw.

If warm water is not available or not practical to use, wrap the affected area in a sheet and warm blankets.

Severe swelling will develop rapidly after thawing. Discontinue warming the victim as soon as the affected area becomes flush.

When the affected area has been warmed, have the victim exercise it. If the fingers or toes are involved, place dry, sterile gauze between the digits to separate them.

If travel is necessary, cover the affected parts with sterile or clean clothes and keep the injured areas elevated. Obtain medical assistance as soon as possible.

It is important during treatment that you do not:

- Rub the affected area as rubbing may cause gangrene (tissue death).
- Allow the victim to put the affected part near a hot stove or fire.
- Break blisters.
- Allow the victim to walk if the affected area is the feet. (However, walking on a frozen foot is better than staying in the cold.)
- Apply other dressings unless the victim is to be transported for medical aid.
- Allow the victim to smoke or drink alcohol.

DRAFT

It is important to protect the frozen area from further injury, to warm the affected area rapidly, and to maintain respiration. Never allow the affected area to refreeze. This may lead to further damage and result in eventual amputation.

It is also important to remember that areas that have had frostbite are more susceptible to recurrent frostbite.

3. Hypothermia

Hypothermia results from prolonged exposure to the cold thereby lowering the body's core temperature. Cold does not necessarily mean temperatures below freezing, as hypothermia can be caused by temperatures above 32°F when the person is hungry, wet, tired, and over-exerted. The target organ of hypothermia is the brain.

Hypothermia Symptoms

- Severe shivering.
- Abnormal behavior characterized by decreased efficiency, decreased level of communication, forgetfulness, repetitive behavior, poor motor skills, poor judgment, and general apathy.
- Listlessness and sleepiness.
- Weakness, inability to walk, and repeated falling.
- Later stages include collapse, stupor, unconsciousness, and eventual death.

During hypothermia, the body's thermoregulatory mechanisms may shut down. Shivering is the body's way of warming itself. At 95°F, the body will produce maximum shivering. At 87.8°F, the body loses its capacity to shiver. Table 2 lists the signs of hypothermia. The worker's exposure to cold should be immediately terminated when severe shivering becomes evident.

It is important to note that if a victim is found in a remote area, despite the death-like appearance, the person may be saved. All attempts should be made to revive the victim.

Hypothermia Emergency Care

All stages of hypothermia are treated by either passive or active rewarming. Passive rewarming is accomplished by better conservation of the patient's body heat. However, the victim's thermoregulatory mechanisms must be intact.

Active rewarming means heat is applied to the victim by an external source, either surficially and/or through the core. Treatment includes:

- Preventing further heat loss. Remove the victim to warm, dry place (out of the wind, cold, and rain/snow).

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- Remove wet clothing piece-by-piece and dry the underlying skin.
- Dress in several layers of warm, dry clothing, giving preference to the central body core rather than the extremities.
- Cover the victim's head, then wrap victim in blankets.
- If the victim is conscious, allow him/her to drink hot fluids.
- Monitor oral body temperature every 15 minutes. If body temperature falls below 96.8°F, the team member should not be allowed outside until body temperature returns to normal.

In more severe cases of hypothermia, implement the above treatment but also institute some type of active rewarming, including:

— Electric pads or blankets

— Hot-air blowers or heaters

— Heated blankets or clothes

— Use of human body heat

It is important to watch for signs of return of the normal thermoregulatory mechanisms (shivering, teeth chattering, "goose flesh"), and to monitor mental status.

Victim should be transferred to a medical facility after the emergency care steps have been initiated and should not be allowed to return to work for at least 48 hours.

If there has been severe hypothermia, the victim should not be considered dead despite his/her appearance. Treat the victim as stated above and prepare for transfer to a medical facility. If the victim is pulseless and not breathing, perform CPR.

Table 3 lists Threshold Limit Values for working in the cold.

Work-Warming Regimen

If work is performed continuously in the cold at an equivalent chill temperature (ECT) or below -7°C (20°F) heated warming shelters (tents, cabins, rest rooms, etc.) shall be made available nearby and the workers encouraged to use these shelters at regular intervals, the frequency depending on the severity of the environmental exposure. The onset of heavy shivering, frostnip, the feeling of excessive fatigue, drowsiness, irritability, or euphoria, are indications for immediate return to the shelter. When entering the heated shelter the outer layer of clothing shall be removed and the remainder of the clothing loosened to permit sweat evaporation or a change of dry work clothing provided. A change of dry work clothing shall be provided as necessary to prevent workers from returning to their work with wet clothing. Dehydration, or the loss of body fluids, occurs insidiously in the cold environment and may increase the susceptibility of the worker to cold injury due to a significant change in blood

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flow to the extremities. Warm sweet drinks and soups should be provided at the work site to provide caloric intake and fluid volume. The intake of coffee should be limited because of diuretic and circulatory effect.

For work practices at or below -12°F (10°F) ECT, the following shall apply:

1. The worker shall be under constant protective observation (buddy system or supervision).
2. The work rate should not be so high as to cause heavy sweating that will result in wet clothing; if heavy work must be done, rest periods must be taken in heated shelters and opportunity for changing into dry clothing shall be provided.
3. New employee shall not be required to work full-time in cold in the first days until they become accustomed to the working conditions and required protective clothing.
4. The weight and bulkiness of clothing shall be included in estimating the required work performance and weights to be lifted by the worker.
5. The work shall be arranged in such a way that sitting still or standing still for long periods is minimized. Unprotected metal chair seats shall not be used. The worker should be protected from drafts to the greatest extent possible.
6. The workers shall be instructed in safety and health procedures. The training program shall include as a minimum instruction in:
    a. Proper rewarming procedures and appropriate first aid treatment.
    b. Proper clothing practices.
    c. Proper eating and drinking habits.
    d. Recognition of impending frostbite.
    e. Recognition signs and symptoms of impending hypothermia or excessive cooling of the body even when shivering does not occur.
    f. Safe work practices.

Special caution shall be exercised when working with toxic substances. Cold exposure may require reduced exposure limits.

Eye protection for workers employed out-of-doors in a snow and/or ice-covered terrain shall be supplied. Special safety goggles to protect against ultraviolet light and glare (which can produce temporary conjunctivitis and/or temporary loss of vision) and blowing ice crystals are required where there is an expanse of snow coverage causing a potential eye exposure hazard.

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Workplace monitoring is required as follows:

a. Suitable thermometry should be arranged at any workplace where the environmental temperature is below 16°C (60°F) to enable overall compliance with the requirements of the TLV to be maintained.

b. Whenever the air temperature at a workplace falls below -1°C (30°F), the dry bulb temperature should be measured and recorded at least every four hours.

c. In indoor workplaces, the wind speed should also be recorded at least every four hours whenever the rate of air movement exceeds 2 meters per second (5 mph).

d. In outdoor work situations, the wind speed should be measured and recorded together with the air temperature whenever the air temperature is below -1°C (30°F).

e. The equivalent chill temperature shall be obtained from Table 1 in all cases where air movement measurements are required, and shall be recorded with the other data whenever the equivalent chill temperature is below -7°C (20°F).

Employees shall be excluded from work in cold at -1°C (30°F) or below if they are suffering from diseases or taking medication which interferes with normal body temperature regulation or reduces tolerance to work in cold environments. Workers who are routinely exposed to temperatures below -24°C (-10°F) with wind speeds less than 5 mph, or air temperatures below -18°C (0°F) with wind speeds above 5 mph should be medically certified as suitable for such exposures.

Trauma sustained in freezing or subzero conditions requires special attention, because an injured worker is predisposed to secondary cold injury. Special provisions must be made to prevent hypothermia and secondary freezing of damaged tissues, in addition to providing for first aid treatment.

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TABLE 1

TABLE 1

COOLING POWER OF WIND ON EXPOSED FLESH EXPRESSED AS AN EQUIVALENT TEMPERATURE (UNDER CALM CONDITIONS)*

Estimated Wind Speed (in mph)	Actual Temperature Reading (°F)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (°F)											
calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect.)	LITTLE DANGER In < hr with dry skin. Maximum danger of false sense of security				INCREASING DANGER Danger from freezing of exposed flesh within one minute				GREAT DANGER Flesh may freeze within 30 seconds.			
Trenchfoot and immersion foot may occur at any point on this chart.												

*Developed by U. S. Army Research Institute of Environmental Medicine, Natick, MA.

TABLE 2

SIGNS OF HYPOTHERMIA

Core Temperature °C	°F	Clinical Signs
37.6	99.6	"Normal" rectal temperature.
37	98.6	"Normal" oral temperature.
36	96.8	Metabolic rate increases in an attempt to compensate for heat loss.
35	95.0	Maximum shivering.
34	91.4	Severe hypothermia below this temperature.
32	89.4	Consciousness clouded, blood pressure becomes difficult to obtain but react to light; shivering ceases.
31	87.8	
30	86.0	Progressive loss of consciousness; muscular rigidity increases; pulse and blood pressure difficult to obtain; respiratory rate decreases.
29	84.2	
28	82.4	Ventricular fibrillation possible with myocardial irritability.
27	80.6	Voluntary motion ceases; pupils nonreactive to light; deep tendon and superficial reflexes absent.
26	78.8	Victim seldom conscious.
25	77.0	Ventricular fibrillation may occur spontaneously.
24	75.2	Pulmonary edema.
22	71.6	Maximum risk of ventricular fibrillation.
21	69.8	
20	68.0	Cardiac standstill.
18	64.4	Lowest accidental hypothermia victim to recover.
17	62.6	Isoelectric electroencephalogram.
9	48.2	Lowest artificially cooled hypothermia patient to recover.

THRESHOLD LIMIT VALUES WORK -UP SCHEDULE FOR FOUR-HOUR SHIFT*

AIR TEMPERATURE — SUNNY SKY		NO NOTICEABLE WIND		5 MPH WIND		10 MPH WIND		15 MPH WIND		20 MPH WIND	
°C (APPROX)	°F	MAXIMUM WORK PERIOD	NUMBER OF BREAKS	MAXIMUM WORK PERIOD	NUMBER OF BREAKS	MAXIMUM WORK PERIOD	NUMBER OF BREAKS	MAXIMUM WORK PERIOD	NUMBER OF BREAKS	MAXIMUM WORK PERIOD	NUMBER OF BREAKS
1. -26° TO -28°	-15° TO -19°	(NORMAL BREAKS)	1	(NORMAL BREAKS)	1	75 MINUTES	2	55 MINUTES	3	40 MINUTES	4
2. -29° TO -31°	-20° TO -24°	(NORMAL BREAKS)	1	75 MINUTES	2	55 MINUTES	3	40 MINUTES	4	30 MINUTES	5
3. -32° TO -34°	-25° to -29°	75 MINUTES	2	55 MINUTES	3	40 MINUTES	4	30 MINUTES	5	NON-EMERGENCY WORK SHOULD CEASE	
4. -35° TO -37°	-30° TO -34°	55 MINUTES	3	40 MINUTES	4	30 MINUTES	5	NON-EMERGENCY WORK SHOULD CEASE			
5. -38° TO -39°	-35° to -39°	40 MINUTES	4	30 MINUTES	5	NON-EMERGENCY WORK SHOULD CEASE					
6. -40° TO -42°	-40° TO -44°	30 MINUTES	5	NON-EMERGENCY WORK SHOULD CEASE							
7. -43° & BELOW	-45° & BELOW	NON-EMERGENCY WORK SHOULD CEASE									

Notes: (a) Schedule applies to moderate to heavy work activity with warm-up beaks of ten (10) minutes in a warm location. For Light-to-Moderate Work (limited physical movement): apply the schedule one step lower. For example, at -30°F with no noticeable wind (Step 4), a worker at a job with little physical movement should have a maximum work period of 40 minutes with four breaks in a 4-hour period (Step 5).

(b) The following is suggested as a guide for estimating wind velocity if accurate information is not available: 5 mph: light flag moves; 10 mph: light flag fully extended; 15 mph: raises newspaper sheet; 20 mph: blowing and drifting snow.

(c) If only the windchill cooling rate is available, a rough rule of thumb for applying it rather than the temperature and wind velocity factors given above would be: (1) special warm-up breaks should be initiated at a windchill of about 1750 W/m²; (2) all non-emergency work should have cased at or below a windchill of 2250 W/m². In general the warm-up schedule provided above slightly under compensates for the wind at the warmer temperatures, assuming acclimatization and clothing appropriate for winter work. On the other hand, the chart slightly over-compensates for the actual temperatures in the colder ranges, since windy conditions rarely prevail at extremely low temperatures.

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*Adapted from Occupational Health & Safety Division, Saskatchewan Department of Labour.

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Field operations during the summer months can create a variety of hazards to the employee. Heat cramps, heat exhaustion, and heat stroke can be experienced; and if not remedied, can threaten life or health. Therefore, it is important that all employees be able to recognize symptoms of these conditions and be capable of arresting the problem as quickly as possible.

A. THE EFFECTS OF HEAT

As the result of normal oxidation processes within the body, a predictable amount of heat is generated. If the heat is liberated as it is formed, there is no change in body temperature. If the heat is liberated more rapidly, the body cools to a point at which the production of heat is accelerated and the excess is available to bring the body temperature back to normal.

Interference with the elimination of heat leads to its accumulation and thus to the elevation of body temperature. As a result, the person is said to have a fever. When such a condition exists, it produces a vicious cycle in which certain body processes speed up and generate additional heat. Then the body must eliminate not only the normal but also the additional quantities of heat.

Heat produced within the body is brought to the surface largely by the bloodstream and escapes to the cooler surroundings by conduction and radiation. If air movement or a breeze strikes the body, additional heat is lost be convection. However, when the temperature of the surrounding air becomes equal to or rises above that of the body, all of the heat must be lost by vaporization of the moisture or sweat from the skin surface. As the air becomes more humid (contains more moisture), vaporization from the skin slows down. Thus, on a day when the temperature is 95 to 100°F, with high humidity and little or no breeze,, conditions are ideal for the retention of heat within the body. It is on such a day, or more commonly a succession of such days (a heat wave), that medical emergencies due to heat are likely to occur. Such emergencies are classified in three categories: heat cramps, heat exhaustion, and heat stroke.

1. HEAT CRAMPS

Heat cramps usually affect people who work in hot environments and perspire a great deal. Loss of salt from the body causes very painful cramps of the leg and abdominal muscles. Heat cramps also may result from drinking iced water or other drinks either too quickly or in too large a quantity.

Heat Cramp Symptoms. The symptoms of heat cramp are:

- Muscle cramps in legs and abdomen,
- Pain accompanying the cramps,
- Faintness, and
- Profuse perspiration.

Heat Cramp Emergency Care. Remove the patient to a cool place. Give him sips of liquids such as "Gatorade" or its equivalent. Apply manual pressure to the cramped muscle. Remove the patient to a hospital if there is any indication of a more serious problem.

2. HEAT EXHAUSTION DRAFT

Heat exhaustion occurs in individuals working in hot environments, and may be associated with heat cramps. Heat exhaustion is caused by the pooling of blood in the vessels of the skin. The heat is transported from the interior of the body to the surface by the blood. The blood vessels in the skin become dilated and a large amount of blood is pooled in the skin. This condition, plus the blood pooled in the lower extremities when an individual is in an upright position, may lead to an inadequate return of blood to the heart and eventually to physical collapse.

Heat Exhaustion Symptoms. The symptoms of heat exhaustion are:

- Weak pulse;
- Rapid and usually shallow breathing;
- Generalized weakness;
- Pale, clammy skin;
- Profuse perspiration;
- Dizziness;
- Unconsciousness; and
- Appearance of having fainted (the patient responds to the same treatment administered in cases of fainting).

Heat Exhaustion Emergency Care. Remove the patient to a cool place and remove as much clothing as possible. Administer cool water, "Gatorade," or its equivalent. If possible, fan the patient continually to remove heat by convection, but do not allow chilling or overcooling. Treat the patient for shock, and remove him to a medical facility if there is any indication of a more serious problem.

3. HEAT STROKE

Heat stroke is a profound disturbance of the heat-regulating mechanism, associated with high fever and collapse. Sometimes this condition results in convulsions, unconsciousness, and even death. Direct exposure to sun, poor air circulation, poor physical condition, and advanced age (over 40) bear directly on the tendency to heat stroke. It is a serious threat to life and carries a 20 percent mortality rate. Alcoholics are extremely susceptible.

Heat Stroke Symptoms. The symptoms of heat stroke are:

- Sudden onset;
- Dry, hot, and flushed skin;
- Dilated pupils;
- Early loss of consciousness;
- Full and fast pulse;
- Breathing deep at first, later shallow and almost absent;
- Muscle twitching, growing into convulsions; and
- Body temperature reaching 105 to 106°F or higher.

Heat Stroke Emergency Care. Remember that this is a true emergency. Transportation to a medical facility should not be delayed. Remove the patient to a cool environment if possible, and remove as much clothing as possible. Assure an open airway. Reduce body temperature promptly, preferably by wrapping in a wet sheet or else by dousing the body with water.

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If cold packs are available, place them under the arms, around the neck, at the ankles, or at any place where blood vessels that lie close to the skin can be cooled. Protect the patient from injury during convulsions, especially from tongue biting.

B. AVOIDANCE OF HEAT-RELATED EMERGENCIES

Please note that in the case of heat cramps or heat exhaustion, "Gatorade" or its equivalent is suggested as part of the treatment regime. The reason for this type of liquid refreshment is that such beverages will return much-needed electrolytes to the system. Without these electrolytes, body systems cannot function properly, thereby increasing the represented health hazard. Therefore, when personnel are working in situations where the ambient temperatures and humidity are high, and especially in situations where protection Levels A, B, and C are require, the site safety officer must:

- Assure that all employees drink plenty of fluids ("Gatorade" or its equivalent);
- Assure that frequent breaks are scheduled so overheating does not occur; and
- Revise work schedules, when necessary, to take advantage of the cooler parts of the day (e.g., 5:00 a.m. to 1:00 p.m. and 6:00 p.m. to nightfall).
- Assure that workers are acclimated before allowing them to work for extended periods. Heat induces a series of physiological and psychological stresses that the individual worker must adjust to during the first week of heat exposure. Workers should slowly work into their peak work performance over a two-week period. Workers absent from the site several days must be allowed to become reacclimated.

If protective clothing must be worn, especially Levels A and B, the suggested guidelines for ambient temperature and maximum wearing time per excursion are given in the following Table:

Suggested guidelines for continuous use of Level A or Level B protection:

Ambient Temperature (°F)	Maximum Wearing Time per Excusion (minutes)
Above 90	15
85 to 90	30
80 to 85	60
70 to 80	90
60 to 70	120
50 to 60	180

C. REST-RECOVERY REGIME **DRAFT**

One method of measuring the effectiveness of employees' rest-recovery regime is by monitoring the heart rate. The "Brouha Guideline" is one such method:

- During a three-minute period, count the pulse rate for the last 30 seconds of the first minute, the last 30 seconds of the second minute, and the last 30 seconds of the third minute.
- **Double the count.**

If the recovery pulse rate during the last 30 seconds of the first minute is at 110 beats/minute or less, and the deceleration between the first, second, and third minutes is at least 10 beats/minute, the work-recovery regime is acceptable. If the employee's rate is above that specified, a longer rest period is required, accompanied by an increase intake of fluids .

HEAT STRESS MONITORING

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NAME: ______________________ DATE/TIME: ______________

SITE: ______________

COMPANY: ______________________ LOCATION: ______________

Pulse Rate Monitoring (30 second rest prior to first measurement):

Starting Time: __________ Pulse Rate: ________ beats/minute;

rest 30 sec.; __________; rest 30; __________ b/m;

rest 30 sec.; __________; rest 60; __________ b/m;

rest 60 sec.; __________; rest 60: __________ b/m;

Starting Time: __________ Pulse Rate: ________ beats/minute;

rest 30 sec.; __________; rest 30; __________ b/m;

rest 30 sec.; __________; rest 60; __________ b/m;

rest 60 sec.; __________; rest 60: __________ b/m;

Starting Time: __________ Pulse Rate: ________ beats/minute;

rest 30 sec.; __________; rest 30; __________ b/m;

rest 30 sec.; __________; rest 60; __________ b/m;

rest 60 sec.; __________; rest 60: __________ b/m;

Starting Time: __________ Pulse Rate: ________ beats/minute;

rest 30 sec.; __________; rest 30; __________ b/m;

rest 30 sec.; __________; rest 60; __________ b/m;

rest 60 sec.; __________; rest 60: __________ b/m;

Method of Measurement:

Carotid Artery: __________; Instrument (specify type): ______________

Self-Determined & Reported: ________

Site Safety Officer: __________(Contractor); ________(Contract Monitor)

____

Site Safety Officer

ATTACHMENT 3

ON-SITE DOCUMENTATION FORMS

PARSONS

PARSONS INFRASTRUCTURE & TECHNOLOGY

PLAN ACCEPTANCE FORM
SITE SAFETY AND HEALTH PLAN

I have read and agree to abide by the contents of the Safety and Health Plan for the following project:

____

____
Name (print)

____
Signature

____
Date

Return to Project Health and Safety Officer **before** work at the site.

PARSONS

PARSONS INFRASTRUCTURE & TECHNOLOGY

ACCIDENT REPORT FORM

Page 1 of 2

EMPLOYER

1. Name: ______________________________

2. Mail Address: ______________________________
(No. and Street) (City or Town) (State and Zip)

3. Location: ______________________________
(if different from mail address)

INJURED OR ILL EMPLOYEE

4. Name: ______________________ Social Sec. No.: ______________
(first) (middle) (last) Employee No: ______________

5. Home Address: ______________________________
(No. and Street) (City or Town) (State and Zip)

6. Age: __________ 7. Sex: male ( ) female ( )

8. Date of injury or illness: ______________ Time of accident: ______________

9. Occupation: ______________________________
(specific job title, **not** the specific activity employee was performing at time of injury)

10. Department: ______________________________
(enter name of department in which injured person is employed, even though they may have been temporarily working in another department at the time of injury)

THE ACCIDENT OR OCCUPATIONAL ILLNESS

11. Place of accident or exposure: ______________________________
(No. and Street) (City or Town) (State and Zip)

12. Project: ______________________________

13. Was place of accident or exposure on employer's premises? Yes ( ) No ( )

14. How did the accident occur? ______________________________
(describe fully the events that resulted in the injury of occupational illness.

____
Tell what happened and how. Name objects and substances involved. Give details on all factors that led to

____
accident. Use separate sheet for additional space).

15. What was the employee doing when injured? ______________________
(be specific—was employee using tools or equipment
____
or handling material?)

16. Witness to Accident: ______________________
(Name) (Affiliation) (Phone No.)
____
(Name) (Affiliation) (Phone No.)

17. Name the object or substance that directly injured the employee: ______________________
(for example, object that struck
____
employee; the vapor or poison inhaled or swallowed; the chemical or radiation that irritated the skin; or in
____
cases of strains, hernias, etc., the object the employee was lifting, pulling, etc.)

18. Did the accident result in employee fatality? Yes ( ) No ( )

19. Number of lost days _____/ restricted workdays ____ resulting from injury or illness?

OTHER

20. Name and address of physician: ______________________
(No. and Street) (City or Town) (State and Zip)

21. If hospitalized, name and address: ______________________
(No. and Street) (City or Town) (State and Zip)

22. Initial diagnosis of injury/occupational illness: ______________________

Date of report: ______________ Prepared by: ______________

Official position: ______________

23. Treatment rendered: ☐ first aid ☐ medical treatment

____

____

PARSONS

PARSONS INFRASTRUCTURE & TECHNOLOGY

ACCIDENT REPORT FOLLOW-UP

Employee: ______________________ **Date of injury or illness:** ________________

ANALYSIS – What caused the accident. Why did it happen:

Primary cause:

Contributing factors:

PREVENTIVE/CORRECTIVE ACTION – State what will be done to prevent reoccurrence.

Immediate action:

Who is responsible: ________________ Completion date(s): ________________

Long-term action:

Who is responsible: ________________ Completion date(s): ________________

Closed by: ____

3. Facility Health and Safety Representative Date

FORM HS07-03 REV 7

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Air Monitoring Instument
Calibration Log

Parsons Engineering Science,Inc.	Client:	Date:
Project:		Project #:
Instrument Type:	Instrument Model:	Instument S/N:

Date	Calibration Gas Concentration	Pre-adjusted Reading	Adjustment Required? Yes/No	Span Gas Concentration Setting	Post-Cal Span Gas Reading	Maintenance Notes	Initials

Field Monitoring Form

Parsons Engineering Science

Date:

Project: ______________________

Location: ______________________

Project No.: ________

Inspector: ________

Crew: ________

Location: ________

Weather: AM ______________________

PM ______________________

Time:	PID	Particulate	Comments:

ATTACHMENT 4

PERSONAL PROTECTIVE EQUIPMENT PROGRAM

RESPIRATORY PROTECTION PROGRAM

Prepared for

THE ENGINEERING-SCIENCE NORTHEAST OPERATIONS OFFICE

June 1990

ST-6-15

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1.0 OBJECTIVE

The objective of the Respiratory Protection Program is to provide Engineering-Science, Inc. (ES) Northeast Operations field personnel with sufficient information and guidance to adequately protect themselves from potential inhalation hazards during hazardous waste or industrial field operations. The use of respirators to protect personnel from inhalation hazards is permitted by OSHA under 29 CFR Part 1910.134 when other more positive methods of protection, such as engineering controls (e.g., ventilation) or work practices (e.g., substitution) are not feasible.

2.0 NEED FOR RESPIRATORY PROTECTION

OSHA has established safe exposure levels for various airborne contaminants that may be encountered at sites during field operations. If worker exposure to these substances exceeds the OSHA permissible exposure limits, OSHA requires that feasible engineering controls and administrative measures be instituted to reduce worker exposure to within acceptable levels. If controls are not feasible, employers are required to provide the appropriate, approved respirators for employee protection. Because of the nature of site work in general, traditional industrial hygiene engineering controls are not usually feasible. Hence, respirators must be relied upon as a means for protecting workers at hazardous waste sites. All respiratory protection practices for ES Denver personnel, including selection and use, shall be in accordance with this program.

3.0 MINIMUM REQUIREMENTS OF AN ACCEPTABLE RESPIRATOR PROGRAM

OSHA has established the requirements for a minimally acceptable program under 29 CFR Part 1910.134. A copy of this standard is included as Appendix A in this manual. Elements that must be incorporated into an OSHA-acceptable program include the following:

- Approved respiratory devices must be properly selected.
- A determination must be made regarding the need for respiratory protective devices.
- An employee training program must be established in which the employee becomes familiar with the respiratory protective devices and is trained in the proper selection and use of respirators and their limitations.
- There must be provisions for:
  The proper maintenance, storage, inspection and repair of respirators.
  Testing for the proper fit of the respiratory protective equipment.
  Medical screening of employees to determine if they are physically able to perform their assigned work while using of respiratory protective equipment.
- Written standard operating procedures for the selection and use of respiratory protective equipment.

4.0 ESTABLISHMENT OF THE RESPIRATOR PROGRAM

Personnel with specific responsibilities for the implementation of the program include the following:

4.1 OFFICE HEALTH AND SAFETY REPRESENTATIVE (PHILLIP HUNT, C.I.H.)

The Office Health and Safety Representative is responsible for:

- Administering the respiratory protection program.
- Setting up and conducting training program.
- Selecting and working with a medical contractor.
- Ensuring the office has the necessary respiratory protective equipment.
- Scheduling and conducting fit testing.
- Development of written standard operating procedures guiding the selection respiratory equipment.
- Maintaining fit test and medical records.

4.2 HEALTH AND SAFETY EQUIPMENT MANAGER

The health and safety equipment manager reports to the Office Health and Safety Representative and is responsible for the following:

- The inspection, maintenance and cleaning of respirators.
- The proper storage of respirators.
- Maintenance of records for the repair of respirators.
- Maintaining an adequate stock of cartridges for air purifying respirators. This person must ensure self-contained breathing apparatuses are filled with Grade D or better breathing air.
- Distributing respirators to field team members.

4.3 PROJECT HEALTH AND SAFETY OFFICER (PHSO)

All hazardous waste and industrial field investigations shall have a Project Health and Safety Officer. This individual reports to the Office Health and Safety Representative and is responsible for the following:

- Ensuring that any team member conducting a field investigation has received training in the selection and use of respirators and has the equipment necessary to conduct the investigation safely.
- Determining the degree of respiratory protection required for each field task or operation.
- Ensuring site-specific training is performed prior to onsite activities.
- Maintaining records of respirator use.

4.4 PROJECT STAFF

All project team members must read and conform to the Project Health and Safety Plan. Employees must present a copy of their fit test log to the equipment manager in order to receive a respirator. Employees are to perform daily inspections and cleaning of their assigned respirator. In the field respirators shall be stored in a convenient, clean and sanitary location when not in use. Workers must report any perceived problems or difficulties with respiratory protecive equipment to their Project Health and Safety Officer. These malfunctions may include, but are not limited to, the following:

- Perception of odor while wearing a respirator.
- Resistance in breathing during respirator use.
- Fatigue due to respirator use.

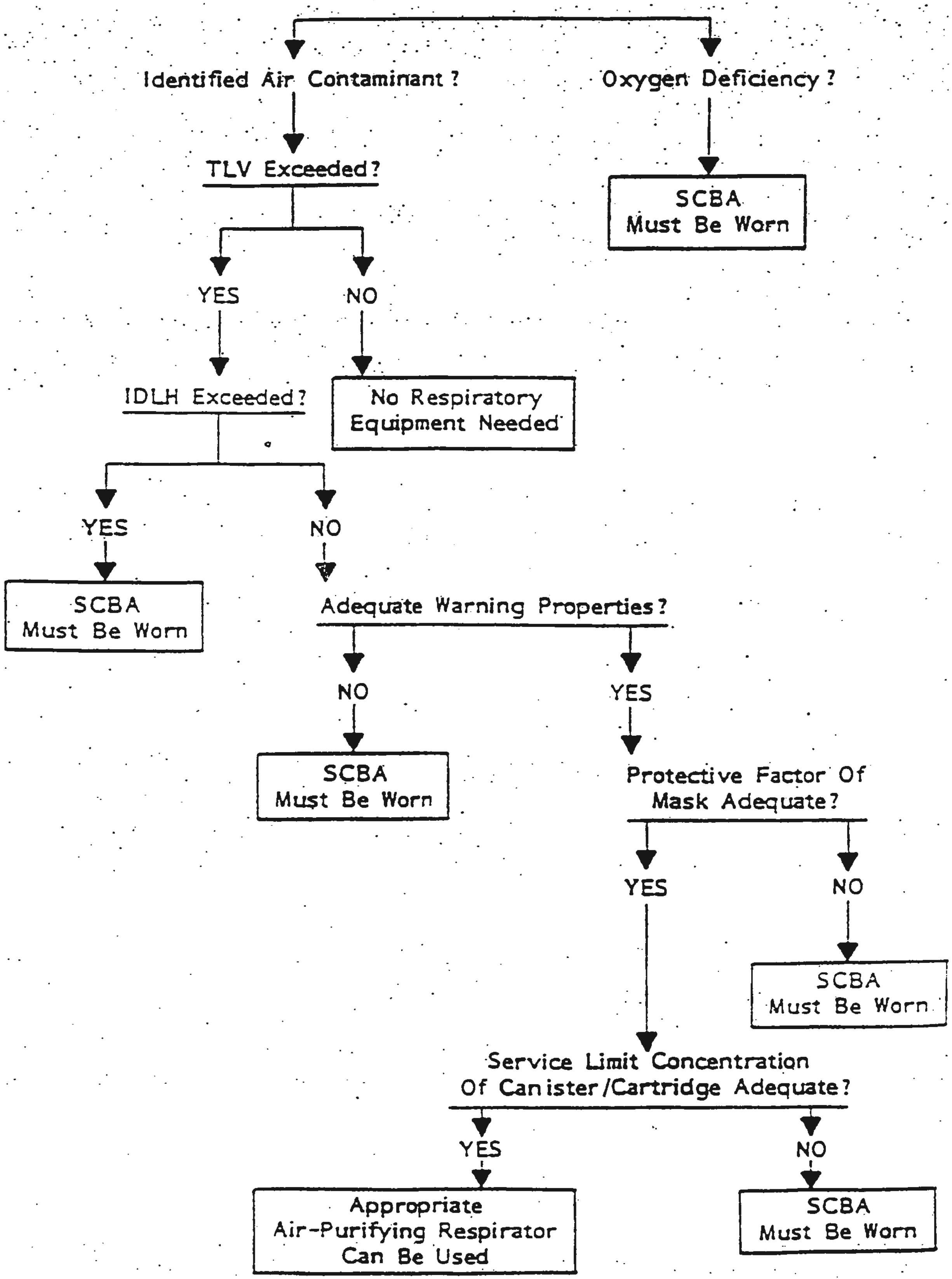
5.0 RESPIRATOR SELECTION

The investigation of hazardous waste sites presents workers with a number of environmental conditions, some of which are better defined than others. It is not the purpose of this document to provide precise decision logic criteria encompassing every potential environmental situation. Each situation is unique. This document recognizes that many decisions concerning respiratory protection selection involve aspects of risk assessment. This procedure ensures that all relevant data are considered in the process of conducting respiratory proectection risk assessments, resulting in the selection of specific respiratory protective equipment items appropriate for protection against hazardous chemical exposure. Steps to take include:

1. Assimilate all available information pertaining to the hazard including: past activities, suspected materials, historical information, land use, analytical data, nature of current activities, etc.
2. Evaluate the relevance and timeliness of the data to determine the appropriate protective level needed for the task.
    a) Is the analytical data relevant?
    b) Was the past sampling or monitoring conducted during the same season as is anticipated for the activities planned? If not, what implication might this hold?
    c) Was past sampling or monitoring conducted from a medium which is pertinent to the evaluation of hazards associated with the activities specified in the task work plan?
3. Identify substances present at the work area.
4. Utilizing the subject areas listed below, evaluate all of the known or suspected chemicals on site. Topics requiring elaboration are detailed in the decision logic criteria section (see Figure 1).
    a) Permissible Exposure Limits (PEL), Threshold Limit Values (TLV).
    b) Eye irritation potential for substance (see below, decision logic criteria section).
    c) Warning properties of substance (see below, decision logic criteria section).
    d) Immediately Dangerous to Life and Health (IDLH) cocnentrations (see below, decision logic criteria section).
    e) Any possibility of poor sorbent efficiency at IDLH concentrations and below.
    f) Is there a possibility of severe skin irritation resulting from skin contact with corrosive gases (see below, decision logic criteria).
    g) The vapor pressure of the substance.
    h) Any possibility of high heat of reaction with sorbent material in cartridge or canister (see below, decision logic criteria).
    i) Is there a possibility of shock sensitivity of chemical being sorbed onto the cartridge or canister (see below, decision logic criteria).

FIGURE 1

DECISION LOGIC FLOW CHART
ON CHOOSING APPROPRIATE RESPIRATOR



5. Determine the physical state(s) of the substance as it is likely to be encountered at the hazardous waste site. It will be either:
   a) a gas or vapor;
   b) particulate (dust, fume, or mist), or
   c) a combination of (a) and (b).
6. Oxygen deficient atmospheres (ANSI Z88.2-1980) — air-purifying respirators shall not be worn in environments deficient in oxygen ($< 19.5\%$ by volume or partial pressure less than 100 mm of mercury).

5.1 DECISION LOGIC CRITERIA

5.1.1 Skin Adsorption and Irritation

A supplied-air suit may provide skin protection from extremely toxic substances which may be absorbed through the skin or cause severe skin irritation. Most information concerning skin irritation is not quantitative but rather is presented in commonly used descriptive terms, such as "a strong skin irritant, highly irritating to the skin" and "corrosive to the skin." Decisions made concerning skin irritation are judgmental and are often based on this non-quantitative information. As a guideline for the use of the supplied-air suit for substances that are sorbed through the skin, a single skin penetration LD50 of 2 g/kg for any animal species is used.

5.1.2 Poor Warning Properties

Air-purifying devices cannot be used to protect against organic vapors with poor warning properties. Warning properties include odor, eye irritation, taste imparting characteristics, and respiratory irritation. Warning properties provide an indication to the wearer of possible cartridge exhaustion or of poor face piece fit. Adequate warning properties can be assumed when the substances odor, taste, or irritation effects are detectable and persistent at concentrations at or below the permissible exposure limit.

If the odor or irritation threshold of a substance is more than two times greater than the PEL, this substance should be considered to have poor warning properties. Some substances have extremely low thresholds of odor and irritation in relation to the permissible exposure limit. These substances can be detected by a worker within the face piece of the respirator even when the respirator is functioning properly. These substances are considered to have poor warning properties (see Table 1).

Although 30 CFR Part 11[*1] does not specifically eliminate the use of air-purifying respirators for pesticides with poor warning properties, prudent practices dictate that a respirator should not be used to protect against any substance with poor warning properties.

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[*] The primary technical criteria for what constitutes a permissible respirator is determined by the technical requirements of 30 CFR Part 11 (Department of Interior, Bureau of Mines, Respiratory Protective Devices and Test for Permissibility).

5.1.3 Sorbents

There are certain limitations to the use of sorbent cartridge/canister respirators. When the following conditions exist, a sorbent cartridge is not recommended:

- A cartridge/canister air-purifying respirator can never be used when evidence exists of immediate (less than 3 minutes) breakthrough time at or below the IDLH concentration.
- An air-purifying canister/cartridge respirator shall not be used when there is reason to suspect that the sorbent does not provide adequate efficiency against the removal of a specific contaminant(s) that may be encountered at the site.
- Where there is reason to suspect that a sorbent has a high heat of reaction with a substance, use of that sorbent is not allowed.
- Where there is reason to suspect that a substance sorbed onto the surface of a cartridge or canister is shock sensitive, use of air-purifying respirators is prohibited.
- For concentrations of organic vapors which exceed 1,000 ppm (10 times the PEL for quarter masks or 50 times the PEL for full facepiece masks). Note: this respirator will not be selected if the contaminant or its concentration are unknown.

5.1.4 Eye Irritation

The decision of whether to use a full-face respirator or a half or quarter-face respirator is often made by cons[illegible]ing the chemical's potential for producing eye irritation or damage. The following guidelines deal with eye protection.

Any eye irritation is considered unacceptable for routine work activities. Therefore, only full-face respirators are permissible in contaminant concentrations that produce eye irritation. For escape, some eye irritation is permissible if it is determined that such irritation would not inhibit escape and such irritation is reversible.

In instances where quantitative eye irritation data cannot be found in literature references, and theoretical considerations indicate that the substance should not be an eye irritant, half-face piece respirators are allowed.

In cases where a review of the literature indicates a substance causes eye irritation but no eye irritation threshold is specified, the full-face piece respirators can be used.
Immediately dangerous to life or health (IDLH)

The definition of IDLH provided in 30 CFR 11.3(t) is as follows:

> "Immediately dangerous to life or health" means conditions that pose an immediate threat to life or health or conditions that pose an immediate threat of severe exposure to contaminants, such as radioactive materials, which are likely to have adverse cumulative or delayed effects on health."

The purpose of establishing an IDLH exposure concentration is to insure that the worker can escape without injury or irreversible health effects in the event of failure of the respiratory protective equipment. The IDLH is considered the maximum concentration above which only

Table 1

Comparison of Selected Odor Thresholds and TIVs for Chemical Compounds

Compounds	Odor Threshold (ppm)	TLV (ppm)
Group 1 - Odor Threshold and TLV Approximately the Same		
Cyclohexane	300	300
Cyclohexanol	100	50
Epichlorhydrin	10	5
Ethylene diamine	11	10
Hydrogen chloride	10	5
Methyl acetate	200	200
Methylamine	10	10
Methyl chloroform	500	350
Nitrogen dioxide	5	3
Propyl alcohol	200	200
Turpentine	200	100
Group 2 - Odor Threshold from 2 to 10 Times the TLV		
Acrolein	0.2	0.1
Acrylonitrile	21.0	2.0
Allyl alcohol	7.0	2.0
Arsine	0.21	0.05
1,2-Dichloroethylene	500.0	200.0
Dichloroethyl ether	35.0	5.0
Dimethyl acetamide	46.0	10.0
Ethyl benzene	200.0	100.0
Hydrogen selenide	0.3	0.05
Isopropyl glycidyl ether (IGE)	300.0	50.0
Group 3 - Odor Threshold Equal to or Greater than 10 Times TLV		
Bromoform	530.0	0.5
Camphor (synthetic)	1.6-200	2.0
Carbon tetrachloride	75.0	5.0
Chloroacetophenone	1.0	0.05
Chloroform	200.0	10.0
Chloropicrin	1.0	0.1
Diglycidyl ether (DGE)	5.0	0.1
Dimethylformamide	100.0	10.0
Ethylene oxide	500.0	1.0
Methyl formate	2000.0	100.0
Methanol	2000.0	200.0
Methyl cyclohexanol	500.0	50.0
Phosgene	1.0	0.1
Toluene 2,4-diisocyanate (TDI)	2.0	0.005

a highly reliable positive-pressure self contained breathing apparatus is permitted. Since IDLH values are conservatively set, any approved respirator may be used up to its maximum use concentration below the IDLH.
In establishing the IDLH concentration the following factors are considered:

1. Escape without loss of life or irreversible health effects. Thirty minutes is considered the maximum permissible exposure time for escape.
2. Severe eye or respiratory irritation or other reactions which would prevent escape without injury.

IDLH should be determined from the following sources:
1. Specific IDLH concentration provided in the literature such as the AIHA

Hygienic Guides and the NIOSH Pocket Guide to Chemical Hazards
2. Human exposure data
3. Acute animal exposure data
4. Acute toxicological data from analogous substances.

The following guidelines should be used to interpret toxicological data reported in the literature for animal species:

1. Where acute inhalation exposure data (30 minutes to 4 hours) are available for various animal species the lowest exposure concentration causing death or irreversible health effects in any species is determined to be the IDLH concentration.
2. Chronic exposure data may have little relevance to the acute effects and should not be used in determining the IDLH.

5.1.6 Protection Factors

The protection factors of respiratory protection devices are a useful numerical tool to aid in the selection of appropriate respiratory protection. Protection factors measure the overall effectiveness of a respirator...

The protection factor of a given respirator for a specific user multiplied by the PEL for a given substance is the maximum allowable concentration of that substance for which the respirator may be used. For example, if the protection factor for a full-face mask respirator is 50 and substance X has a PEL (or TLV) of 10 ppm, the full-face mask respirator will provide protection up to 500 ppm (see Table 2).

5.1.2 Respirator Types

5.1.2.1 Air-Purifying Respirators

As mentioned earlier, an air-purifying respirator can be used only if the atmosphere contains greater than 19.5 percent oxygen and the contaminant is present at a concentration below the IDLH level. Another important consideration is that the contaminant in question has properties which will alert the user that the filter or sorbent is about to be exhausted. The various types of air-purifying respirators utilized by Atlanta are listed below.

5.1.2.2 Half-Mask Respirators

A half-mask respirator fits from under the chin to above the nose. One or two cartridges are used to filter the air and discarded once the use limits are reached. Whereas the quarter-mask is approved for only dusts, the half-mask has approved cartridges for pesticides, organic vapors, dusts, mists, fumes, acid gases, ammonia, and several combinations.

5.1.2.3 Full Face Mask Respirators

The whole face, including the eyes, is protected by the full face mask. It gives 5 times the protection of a half-mask (full face mask PF = 50, half-mask PF = 10). Full Face masks are more expensive, but the added protection is certainly advantageous, no matter how small the risk in a given situation.

5.1.2.4 Atmosphere Supplying Respirators

Atmosphere supplying respirators provide from 5 minutes to several hours of breathing air. The amount of protection provided is based upon the type of face piece and its mode of operation. The full face mask provides the best protection.

Of the three modes of operation, continuous, demand, and pressure-demand, the pressure-demand mode provides the best protection.

There are two types of atmosphere supplying respirators that the Atlanta office uses: airline and self-contained breathing apparatus (SCBA). A description of each is presented below.

5.2.4.1 Airline Respirator

This respirator uses an airline to transport clean compressed air to the wearer. The mode of operation may be either continuous, demand, or pressure-demand. This respirator may be worn in an IDLH environment if: (1) it is pressure-demand type, and (2) it incorporates an escape SCBA into the system, however, no more than 300 feet of airline is allowed.

5.2.4.2 Self-Contained Breathing Apparatus

The self-contained breathing apparatus (SCBA) allows the wearer to carry a cylinder of compressed air or oxygen without the confinement of a hose or airline.
The North 801 and MSA Ultralite are the two types of SCBAs used by Engineering-Science. Both are open-circuit SCBAs. The North respirator is approved for demand and pressure demand modes. Greater protection is afforded, however, when these respirators are operated in the pressure demand mode.

5.2.4.3 Escape

Engineering-Science will provide and ensure that all employees will carry an escape respirator where exposure to extremely toxic substances may occur. (An extremely toxic substance is defined as a gas or vapor having an LC50 equal to or less than 10 ppm). An

Table 2

Selected Respirator Protection Factors

Type of Respirator	Protection Factor (Qualitative Test)
Air-purifying	
quarter-mask	10
half-mask	10
Air-line	
quarter-mask	10
half-mask	10
Hose mask	
full facepiece	10
SCBA, demand	
quarter-mask	10
half-mask	10
Air-purifying	
full facepiece	50
Air-line, demand	
full facepiece	50
SCBA, demand	
full facepiece	50
Air-line, pressure-demand, with escape provision	
full facepiece (no test required)	10,000+
SCBA, pressure-demand or positive pressure	
full facepiece (no test required)	10,000+

For additional information consult ANSI Z88.2 - 1980.

escape SCBA must have at least 5 minutes of breathing air stored in a small cylinder or coiled stainless-steel tube. Escape devices should never be used for entry into hazardous atmospheres.

4.3 SELECTION OF RESPIRATORS USING ACTIVITY MEASUREMENTS

Identification and evaluation of the contaminants that exist at a particular time provide the basis for selection of a respirator. However, real-time monitoring of activities at sites will be conducted using direct reading air monitoring instruments as the index of hazard. Therefore, respirators must be selected prior to initiating an activity, based on characterizations of groundwater and soils, knowledge of the area and associated waste, and previous measurements of worker exposure levels for the same or very similar tasks under similar conditions. Once a level of protection has been chosen, it can be modified based on real-time activity measurements, supplemented with background information and professional judgment.

Below are the allowed modifications. Please note carefully the qualifiers.

- Level B to Level D

This modification may be made in the sustained absence of volatiles or particulates as measured on real-time equipment and at the direction of the PHSO.

- Level C to Level D
  Same as Level B to Level D
- Level D to Level B

May be made at the direction of the PHSO based on the magnitude of the measurements and on professional judgment.

- Level C to Level B

Permissible at the direction of the PHSO in cases where total volatiles or particulate measurements exceed the preset action level based on characterization on the expected contaminants.

- Level D to Level C

Permissible at the direction of the PHSO when total volatiles or particulates exceed the preset action level based on characterization of the expected contaminants and when PEL-TWA measurements are being taken concurrently.

- Level B to Level C

May be made at the direction of the PHSO only when the contaminants and their concentrations are known. This modification should not be used without substantial knowledge of all the chemicals involved and their expected behavior in relation to change in concentration and effect on absorbent cartridges.

6.0 TRAINING AND FITTING

6.1 TRAINING

Selecting the respirator appropriate for a given hazard is important, but equally important is using the selected device properly. Proper use can be ensured by careful training of users and by maintenance of respiratory protective devices.

Engineering-Science requires respirator training as part of the initial training course conducted for workers who are to perform hazardous waste or industrial field operations. Additionally, the ES Denver office requires respirator training to be incorporated into the annual refresher training provided to employees performing hazardous waste activities. Both trainings will address the subjects in Table 3. Project-specific respirator training should be offered by the Project Health and Safety Officer as part of the initial site-specific training.

6.2 RESPIRATOR FITTING

The proper fitting of respiratory protective devices requires the use of a fit test. The fit test is needed to determine a proper match between the facepiece of the respirator and the face of the user.

The test subject shall be given the opportunity to choose the most comfortable respirator from various sizes and manufacturers. The test subject shall hold each facepiece up to the face and eliminate those which do not provide a comfortable fit.

The most comfortable mask is donned and worn for at least 5 minutes to assess comfort. The test subject should evaluate the following points:

- The position of the mask on the nose.
- The room available for eye protection or prescription inserts.
- The room available to talk.
- The position of the mask on the face and cheeks.

After the subject has determined the respirator of greatest comfort, that person shall conduct a negative and positive pressure fit check. Another facepiece shall be selected and retested if the test subject fails the fit checks. After the successful completion of the fit checks, the respirator fit shall be evaluated using a test atmosphere.

6.2.1 Test Atmospheres

The users of respirators are required to test the facepiece-to-face seal of the respirator and to wear the respirator in a test atmosphere. The test atmosphere is simulated in an enclosure that permits the user to enter with the equipment on while an atmosphere of a low-toxicity compound is generated. The isoamyl acetate and irritant smoke test described in the text that follows will be performed by the Office Health and Safety Representative every 6 months for personnel engaged in hazardous waste and industrial field operations. The Office Health and Safety Representative will follow the OSHA protocols for fit testing (29 CFR Part 1910.1028). A summary of this protocol is presented below. After

Table 3

Respirator Training

Lecture and Discussion

- Discussion of classification of respirators (e.g., air purifying and atmosphere-supplying respirators)
- Discussion of respirator capabilities and limitations.
- Instruction on setting "action levels".
- Instruction on OSHA Standard for respiratory protection.
- Proper fitting.
- Classroom and field training in recognizing and copy with emergencies.

Workshop and Field Exercise

- Field exercise in Levels A, B, and C protective ensembles.
- Disassembly and reassembly of respirators emphasizing components, their function, and their relation to the overall function of the respirator.
- Inspection of respirators.
- Proper donning and field fit testing.
- Fit testing with a test atmosphere.
- Cleaning, maintenance, and storage.

the fit test has been successfully completed, a fit test log (see Table 4) will be issued to the test subject.

6.2.1.1 Isoamyl Acetate Test

Isoamyl acetate, a low-toxicity substance with a banana-like odor, is used widely in testing the facepiece fit of organic vapor cartridge/canister respirators. The substance is applied to the cotton wad inside the enclosure. The user should put on the respiratory protective device in an area away from the test enclosure so there is no prior contamination of the cartridge or "pre-exposure" to the isoamyl acetate. The user should perform the following:

- Normal breathing.
- Deep breathing, as during heavy exertion.
- Side-to-side and up-and-down head movements. These movements should not be exaggerated, but should approximate those that take place on the job.
- Talking. This is most easily accomplished by reading a prepared text (e.g., Rainbow Passage) loudly enough to be understood by someone standing nearby.
- Other exercises may be added depending upon the need.

The major drawback of isoamyl acetate test is that odor thresholds vary widely among individuals. Also, the sense of smell is easily dulled and may deteriorate during the test so the user can detect only high vapor concentrations.

Another disadvantage is isoamyl acetate smells pleasant, even in high concentrations. Therefore, unless the worker is highly motivated toward wearing respirators, the results of this test are sometimes suspect.

6.2.1.2 Irritant Smoke Test

The irritant smoke test, similar to the isoamyl acetate test, is used widely in testing the facepiece fit of particulate and particulate/organic vapor filter respirators. This test can be used for both air-purifying and supplied-air respirators. The challenge agent is an irritant (stannic oxychloride) that is available commercially in sealed glass tubes. When the tube ends are broken and air passed through them, a dense, irritating smoke is emitted. In this test, the user steps into the test enclosure and the irritant smoke is sprayed into the enclosure. If the user detects any of the irritant smoke, a defective fit is indicated and adjustment or replacement of the respirator is required. <u>The irritant smoke test must be performed with caution because the aerosol is highly irritating to the eyes, skin, and mucous membranes</u>. As a qualitative means of determining respirator fit, this test has a distinct advantage in that the wearer usually reacts involuntarily to leakage by coughing or sneezing. The likelihood of giving a false indication of proper fit is reduced.

6.2.2 Daily Qualitative Fit Check at the Site

In the field each employee is responsible for performing daily qualitative fit checks of their assigned respirator prior to entry into a hazardous atmosphere. The daily determination of fit will consist of a negative and positive pressure fit checked as described below.

TABLE 4
ENGINEERING SCIENCE, INC.
BOSTON OFFICE
FIT-TEST RECORD LOG

NAME OF EMPLOYEE: ______________________

LOCATION: ES BOSTON OFFICE (101 HUNTINGTON AVE., BOSTON, MA.)

SIGNATURE: ______________________ DATE: __________

NAME OF FIT-TESTER: ______________________

SIGNATURE: ______________________ DATE: __________

TYPE OF RESPIRATOR:	FULL FACE
MANUFACTURER:	NORTH
MODEL:	7600-8A
CORRECTIVE LENSES:	YES

TYPE OF TEST	PASS/FAIL
ISOAMYL ACETATE	P F
IRRITANT SMOKE	P F

6.2.2.1 The Negative Pressure Test

In this test, the user closes off the inlet of the canister, cartridge(s), or filter(s) by covering it with the palm of their hand; inhales gently so that the facepiece collapses slightly; and holds their breath for about 10 seconds. If the facepiece remains slightly collapsed and no inward leakage is detected, the respirator is probably functioning correctly.

6.2.2.2 The Positive Pressure Test

This test is conducted by closing off the exhalation valve and exhaling gently into the facepiece. The fit is considered satisfactory if slight positive pressure can be built up inside the facepiece without any evidence of outward leakage.

7.0 RESPIRATOR INSPECTION, CLEANING, MAINTENANCE, AND STORAGE

7.1 INSPECTION

Respirator inspection to verify operating conditions and maintenance must be made an integral part of the overall respirator program. Wearing a poorly maintained or malfunctioning respirator is, in one sense, more dangerous than not wearing a respirator at all. The employee wearing a defective device thinks they are protected when, in reality, they are not. Emergency escape devices are particularly vulnerable to poor maintenance, since they generally are used infrequently, and then in the most hazardous and demanding circumstances.

7.1.1 Air Purifying Respirators (MSA UltraTwin)

Each individual must inspect their air purifying respirator. The warehouse health and safety equipment manager is responsible for inspecting respirators prior to assignment and upon receipt from the field. Table 5 lists the elements to be observed during the inspection process.

7.1.2 Self-contained Breathing Apparatus (MSA Ultralite and North 801)

Self-contained breathing apparatuses (SCBAs) must be inspected by the warehouse manager on a monthly basis and by the Project Health and Safety Officer prior to beginning work. Each worker must inspect their individual facepiece assembly according to the rubber facepiece and head harness inspection procedures in Table 6. An inspection checklist for SCBAs is presented in Table 7.

7.1.3 Emergency Escape Packs

These 5-minute escape packs will be thoroughly inspected monthly and placed back into service by the health and safety equipment manager. Inspections must include the following:

- Air supply.
- Hood integrity.
- Overall cleanliness.

- Air delivery hose.
- Harness integrity.

7.2 CLEANING AND STORAGE

The health and safety equipment manager is responsible for inspecting and cleaning (if necessary) all respirators returning from the field. Cleaning is accomplished either by using the manufacturers cleaner-sanitizer or by hand washing with a mild soap solution followed by a thorough rinse and air drying. After cleaning, sanitizing and inspecting the respirator, the equipment manager will repackage and store the respirator in an area protected against dust, sunlight, heat, extreme cold, excessive moisture or damaging chemicals. The respirators must be packed and stored so the exhalation valve will rest in a normal position. When respirators are used routinely in the field, they must be cleaned daily by the assigned person.

7.3 MAINTENANCE

Continued usage of respirators will require periodic repair or replacement of component parts of the equipment. Replacement of parts and repair of air purifying respirators, in most cases, present few problems. The manufacturer will provide replacement parts. Replacement parts for respiratory protective devices <u>must</u> be those of the manufacturer of the equipment. <u>Substitution of parts from a different brand or type of respirator will invalidate the approval of the respirator</u>. Maintenance of SCBA equipment is more difficult, primarily because of the valve and regulator assembly. Because of this, regulations <u>require</u> that SCBA equipment be returned to the manufacturer for adjustment or repair.

All maintenance required on a respirator must be recorded in the respirator's log book.

8.0 MEDICAL ASPECTS OF RESPIRATOR USE

Engineering-Science policy provides that no personnel will be permitted to wear a respirator without clearance from a physician to do so. The diagnostic protocol for a fit-to-work classification includes as assessment of the worker's ability to use air purifying respirators and SCBAs. The examining physician will have clinical data, including spirometry, x-ray, and cardiac-function data as well as physical observations on which to base a conclusion. Some individuals, especially those with marginal respiratory and cardiac functions, may experience a sense of choking (angina) when using respirators. If this is distinct and persistent, the worker should not be allowed to wear respiratory protective equipment. A specific conclusion addressing this requirement must accompany the worker's fit-to-work statement from the examining physician.

9.0 EVALUATION OF THE RESPIRATOR PROGRAM

The respirator program will be periodically evaluated by the Office Health and Safety Representative and modified as appropriate.

The auditing of respirator practices will determine whether the appropriate respirators are being selected and worn properly. Examination of respirators in use and in storage will indicate how well the equipment is being maintained. The results of periodic audits of

Table 5

Daily Inspection of Air Purifying Respirators

- Rubber facepiece - check for:
  - Excessive dirt (clean all dirt from facepiece).
  - Cracks, tears, or holes (obtain new facepiece).
  - Distortion (allow facepiece to "sit" free from any constraints and see if distortion disappears; if not, obtain new facepiece).
  - Cracked, scratched, or loose-fitting lenses.

- Head harness - check for:
  - Breaks or tears (replace head straps)
  - Loss of elasticity (replace head straps)
  - Broken or malfunctioning buckles or retaining clips (obtain new buckles).

- Inhalation valve, exhalation valve - check for:
  - Detergent residue, dust particles, or dirt on valve or valve seat (clean residue with soap and water).
  - Cracks, tears, or distortion in the valve material or valve seat (contact warehouse manager).
  - Missing or defective valve cover (obtain valve cover from equipment manager).

- Cartridges and canisters - check for:
  - Proper filter for the hazard (verify with Project Health and Safety Officer).
  - Missing or worn gaskets (contact warehouse manager for replacement).
  - Worn filter and facepiece threads (replace filter or facepiece).
  - Cracks or dents in filter housing (replace filter).

Table 6

Facepiece Inspection Sheet

Device:

ID#:

Date inspected:

Inspected by:

Checklist

Rubber facepiece:

Rubber head harness:

Rubber hose:

Exhalation valve:

Inhalation valves (APR):

Speaking diaphram:

Remarks:

O-rings (APR)

Cartridge (APR)

Type:

Exp. date:

Washing
Sanitization:

Antifogging Agent Application
on lenses:

Table 7

Self-Contained Breathing Apparatus Monthly Inspection Sheet

Device:

Serial #:

Date inspected:

Inspected by:

Checklist

Rubber facepiece:

Rubber head harness:

Rubber hose:

O-rings

Exhalation valve:

Facepiece Lens:

Harness:

Backpack:

Washing/Sanitizing:

Operating Instructions:

Hydrostatic test date:

No visible damage:

Remarks:

Antifogging Agent Application on lenses:

Air Cylinder Pressure:

Bypass Valve (MSA):

Mainline Valve (MSA):

Alarm:

Regulatory Diaphragm (MSA):

Regulatory Function:

Demand Valve O.K. (North):

Pressure Demand:

Storage Box:

respirator storage and use, consultations with wearers, measurements of hazard levels in work areas, and medical surveillance of wearers will be reviewed and analyzed to determine the effectiveness of the respirator program. Evidence of excessive exposure to hazards will be followed up to determine why inadequate protection was provided, and action will be taken to prevent a repeat of this problem.

APPENDIX A

OSHA RESPIRATORY PROTECTION STANDARD

(29 CFR Part 1910.134)

§ 1910.135 Occupational head protection.

Helmets for the protection of heads of occupational workers from impact and penetration from falling and flying objects and from limited electric shock and burn shall meet the requirements and specifications established in American National Standard Safety Requirements for Industrial Head Protection, Z89.1-1969.

§ 1910.136 Occupational foot protection.

Safety-toe footwear for employees shall meet the requirements and specifications in American National Standard for Men's Safety-Toe Footwear, Z41.1-1967.

§ 1910.137 Electrical protective devices.

Rubber protective equipment for electrical workers shall conform to the requirements established in the American National Standards Institute Standards as specified in the following list:

Item	*Standard*
Rubber insulating gloves.	J6.6-1967.
Rubber matting for use around electric apparatus	J6.7-1935 (R1962).
Rubber insulating blankets.	J6.4-1970.
Rubber insulating hoods.	J6.2-1950 (R1962)
Rubber insulating line hose	J6.1-1950 (R1962)
Rubber insulating sleeves	J6.6-1962.

§ 1910.138 Effective dates.

(a) The provisions of this Subpart I shall become effective on August 27, 1971, except that:

(1) Any provision in any other section of this subpart which contains in itself a specific effective date or time limitation shall become effective on such date or shall apply in accordance with such limitation; and

(2) If any standard in 41 CFR Part 50-204, other than a national consensus standard incorporated by reference in § 50-204.2(a)(1), is or becomes applicable at any time to any employment and place of employment, by virtue of the Walsh-Healey Public Contracts Act, or the Service Contract Act of 1965, or the National Foundation on Arts and Humanities Act of 1965, any corresponding established Federal standard in this Subpart I which is derived from 41 CFR Part 50-204 shall also become effective, and shall be applicable to such employment and place of employment, on the same date

§ 1910.139 Sources of standards.

Sec.	*Source*
1910.132	41 CFR 50-204.7.
1910.133(a)	ANSI Z87.1-1968. Eye and Face Protection.
1910.134	ANSI Z88.2-1969. Standard Practice for Respiratory Protection
1910.134 Table I-I.	ANSI K13.1-1967. Identification of Gas Mask Canister.
1910.135	ASNI Z89.1-1969. Safety Requirements for Industrial Head Protection.
1910.136	ANSI Z41.1-1967. Men's Safety-Toe Footwear.
1910.137	ANSI Z9.4-1968. Ventilation and Safe Practices of Abrasive Blasting Operations.

§ 1910.140 Standards organizations.

Specific standards of the following organization have been referenced in this part. Copies of the referenced materials may be obtained from the issuing organization.

American National Standards Institute, 1430 Broadway, New York, NY 10018.

OCCUPATIONAL SAFETY AND HEALTH STANDARDS
SUBPART I — PERSONAL PROTECTIVE EQUIPMENT

(Code of Federal Regulations, Title 29, Chapter XVII, Part 1910, Subpart I; 36 FR 10466, May 29, 1971; amended at 36 FR 15105, August 13, 1971; 37 FR 22231, October 18, 1972; republished at 39 FR 23502, June 27, 1974; standard provision revoked at 43 FR 49726, October 24, 1978; amended at 49 FR 5322, February 10, 1984)

Subpart I—Personal Protective Equipment

§ 1910.132 General requirements.

(a) *Application.* Protective equipment, including personal protective equipment for eyes, face, head, and extremities, protective clothing, respiratory devices, and protective shields and barriers, shall be provided, used, and maintained in a sanitary and reliable condition wherever it is necessary by reason of hazards of processes or environment, chemical hazards, radiological hazards, or mechanical irritants encountered in a manner capable of causing injury or impairment in the function of any part of the body through absorption, inhalation or physical contact.

(b) *Employee-owned equipment.* Where employees provide their own protective equipment, the employer shall be responsible to assure its adequacy, including proper maintenance, and sanitation of such equipment.

(c) *Design.* All personal protective equipment shall be of safe design and construction for the work to be performed.

§ 1910.133 Eye and face protection.

(a) *General.* (1) Protective eye and face equipment shall be required where there is a reasonable probability of injury that can be prevented by such equipment. In such cases, employers shall make conveniently available a type of protector suitable for the work to be performed, and employees shall use such protectors. No unprotected person shall knowingly be subjected to a hazardous environmental condition. Suitable eye protectors shall be provided where machines or operations present the hazard of flying objects, glare, liquids, injurious radiation, or a combination of these hazards.

(2) Protectors shall meet the following minimum requirements:

(i) They shall provide adequate protection against the particular hazards for which they are designed.

(ii) They shall be reasonably comfortable when worn under the designated conditions.

(iii) They shall fit snugly and shall not unduly interfere with the movements of the wearer.

(iv) They shall be durable.

(v) They shall be capable of being disinfected.

(vi) They shall be easily cleanable.

(vii) Protectors should be kept clean and in good repair.

(3) Persons whose vision requires the use of corrective lenses in spectacles, and who are required by this standard to wear eye protection, shall wear goggles or spectacles of one of the following types:

(i) Spectacles whose protective lenses provide optical correction.

(ii) Goggles that can be worn over corrective spectacles without disturbing the adjustment of the spectacles.

(iii) Goggles that incorporate corrective lenses mounted behind the protective lenses.

(4) Every protector shall be distinctly marked to facilitate identification only of the manufacturer.

(5) When limitations or precautions are indicated by the manufacturer, they shall be transmitted to the user and care taken to see that such limitations and precautions are strictly observed.

(6) Design, construction, testing, and use of devices for eye and face protection shall be in accordance with American National Standard for Occupational and Educational Eye and Face Protection, Z87.1-1968.

§ 1910.134 Respiratory protection.

(a) *Permissible practice.* (1) In the control of those occupational diseases caused by breathing air contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, sprays, or vapors, the primary objective shall be to prevent atmospheric contamination. This shall be accomplished as far as feasible by accepted engineering control measures (for example, enclosure or confinement of the operation, general and local ventilation, and substitution of less toxic materials). When effective engineering controls are not feasible, or while they are being instituted, appropriate respirators shall be used pursuant to the following requirements.

(2) Respirators shall be provided by the employer when such equipment is necessary to protect the health of the employee. The employer shall provide the respirators which are applicable and suitable for the purpose intended. The employer shall be responsible for the establishment and maintenance of a respiratory protective program which shall include the requirements outlined in paragraph (b) of this section.

(3) The employee shall use the provided respiratory protection in accordance with instructions and training received.

(b) *Requirements for a minimal acceptable program.* (1) Written standard operating procedures governing the selection and use of respirators shall be established.

(2) Respirators shall be selected on the basis of hazards to which the worker is exposed.

(3) The user shall be instructed and trained in the proper use of respirators and their limitations.

[4] [Removed]

[1910.134(b)(4) deleted by 49 FR 5322, February 10, 1984]

[5] Respirators shall be regularly cleaned and disinfected. Those used by more than

one using it shall be thoroughly cleaned and disinfected after each use.
[1910.134(b)(5) amended by 49 FR 5322, February 10, 1984]

(6) Respirators shall be stored in a convenient, clean, and sanitary location.

(7) [illegible] ors used routinely shall be inspected during cleaning. Worn or deteriorated parts shall be replaced. Respirators for emergency use such as self-co[illegible] shall be thoroughly inspected [illegible] and after each [illegible]

(8) Appropriate surveil[illegible] work conditions and degree of employee exposure or stress shall be maintained.

(9) There shall be regular inspection and evaluation to determine the continued effectiveness of the progr[illegible]

(10) Persons [illegible] to tasks [illegible] it has [illegible] physically a[illegible] m the work and use [illegible]. The local physician shall determine what health and physical conditions are pertinent. The respirator user's medical status should be reviewed periodically (for instance, annually).

(11) Approved or accepted respirators shall be used when they are available. The respirator furnished shall provide adequate respiratory protection against the particular hazard for which it is designed in accordance with standards established by competent authorities. The U.S. Department of Interior, Bureau of Mines, and the U.S. Department of Agriculture are recognized as such authorities. Although respirators listed by the U.S. Department of Agriculture continue to be acceptable for protection against specified pesticides, the U.S. Department of the Interior, Bureau of Mines, is the agency now responsible for testing and approving pesticide respirators.

(c) *Selection of respirators.* Proper selection of respirators shall be made according to the guidance of American National Standard Practices for Respiratory Protection Z88.2–1969.

(d) *Air quality.* (1) Compressed air, compressed oxygen, liquid air, and liquid oxygen used for respiration shall be of high purity. Oxygen shall meet the requirements of the United States Pharmacopoeia for medical or breathing oxygen. Breathing air shall meet at least the requirements of the specification for Grade D breathing air as described in Compressed Gas Association Commodity Specification G–7.1–1966. Compressed oxygen shall not be used in supplied-air respirators or in open circuit self-contained breathing apparatus that have previously used compressed air. Oxygen must never be used with air line respirators.

(2) Breathing air may be supplied to respirators from cylinders or air compressors.

(i) Cylinders shall be tested and maintained as prescribed in the Shipping Container Specification Regulations of the Department of Transportation (49 CFR Part 178).

(ii) The compressor for supplying air shall be equipped with necessary safety and standby devices. A breathing air-type compressor shall be used. Compressors shall be constructed and situated so as to avoid entry of contaminated air into the system and suitable in-line air purifying sorbent beds and filters installed to further assure breathing air quality. A receiver of sufficient capacity to enable the respirator wearer to escape from a contaminated atmosphere in event of compressor failure, and alarms to indicate compressor failure and overheating shall be installed in the system. If an oil-lubricated compressor is used, it shall have a high-temperature or carbon monoxide alarm, or both. If only a high-temperature alarm is used, the air from the compressor shall be frequently tested for carbon monoxide to insure that it meets the specifications in sub-[illegible] tems to prevent inadvertent [illegible] air line respirators with non[illegible] gases or oxygen.

(4) Breathing gas containers shall be marked in accordance with American National Standard Method of Marking Portable Compressed Gas Containers to Identify the Material Contained, Z48.1–1954; Federal Specification BB–A–1034a, June 21, 1968, Air, Compressed for Breathing Purposes; or Interim Federal Specification GG–B–00675b, April 27, 1965, Breathing Apparatus, Self-Contained.

(e) *Use of respirators.* (1) Standard procedures shall be developed for respirator use. These should include all information and guidance necessary for their proper selection, use, and care. Possible emergency and routine uses of respirators should be anticipated and planned for.

(2) The correct respirator shall be specified for each job. The respirator type is usually specified in the work procedures by a qualified individual supervising the respiratory protective program. The individual issuing them shall be adequately instructed to insure that the correct respirator is issued.
[1910.134(e)(2) amended by 49 FR 5322, February 10, 1984]

(3) Written procedures shall be prepared covering safe use of respirators in dangerous atmospheres that might be encountered in normal operations or in emergencies. Personnel shall be familiar with these procedures and the available respirators.

(i) In areas where the wearer, with failure of the respirator, could be overcome by a toxic or oxygen-deficient atmosphere, at least one additional man shall be present. Communications (visual, voice, or signal line) shall be maintained between both or all individuals present. Planning shall be such that one individual will be unaffected by any likely incident and have the proper rescue equipment to be able to assist the other(s) in case of emergency.

(ii) When self-contained breathing apparatus or hose masks with blowers are used in atmospheres immediately dangerous to life or health, standby men must be present with suitable rescue equipment.

(iii) Persons using air line respirators in atmospheres immediately hazardous to life or health shall be equipped with safety harnesses and safety lines for lifting or removing persons from hazardous atmospheres or other and equivalent provisions for the rescue of persons from hazardous atmospheres shall be used. A standby man or men with suitable self-contained breathing apparatus shall be at the nearest fresh air base for emergency rescue.

(4) Respiratory protection is no better than the respirator in use, even though it is worn conscientiously. Frequent random inspections shall be conducted by a qualified individual to assure that respirators are properly se[illegible] used, cleaned, and maintained.

[illegible] safe use of any respirator, it [illegible] that the user be properly in[illegible] selection, use, and maintenance [illegible] pervisors and workers shall be so instructed by competent persons. Training shall provide the men an opportunity to handle the respirator, have it fitted properly, test its face-piece-to-face seal, wear it in normal air for a long familiarity period, and, finally, to wear it in a test atmosphere.

(i) Every respirator wearer shall receive fitting instructions including demonstrations and practice in how the respirator should be worn, how to adjust it, and how to determine if it fits properly. Respirators shall not be worn when conditions prevent a good face seal. Such conditions may be a growth of beard, sideburns, a skull cap that projects under the facepiece, or temple pieces on glasses. Also, the absence of one or both dentures can seriously affect the fit of a facepiece. The worker's diligence in observing these factors shall be evaluated by periodic check. To assure proper protection, the facepiece fit shall be checked by the wearer each time he puts on the respirator. This may be done by following the manufacturer's facepiece fitting instructions.

(ii) Providing respiratory protection for individuals wearing corrective glasses is a serious problem. A proper seal cannot be established if the temple bars of eye glasses extend through the sealing edge of the full facepiece. As a temporary measure, glasses with short temple bars or without temple bars may be taped to the wearer's head. Wearing of contact lenses in contaminated atmospheres with a respirator shall not be allowed. Systems have been developed for mounting corrective lenses inside full facepieces. When a workman must wear corrective lenses as part of the facepiece, the facepiece and lenses shall be fitted by qualified individuals to provide good vision, comfort, and a gas-tight seal.

(iii) If corrective spectacles or goggles are required, they shall be worn so as not to affect the fit of the facepiece. Proper selection of equipment will minimize or avoid this problem.

(f) *Maintenance and care of respirators.* (1) A program for maintenance and care of respirators shall be adjusted to the type of plant, working conditions, and hazards involved, and shall include the following basic services:

(i) Inspection for defects (including a leak check),
(ii) Cleaning and disinfecting,
(iii) Repair,
(iv) Storage.

Equipment shall be properly maintained to retain its original effectiveness.

(2) (i) All respirators shall be inspected routinely before and after each use. A respirator that is not routinely used but is kept ready for emergency use shall be inspected after each use and at least monthly to assure that it is in satisfactory working condition.

(ii) Self-contained breathing apparatus shall be inspected monthly. Air and oxygen cylinders shall be fully charged according to the manufacturer's instructions. It shall be determined [illegible] regulator and warning de[illegible] properly.

(iii) Respirator [illegible] clude a check of [illegible] of connections and the condition of the facepiece, headbands, valves, connecting tube, and canisters. Rubber or elastomer parts shall be inspected for pliability and signs of deterioration. Stretching and manipulating rubber or elastomer parts with a massaging action will keep them pliable and flexible and prevent them from taking a set during storage.

(iv) A record shall be kept of inspection dates and findings for respirators maintained for emergency use.

(3) Routinely used respirators shall be collected, cleaned, and disinfected as frequently as necessary to insure that proper protection is provided for the wearer. Respirators maintained for emergency use shall be cleaned and disinfected after each use.

[1910.134(f)(3) amended by 49 FR 5322, February 10, 1984]

(4) Replacement or repairs shall be done only by experienced persons with parts designed for the respirator. No attempt shall be made to replace components or to make adjustment or repairs beyond the manufacturer's recommendations. Reducing or admission valves or regulators shall be returned to the manufacturer or to a trained technician for adjustment or repair.

(5) (i) After inspection, cleaning, and necessary repair, respirators shall be stored to protect against dust, sunlight, heat, extreme cold, excessive moisture, or damaging chemicals. Respirators placed at stations and work [illegible] quickly accessible at all times and should be stored in compartments built for the purpose. The compartments should be clearly marked. Routinely used respirators, such as dust respirators, may be placed in plastic bags. Respirators should not be stored in such places as lockers or tool boxes unless they are in carrying cases or cartons.

(ii) Respirators should be packed or stored so that the facepiece and exhalation valve will rest in a normal position and function will not be impaired by the elastomer setting in an abnormal position.

(iii) Instructions for proper storage of emergency respirators, such as gas masks and self-contained breathing apparatus, are found in "use and care" instructions usually mounted inside the carrying case lid.

(g) *Identification of gas mask canisters.* (1) The primary means of identifying a gas mask canister shall be by means of properly worded labels. The secondary [illegible]

[illegible] all gas mask canisters purchased or used by them are properly labeled and colored in accordance with these requirements before they are placed in service and that the labels and colors are properly maintained at all times thereafter until the canisters have completely served their purpose.

(3) On each canister shall appear in bold letters the following:

(i)—

Canister for ....
(Name for atmospheric contaminant)
or

Type N Gas Mask Canister

(ii) In addition, essentially the following wording shall appear beneath the appropriate phrase on the canister label: "For respiratory protection in atmospheres containing not more than .... percent by volume of ....
....
(Name of atmospheric contaminant)

(iii) [Revoked]

(4) Canisters having a special high-efficiency filter for [illegible] against radionuclides and other highly toxic particulates shall be labeled with a statement of the type and degree of protection afforded by the filter. The label shall be affixed [illegible] end of, or to the [illegible] and near th[illegible] degree of [illegible] shall be marked as the per[illegible] of penetration of the canister by [illegible] 0.3-micron-diameter [illegible] phthalate (DOP) smoke at a flow rate of 85 liters per minute.

(5) Each canister shall have a label [illegible] that gas masks should be used [illegible] containing suffi[illegible] at least 16 pe[illegible] gas mask canisters are [illegible] to neutralize or remove conta[illegible] the air.

(6) Each gas mask canister shall be painted a distinctive color or combination of colors indicated in Table I–1. All colors used shall be such that they are clearly identifiable by the user and clearly distinguishable from one another. The color coating used shall offer a high degree of resistance to chipping, scaling, peeling, blistering, fading, and the effects of the ordinary atmospheres to which they may be exposed under normal conditions of storage and use. Appropriately colored pressure sensitive tape may be used for the stripes.

[Section 1910.134(g)(3)(iii) revoked at 43 FR 49726, October 24, 1978, 1978 effective November 24, 1978]

TABLE I–1

Atmospheric contaminants to be protected against	*Colors assigned**
Acid gases	White.
Hydrocyanic acid gas	White with ½-inch green stripe completely around the canister near the bottom
Chlorine gas	White with ½-inch yellow stripe completely around the canister near the bottom
Organic vapors	Black.
Ammonia gas	Green.
Acid gases and ammonia gas	Green with ½-inch white stripe completely around the canister near the bottom.
Carbon monoxide	Blue.
Acid gases and organic vapors	Yellow.
Hydrocyanic acid gas and chloropicrin vapor.	Yellow with ½-inch blue stripe completely around the canister near the bottom.
Acid gases, organic vapors, and ammonia gases.	Brown.
Radioactive materials, excepting tritium and noble gases.	Purple (Magenta).
Particulates (dusts, fumes, mists, fogs, or smokes) in combination with any of the above gases or vapors.	Canister color for contaminant, as designated above, with ½-inch gray stripe completely around the canister near the top.
All of the above atmospheric contaminants.	Red with ½-inch gray stripe completely around the canister near the top

*Gray shall not be assigned as the main color for a canister designed to remove acids or vapors.

NOTE: Orange shall be used as a complete body, or stripe color to represent gases not included in this table. The user will need to refer to the canister label to determine the degree of protection the canister will afford.

§ 1910.135 Occupational head protection.

Helmets for the protection of heads of occupational workers from impact and penetration from falling and flying objects and from limited electric shock and burn shall meet the requirements and specifications established in American National Standard Safety Requirements for Industrial Head Protection, Z89.1-1969.

§ 1910.136 Occupational foot protection.

Safety-toe footwear for employees shall meet the requirements and specifications in American National Standard for Men's Safety-Toe Footwear, Z41.1-1967.

§ 1910.137 Electrical protective devices.

Rubber protective equipment for electrical workers shall conform to the requirements established in the American National Standards Institute Standards as specified in the following list:

Item	*Standard*
Rubber insulating gloves.	J6.6-1967.
Rubber matting for use around electric apparatus	J6.7-1935 (R1962).
Rubber insulating blankets.	J6.4-1970.
Rubber insulating hoods.	J6.2-1950 (R1962)
Rubber insulating line hose	J6.1-1950 (R1962)
Rubber insulating sleeves	J6.5-1962.

§ 1910.138 Effective dates.

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§ 1910.139 Sources of standards.

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